ORAL ARGUMENT NOT YET SCHEDULED

No. 20-1145

Consolidated with Cases No. 20-1167, -1168,
-1169, -1173, -1174, -1176, -1177 & -1230

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

COMPETITIVE ENTERPRISE INSTITUTE et al.,

Petitioners,

v.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION et al.,

Respondents,

ALLIANCE FOR AUTOMOTIVE INNOVATION et al.,

Intervenors for Respondents.

PROOF BRIEF OF PUBLIC INTEREST ORGANIZATION PETITIONERS

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CERTIFICATE AS TO PARTIES, RULINGS, AND RELATED CASES

A. Parties and Amici curiae

Petitioners

Case No. 20-1145: Competitive Enterprise Institute, Anthony Kreucher, Walter M. Kreucher, James Leedy, and Marc Scribner.

Case No. 20-1167: State of California, by and through Governor Gavin Newsom, Attorney General Xavier Becerra, and the California Air Resources Board, the States of Colorado, Connecticut, Delaware, Hawaii, Illinois, Maine, Maryland, Minnesota, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Rhode Island, Vermont, Washington, Wisconsin; Commonwealths of Massachusetts, Pennsylvania, and Virginia; the People of the State of Michigan; the District of Columbia; the Cities of Los Angeles and New York; and Cities and Counties of San Francisco and Denver.

Case No. 20-1168: Natural Resources Defense Council, Inc., Center for Biological Diversity, Chesapeake Bay Foundation, Inc., Communities for a Better Environment, Conservation Law Foundation, Consumer Federation of America, Environment America, Environmental Defense Fund, Environmental Law and Policy Center, Public Citizen, Inc., Sierra Club, and Union of Concerned Scientists.

Case No. 20-1169: Environmental Defense Fund, Center for Biological Diversity, Chesapeake Bay Foundation, Inc., Communities for a Better Environment, Conservation Law Foundation, Consumer Federation of America, Environment America, Environmental Law and Policy Center, Natural Resources Defense Council, Inc., Public Citizen, Inc., and Sierra Club.

Case No. 20-1173: South Coast Air Quality Management District, Bay Area Air Quality Management District, and Sacramento Metropolitan Air Quality Management District.

Case No. 20-1174: National Coalition for Advanced Transportation.

Case No. 20-1176: Advanced Energy Economy.

Case No. 20-1177: Calpine Corporation, Consolidated Edison, Inc., National Grid USA, New York Power Authority, and Power Companies Climate Coalition.

Case No. 20-1230: Clean Fuels Development Coalition, Environmental and Energy Study Institute, The Farmers' Educational & Cooperative Union of America, d/b/a National Farmers Union, Farmers Union Enterprises, Inc., Glacial Lakes Energy, LLC., Governors' Biofuels Coalition, Montana Farmers Union, North Dakota Farmers Union, Siouxland Ethanol, LLC, South Dakota Farmers Union, and Urban Air Initiative, Inc.*

<u>Respondents</u>

Case Nos. 20-1145, -1173: National Highway Traffic Safety Administration; James C. Owens, in his official capacity as Acting Administrator, National Highway Traffic

* On January 14, 2021, petitioners in Case No. 20-1230 moved for voluntary dismissal of their petition for review. ECF No. 1880120.

Safety Administration; U.S. Environmental Protection Agency; and Andrew Wheeler, in his official capacity as Administrator of the U.S. Environmental Protection Agency.

Case Nos. 20-1167, 20-1174, 20-1176: Andrew Wheeler, in his official capacity as Administrator, U.S. Environmental Protection Agency; U.S. Environmental Protection Agency; Elaine L. Chao, in her official capacity as Secretary, U.S. Department of Transportation;† U.S. Department of Transportation; James C. Owens, in his official capacity as Acting Administrator, National Highway Traffic Safety Administration; and National Highway Traffic Safety Administration.

Case No. 20-1168: Andrew Wheeler, in his official capacity as Administrator of the U.S. Environmental Protection Agency; and U.S. Environmental Protection Agency.

Case No. 20-1169: James C. Owens, in his official capacity as Acting Administrator of the National Highway Traffic Safety Administration; Elaine L. Chao, in her official capacity as Secretary of the U.S. Department of Transportation; and National Highway Traffic Safety Administration.

Case Nos. 20-1177 & 20-1230: U.S. Environmental Protection Agency; U.S. Department of Transportation; and National Highway Traffic Safety Administration.

† Steven G. Bradbury is "automatically substituted" for Elaine L. Chao as of January 12, 2021, pursuant to Federal Rule of Appellate Procedure 43(c)(2).

<u>Respondent-Intervenors</u>

Case No. 20-1145: Alliance for Automotive Innovation; Bay Area Air Quality Management District; City and County of Denver; the Commonwealths of Massachusetts, Pennsylvania, and Virginia; Conservation Law Foundation; Consumer Federation of America; District of Columbia; Environment America; Environmental Defense Fund; Environmental Law and Policy Center; Ingevity Corporation; Natural Resources Defense Council, Inc.; Public Citizen, Inc.; Sacramento Metropolitan Air Quality Management District; Sierra Club; South Coast Air Quality Management District; the States of California, Colorado, Connecticut, Hawaii, Illinois, Maine, Maryland, Minnesota, Nevada, New Jersey, New York, North Carolina, Oregon, Rhode Island, Vermont, Washington, and Wisconsin; and the Union of Concerned Scientists.

<u>Other Intervenors</u>

American Honda Motor Co., Inc., BMW of North America, LLC, Ford Motor Company, Rolls-Royce Motor Cars NA, LLC, and Volkswagen Group of America, Inc. have intervened in all cases solely with respect to the issue of remedy.

<u>Amici Curiae</u>

To date, no individuals or entities have sought leave to participate as amicus curiae. On December 21, 2020, all parties consented to the filing of amicus briefs provided that amici comply with applicable court rules. ECF No. 1876643.

B. Rulings Under Review

Certain of these petitions challenge an action of the U.S. Environmental Protection Agency published at 83 Fed. Reg. 16,077 (Apr. 13, 2018). All petitions challenge actions of the U.S. Environmental Protection Agency and the National Highway Traffic Safety Administration jointly published as *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks*, 85 Fed. Reg. 24,174 (April 30, 2020).

C. Related Cases

The undersigned is not aware of any related cases within the meaning of Circuit Rule 28(a)(1)(C) that have not been consolidated with these petitions.

/s/ Matthew Littleton
Matthew Littleton

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TABLE OF AUTHORITIES

Cases

* Authorities upon which we chiefly rely are marked with asterisks.

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GLOSSARY

EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EPCA	Energy Policy and Conservation Act of 1975
GHG	greenhouse gas
NHTSA	National Highway Traffic Safety Administration

INTRODUCTION

These jointly issued rules to weaken vehicular emissions standards of the U.S. Environmental Protection Agency (EPA) and fuel-economy standards of the National Highway Traffic Safety Administration (NHTSA) are indefensible. These rules, which we refer to collectively as the "Rollback," gravely endanger public health, harm national energy security, cost consumers money, and lack legal or factual support.

Transportation is the largest domestic source of greenhouse gas (GHG) emissions, which EPA has found cause or contribute to climate change. The immense damage that climate change inflicts on human health, the economy, and natural resources will increase dramatically absent immediate action to curb emissions. Technologies that sharply reduce climate-disrupting emissions from light-duty vehicles (cars and light trucks) are already on the road. They mitigate climate change and other severe air pollution problems and save consumers billions by reducing fuel costs far more than they increase vehicle prices. They also strengthen national security by conserving massive amounts of oil and reducing international instability driven by climate change. Absent regulation, however, those technologies will be under-deployed because market forces alone do not account for the vast damage these emissions and oil consumption cause.

Congress tackled this market failure with two "overlap[ping]," but "wholly independent," federal statutes designed to promote cleaner, more fuel-efficient vehicles. *Massachusetts v. EPA*, 549 U.S. 497, 532 (2007). The Clean Air Act requires EPA to set GHG emissions standards that "shall take effect" no later than "necessary to permit the development and application of the requisite technology." 42 U.S.C. § 7521(a)(2). And, under the Energy Policy and Conservation Act (EPCA), NHTSA must require automakers' fleets to achieve the "maximum feasible" level of average fuel economy. 49 U.S.C. § 32902(f). In 2012, EPA set standards to reduce GHG emissions by roughly 5% annually from model years 2021–2025, and NHTSA set comparable fuel-economy standards for model year 2021. Based on an extensive and unequivocal technical record, EPA determined in a January 2017 final action that its model year 2022–2025 standards remained appropriate and would cost less than previously projected, with net societal benefits of $59–98 billion.

The Trump Administration renounced EPA's 2017 final determination, replaced it with a slipshod contrary determination, and finalized far weaker emission and fuel-economy standards for model year 2021–2026 vehicles. The new standards increase in stringency by only 1.5% annually: comparable to—and, in NHTSA's case, even worse than—what the Agencies found automakers would attain even if the standards were flatlined at model year 2020 levels. The Agencies (under)project that, in the aggregate, the Rollback will increase GHG emissions by nearly one billion metric tons, increase oil consumption by nearly two billion barrels, and cost drivers at least $175 billion to purchase that additional fuel. Nothing in the record justifies actions so inimical to the Agencies' governing statutes. Even the Agencies' own economic analysis (which is rife with arbitrary assumptions and obvious, major computational mistakes), does not claim the Rollback's benefits outweigh its costs.

Both the Rollback and EPA's determination that its prior standards were "inappropriate" are irredeemably flawed and must be vacated for the reasons stated by State and Local Government Petitioners, whose arguments we adopt. This brief, filed by twelve Public Interest Organization Petitioners in Cases No. 20-1168 and 20-1169, supplies additional reasons why the Rollback is unlawful.

STATEMENT OF JURISDICTION

We adopt the statement of State and Local Government Petitioners.

STATEMENT OF ISSUES

1. Whether the Rollback was arbitrary, capricious, and contrary to law because the Agencies did not adequately consider air pollution impacts.
2. Whether the Rollback was arbitrary, capricious, and contrary to law because the Agencies over-relied on purported consumer preferences to subvert statutory mandates; undervalued fuel savings as compared to upfront vehicle costs; and ignored the effect of higher fuel prices under the Rollback.
3. Whether the Rollback was arbitrary and capricious because the Agencies' cost-benefit analysis contains many significant computational mistakes.
4. Whether NHTSA's minimum domestic passenger-car standards violated 49 U.S.C. § 32902(b)(4) and were arbitrary and capricious.
5. Whether the Agencies violated the Endangered Species Act.
6. Whether NHTSA violated the National Environmental Policy Act.

STATUTES AND REGULATIONS

Pertinent statutes and regulations appear in the addendum to State and Local Government Petitioners' brief.

STATEMENT OF THE CASE

We adopt the statement of State and Local Government Petitioners.

SUMMARY OF ARGUMENT

1. The Rollback was unlawful and arbitrary because the Agencies relied on a fundamentally flawed analysis of pollution impacts. Pollution control is central to EPA's statutory charge (and important to NHTSA's), yet the Agencies gave scant, if any, consideration to the huge increases in climate-disrupting pollution the Rollback will cause. The Agencies undervalued the consequent harm by tens of billions of dollars when they slashed the well-grounded economic valuation of climate-change harms (the "social cost of carbon"). The Agencies also miscalculated the increases in emissions of smog- and soot-causing air pollutants ("criteria pollutants," *see* State Br. 20 n.4) and the resulting premature deaths and other societal costs of the Rollback.

2. The Agencies claimed the Rollback benefits consumers, but their treatment of its consumer effects was unlawful and arbitrary. First, defying the statutes' express aims of addressing pollution, energy-security, and consumer impacts that market forces overlook, the Agencies relied heavily on speculative concerns about "consumer acceptance" of cleaner, more fuel-efficient vehicles to weaken their standards. Second, while conceding that consumers will pay more at the pump under the Rollback than they save in

vehicle purchase prices, the Agencies capriciously assigned special "value" to lowering "upfront costs." Third, while admitting that the Rollback will markedly increase oil consumption and thereby increase fuel prices, the Agencies arbitrarily understated that increase and ignored its substantial effect on consumers.

3. The Rollback rested in part on a cost-benefit analysis the Agencies claimed "straddled zero." They mistook this ostensible rough equivalence as license to weaken standards. But large and patent mistakes in the Agencies' analysis render the premise of equivalence arbitrary and capricious. Most prominently, the Agencies ascribed massive "congestion benefits" to the Rollback, reasoning that it will depress driving by making it more expensive, thereby reducing traffic delays and related costs. But the Agencies' congestion analysis contained basic errors, including failure to adjust for inflation and flagrant misapplications of federal driving statistics. Correcting these errors reduces the Rollback's supposed congestion benefits by nearly $30 billion.

Other clear errors inflated the Rollback's benefits by billions more dollars. Contrary to the Agencies' representation, their computer modeling barred automakers from deploying cost-effective "high-compression ratio technologies" on dozens of new-vehicle models, which would have reduced automakers' compliance costs. Another modeling error artificially inflated compliance costs by rendering more than one-quarter of automakers' bank of compliance credits unusable in circumstances where the Agencies themselves said credits *could* be used.

There was more. In assessing additional fuel consumption under the Rollback, the Agencies ignored gasoline's ethanol content, thereby understating the gasoline to be consumed under the Rollback and inflating its purported benefits by billions. The Agencies also overstated the public-health benefits of the Rollback's modest reduction in power-plant emissions—due to reduced electric-vehicle sales—by calculating the harms from power-plant emissions as if they were (doubly harmful) refinery emissions.

4. NHTSA unlawfully weakened its minimum fuel-economy standards for domestic passenger cars by using fuel-economy projections that were inconsistent with the projections used to justify the overall fleetwide standards.

5. The Agencies failed to consult with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service as required by the Endangered Species Act. The Rollback is a discretionary action to which that Act applies, and the Agencies' (erroneous) finding of uncertainty regarding the Rollback's effects on endangered and threatened species and their critical habitat cannot substitute for consultation. NHTSA also violated the National Environmental Policy Act by not considering action alternatives that lessen environmental impacts, or the cumulative impacts of the Rollback when coupled with the Agencies' recent actions invalidating state zero-emission-vehicle laws.

STANDARD OF REVIEW

We agree with the standard stated by State and Local Government Petitioners.

STANDING

Public Interest Organization Petitioners' members are injured by increased emissions of GHGs and other pollutants traceable to the Rollback. *See, e.g.*, 85 Fed. Reg. 24,174, 25,055, 25,060, 25,084, 25,172 (Apr. 30, 2020) (Final Rollback). Some members live or own property in areas that experience concrete and serious effects of climate change; live or work near oil refineries or major roadways where higher localized pollution will be experienced; or study, photograph, teach about, or enjoy imperiled species harmed by climate-change or localized pollution from refineries and tailpipes. The Rollback exacerbates the disproportionate and cumulative impacts that members in minority and economically disadvantaged communities experience from pollution, like respiratory illnesses, and from climate change, like wildfires and flooding. Some members want to purchase lower-emitting and/or fuel-efficient vehicles whose availability the Rollback will diminish, and some members' livelihoods depend on professions the Rollback adversely affects. Vacatur will redress all these injuries.[1]

ARGUMENT

We incorporate by reference the arguments of State and Local Government Petitioners and provide the following additional reasons why the Rollback is unlawful.

[1] Our standing declarations are reproduced in a separately bound addendum.

I. THE AGENCIES' DISREGARD OF AIR POLLUTION IMPACTS WAS ARBITRARY AND UNLAWFUL

The objective of the Clean Air Act, and Section 202 in particular, is to reduce pollution that endangers public health and welfare. EPA must mitigate those dangers through vehicular emissions standards. *See Coal. for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102, 121–22 (D.C. Cir. 2012). Further, analysis of pollution impacts associated with oil consumption is part of NHTSA's duty under EPCA to consider "the need of the United States to conserve energy." 49 U.S.C. § 32902(f); *see, e.g.*, *Pub. Citizen v. NHTSA*, 848 F.2d 256, 262-63 n.27 (D.C. Cir. 1988); 77 Fed. Reg. 62,623, 62,669 & nn.118–19 (Oct. 15, 2012). Yet the Agencies' analysis of the Rollback's enormously harmful pollution effects was grievously deficient.

The Agencies did not rationally assess the massive climate harms of the Rollback, which will dramatically *increase* GHG emissions despite a record showing the urgency of *decreasing* them. The Agencies arbitrarily underestimated the economic cost of pollution harms by tens of billions of dollars when they slashed the well-grounded social cost of carbon. State Br. 88–89. They also under-projected increases in other emissions and the harms they will cause, by a total of $11.6 billion and up to 2,438 premature deaths.

A. The Agencies Did Not Reasonably Consider The Rollback's Contributions to Climate-Destabilizing Pollution

The Agencies described their 2012 standards as "the most significant federal actions ever taken to reduce GHG emissions and improve fuel economy." 77 Fed. Reg.

at 62,630. The Rollback, by contrast, *increases* emissions and fuel combustion enormously; few, if any, administrative actions have had larger adverse climate effects. The Agencies estimate that affected vehicles will spew at least 867 million more tons of GHGs into the atmosphere, 85 Fed. Reg. at 24,176—more than Germany's total annual emissions, and enough on its own to measurably raise global GHG concentrations, average temperature, and sea level. *See* JA_–_[NHTSA-2017-0069-0738_5-40_to_5-45]. Beyond these additions to long-lived atmospheric pollution, the Rollback imperils U.S. leadership in developing and commercializing technologies to mitigate the climate crisis.

These massive emissions increases will occur even as the window narrows to avoid the most severe climatic damages. The Rollback defies reports from leading scientific bodies, and EPA itself, sounding the alarm for immediate action to lower GHG emissions. The 2018 National Climate Assessment (authored by EPA and 12 other federal agencies under a congressional charge) found that "the evidence of human-caused climate change is overwhelming and continues to strengthen," and that impacts "are intensifying across the country." JA_[NHTSA-2017-0069-0803_36]. Devastating, cascading damage threatens to become irreversible if global temperatures rise more than 1.5° Celsius over pre-industrial levels. JA_–_[NHTSA-2017-0069-0630_SPM-8_to_SPM-13]; *see also* 80 Fed. Reg. 64,510, 64,518-99 (Oct. 23, 2015) (EPA listing climate-change dangers that depend on timing and extent of emissions reductions); JA_–_[EPA-HQ-OAR-2018-0283-5075_2-27]; State Br. 36–38.

The Agencies did not seriously consider any of this. EPA's failure was particularly abject, as it is specifically charged in Section 202(a) with limiting emissions of dangerous pollution from motor vehicles.[2] EPA has itself repeatedly documented the massive damage wrought by vehicular GHG emissions and the urgency of curtailing climate change. *See* JA_–_[EPA-HQ-OAR-2018-0283-5075_3-7]; State Br. 36–38. EPA's duty is to prescribe standards addressing this "endanger[ment]," while considering necessary lead time in light of technology and compliance costs. 42 U.S.C. § 7521(a)(1). EPA cannot rationally perform that task without seriously examining the nature, magnitude, and effects of climate-changing pollution and weighing it against technological and cost constraints. *Cf. Michigan v. EPA*, 576 U.S. 743, 752 (2015) ("[R]easonable regulation ordinarily requires paying attention to the advantages and disadvantages of agency decisions."). EPA nowhere explained why it was reasonable, in light of its own endangerment findings and the dangers documented in this record, to weaken its prior standards, vastly increasing vehicular emissions despite ready availability of effective technologies to reduce them.

EPA's discussion of climate change comprised little more than references to *NHTSA*'s Environmental Impact Statement. 85 Fed. Reg. at 24,846, 24,849, 25,111

[2] As State and Local Government Petitioners show (Br. 43–44), EPA misconstrued Section 202(a)'s directive to impose standards to reduce dangerous emissions—bounded by consideration of timing, technical feasibility, and cost—as an open-ended balancing test giving the agency "effectively complete discretion." *Oceana, Inc. v. Locke*, 670 F.3d 1238, 1242 (D.C. Cir. 2011).

n.2480. NHTSA's document cannot discharge EPA's Clean Air Act duty. In any event, NHTSA arbitrarily brushed off the effects of nearly a billion metric tons of climate pollution as "extremely small in relation to global emissions trajectories." JA_[NHTSA-2017-0069-0738_S-13]. That ignores the fundamental point—repeatedly made by EPA and other expert bodies—that mitigating climate-change impacts requires reducing emissions from *all* important source categories. *See, e.g.*, JA_[NHTSA-2018-0067-12088_24].

EPA made exactly that point in its 2009 endangerment finding for vehicular GHG emissions:

> [N]o single [GHG] source category dominates on the global scale, and many (if not all) individual ... source categories could appear small in comparison to the total when, in fact, they could be very important contributors in terms of both absolute emissions or in comparison to other source categories, globally or within the United States.

74 Fed. Reg. 66,498, 66,543 (Dec. 15, 2009). Foregoing regulation on the fatalistic grounds embraced here "would effectively lead to a tragedy of the commons, whereby no country or source category would be accountable for contributing to the global problem of climate change, and nobody would take action as the problem persists and worsens." *Id.*; *see also Massachusetts*, 549 U.S. at 524–25 (observing that agencies "do not generally resolve massive problems in one fell regulatory swoop"). Here, EPA did not recognize, much less explain, its departure from that reasoning—even though climate-change dangers are now known to be far more severe. *See Physicians for Social Responsibility v. Wheeler*, 956 F.3d 634, 644 (D.C. Cir. 2020) ("Reasoned decision-making requires that

when departing from precedents or practices, an agency must 'offer a reason to distinguish them or explain its apparent rejection of their approach.'"). EPA's new stance is arbitrary, capricious, and inconsistent with its statutory mandate. On that view, climate-pollution mitigation is never warranted because each source category causes or contributes to only a fraction of the overall problem.

The Agencies' error was magnified because they used an unsound "interim" estimate of the social cost of carbon, thereby slashing the economic value ascribed to carbon reductions more than five-fold. State Br. 88–89; *see also California v. Bernhardt*, 472 F.Supp.3d 573, 611–14 (N.D. Cal. 2020) (agency erred by using an "interim domestic" model rather than well-established intergovernmental model to calculate cost of methane emissions); JA_–_[EPA-HQ-OAR-2018_0283-4213_6-20].

In sum, neither Agency explained how weakening standards to dramatically increase climate-destabilizing emissions is consistent with statutory requirements or reasonable on a record showing severe dangers and ready, effective means to control those emissions. The Agencies failed to reach an "express and considered conclusion" on an "important aspect of the problem" that they "must consider." *Cigar Ass'n of Am. v. FDA,* 964 F.3d 56, 61 (D.C. Cir. 2020) (cleaned up).

B. The Agencies Grossly Underestimated Emissions Increases And Attendant Harms Under The Rollback

The Agencies severely underestimated the increase in emissions of GHGs and other air pollutants traceable to the Rollback. The Agencies unjustifiably lowered their estimate of additional emissions under the Rollback by inflating the rate at which "newer, cleaner" vehicles will replace older ones, State Br. 51–57, and by overstating the "rebound" effect of their prior standards—i.e., projecting that the Rollback will dramatically reduce driving, *id.* at 91–94.

Additionally, as shown below, the Agencies *understated* the *increase* in pollution from domestic refineries (which must refine more gasoline for less fuel-efficient vehicles) and *overstated* the Rollback's *decrease* in pollution from power plants (which need not generate power for as many electric vehicles). These errors fatally undermine the Agencies' conclusion that "incremental fuel savings, emissions reductions, and environmental benefits of higher standards [are] not significant enough to outweigh the immediate economic costs." 85 Fed. Reg. at 25185–86.

1. The Agencies significantly understated increases in refinery pollution

The Agencies significantly understated the Rollback's criteria-pollution impacts, and thereby omitted hundreds of premature deaths from their analysis. They assumed that increased domestic refining will supply half the additional gasoline consumed under the Rollback, with the other half supplied by a combination of increased imports and reduced exports of domestically refined gasoline. 85 Fed. Reg. at 24,881. Because this export-bound gasoline would be refined either way (diverting it to meet additional domestic demand under the Rollback only affects where it is ultimately used), the Agencies asserted that domestic refining and associated pollution will rise by only half the amount needed to accommodate the Rollback's total additional gasoline demand.

That assertion conflicts with modeling on which the Agencies elsewhere relied. In 2018, the federal Energy Information Administration (EIA) modeled the effects of flatlining light-duty vehicle standards in 2021. EIA found that the vast majority (92%) of increased gasoline demand would be satisfied by domestic refining.[3] The Agencies never addressed this finding in analyzing the Rollback's impact on gasoline refining, despite relying on EIA's analysis in the next breath to document the relationship between gasoline demand and domestic crude-oil production. 85 Fed. Reg. at 24,882. The Agencies' selective, "internally inconsistent" use of the EIA analysis was arbitrary. *ANR Storage Co. v. FERC*, 904 F.3d 1020, 1024, 1028 (D.C. Cir. 2018).

The Agencies tried to justify their approach by citing *other* EIA projections that future gasoline exports will rise. 85 Fed. Reg. at 24,877. But those projections comport with EIA's 2018 analysis, which shows a strong positive correlation between domestic

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[3] JA_–_[EIA_*AnnualEnergyOutlook2018,Table:PetroleumAndOtherLiquidsSupplyAnd_Disposition*,https://www.eia.gov/outlooks/aeo/data/browser/#/?id=11-AEO2018&region=0-0&cases=ref2018~effrelax-all&start=2016&end=2050&f=A&linechart=~~ref2018-d121317a.43-11-AEO2018~effrelaxall-d030918a.43-11-AEO2018~~~~~~~~~~ref2018-d121317a.10-11-AEO2018~effrelaxall-d030918a.10-11-AEO2018&ctype=linechart&chartindexed=0&sourcekey=0]. This number is calculated by dividing the increase in gasoline consumption under the flatlined standards by the increase in crude oil processed by U.S. refineries (called "Total Crude Supply" in EIA's analysis) in each year from 2022–2050 (the period when flatlined standards result in higher gasoline consumption), and then averaging the results.

demand and domestic refining, even as net refined product exports increase from 4.7 to 5.1 million barrels per day between 2020 and 2050.[4]

This error was highly consequential. The Agencies projected that if domestic refining met all additional gasoline demand from the Rollback, nitrogen-oxide pollution would triple under the Rollback, particulate pollution would roughly double, and sulfur dioxide pollution would increase over two-and-a-half fold. JA_, _[EPA-HQ-OAR-2018-0283-7671_1769,1800] (reporting results for "Maximum Impact on Domestic Refining" sensitivity run). Under this scenario, the Rollback's net societal costs will increase by $7.7 billion, JA_[EPA-HQ-OAR-2018-0283-7671_1807],[5] and premature deaths will increase by 694 (on the low end) to 1,591 (on the high end). *Compare* JA_[CO2_Max_Refining_Impact_Annual_Societal_Effects_Report,https://www.nhtsa.gov/content/nhtsa-ftp/178111], col. AT–AU, *with* 85 Fed. Reg. at 25,083.

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[4] JA_–_[EIA_*AnnualEnergyOutlook2018,Table:PetroleumAndOtherLiquidsSupplyAndDisposition*,https://www.eia.gov/outlooks/aeo/data/browser/#/?id=11-AEO2018&region=0-0&cases=ref2018~effrelax-all&start=2016&end=2050&f=Q&linechart=~~ref2018-d121317a.43-11-AEO2018~effrelaxall-d030918a.43-11-AEO2018~~~~~~~~~~ref2018-d121317a.10-11-AEO2018~effrelaxall-d030918a.10-11-AEO2018~effrelaxall-d030918a.12-11-AEO2018~ref2018-d121317a.12-11-AEO2018&map=&ctype=linechart&chartindexed=0&sourcekey=0].

[5] The Agencies separately reported impacts of EPA's and NHTSA's standards using two alternative discount rates for each (3% and 7%). The impacts—and the effects of correcting the Agencies' errors—are generally of the same direction and magnitude for both sets of standards. For simplicity, we typically report only the impacts of EPA's standards, discounted at 3%.

2. The Agencies underestimated the Rollback's health harms by overstating the decrease in power-plant pollution

The Agencies asserted that the Rollback's increased refinery pollution will be partially offset by a reduction in power-plant pollution due to lower electric-vehicle sales. Owing to at least two crucial errors, however, the Agencies dramatically overstated this decrease in power-plant emissions and resultant public-health benefits.

First, the Agencies estimated emissions reductions based on nationwide *average* power-plant emission rates. 85 Fed. Reg. at 24,875. But *incremental* electricity demand from electric vehicles under stronger standards would be met by *incremental* generation, for which emissions are much lower due to trends toward renewable generation. Notably, the Agencies correctly followed the incremental approach to quantify upstream emissions from gasoline production (where doing so reduced the Rollback's perceived cost). *Id.* at 24,876 (addressing relationship of "*changes* in consumption" from the Rollback to "*changes* in" determinants of upstream gasoline emissions); *see also id.* at 24,736 (discussing the "extremely important" distinction between average and marginal congestion costs). The Agencies also previously analyzed their standards' impact on incremental electricity generation, JA_–_[EPA-HQ-OAR-2018-0283-0651_4-152_to_4-153], revealing that only 14% of incremental electricity consumed by electric vehicles in 2030 will be produced by coal (the highest-emission source), compared to coal's 42% share of nationwide average generation, JA_[EPA-HQ-OAR-2018-0283-0651_4-160].

The Agencies' analysis here thus is not only internally inconsistent but also an unacknowledged and unexplained departure from past practice.

Second, the Agencies overstated the health benefits of lower electricity emissions under the Rollback by equating those benefits with the benefits of reducing oil-refining emissions—the latter of which the Rollback increases. 85 Fed. Reg. at 24,884. The very EPA analysis the Agencies used to evaluate health harms finds that refinery pollution is generally about twice as harmful as power-plant pollution, due to factors like proximity to affected populations.[6] Correcting this error adds 347–847 premature deaths and $3.9 billion in net societal costs under the Rollback.[7] Combined with the increased premature deaths from refinery pollution discussed above, the premature

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[6] JA_, _–_[NHTSA-2017-0069-0772_6_16-17] (valuing electricity-generation-unit emissions of particulate matter in 2020 at $140,000–350,000 per ton and corresponding refinery emissions at $330,000–830,000 per ton), cited in 85 Fed. Reg. at 24,883.

[7] Premature deaths are calculated by multiplying the annual change in upstream criteria-pollutant emissions for model year 1978–2029 electric vehicles under the Rollback (reported in JA_–_[CO2_Ref_Annual_Societal_Effects_Report, https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system]) by the difference between the number of premature deaths per ton of refinery pollution versus power plant pollution, using the low- and high-end estimates, and summing the results for each calendar year and pollutant. *See* JA__, __[NHTSA-2017-0069-0772_50_63]; 85 Fed. Reg. at 24,884 (describing the Agencies' methodology). The monetary impacts are calculated the same way, using the difference between refinery and power-plant harm values and discounting costs in each year to 2019. *See, e.g.*, JA__[NHTSA-2017-0069-0772_16]. Calculations use the average of low and high reported harm values; consistent with the Agencies' approach, these are converted from 2015 to 2018 dollars. *See* 85 Fed. Reg. at 24,884.

deaths attributable to the Rollback increases to 1,485–3,438—more than *triple* the Agencies' estimate of 444–1,000 for EPA's standards, 85 Fed. Reg. at 25,083.

II. THE AGENCIES' ANALYSIS OF THE ROLLBACK'S EFFECTS ON CONSUMERS WAS UNLAWFUL AND ARBITRARY

The Agencies' conclusion that the Rollback benefits consumers was unlawful, arbitrary, and unsupported. First, they committed legal error by claiming "uncertainty" about future consumer preferences to override their statutory mandates to control pollution and conserve energy. Even if deferring to consumer preferences to this degree were legally permissible, it was arbitrary here because the Agencies' analysis revealed that the Rollback imposes large net costs on consumers. The assertion that consumers nonetheless benefit from a reduction in "upfront costs" is irrational, internally inconsistent, and ignores contrary record evidence. Further, the Agencies' consideration of consumer impacts arbitrarily disregarded the substantial increase in fuel prices for consumers, which the Agencies elsewhere admitted will occur as gasoline demand increases.

A. The Agencies Wrongfully Elevated Purported Consumer Preferences Over Statutory Pollution-Control And Energy-Conservation Objectives

A central justification for EPA's rollback was its claim that, in 2020, "greater uncertainty about consumer acceptance of [emissions-reduction] technologies" existed than before. 85 Fed. Reg. at 25,108. For its part, NHTSA expected "that consumer demand for fuel-efficient vehicles" will not "grow significantly in the rulemaking timeframe without regulation to prop up manufacturer sales of significantly larger volumes of more fuel-efficient models." *Id.* at 25,183.

These statements contradict the aims of the Agencies' governing statutes, enacted to address harms from pollution and oil consumption that are *not* remedied by unregulated market forces. Even if consumer preferences had been definitively established, rather than hypothesized, they could not override the Agencies' respective duties under the Clean Air Act and EPCA.

Congress enacted these laws precisely because market forces alone had resulted in insufficient adoption of emissions-reduction and fuel-conservation technologies. *See Ctr. for Auto Safety v. NHTSA* (*CAS*), 793 F.2d 1322, 1339 (D.C. Cir. 1986) ("Congress rejected market forces as the sole means of improving energy conservation." (emphasis omitted)); *NRDC v. EPA*, 655 F.2d 318, 328 (D.C. Cir. 1981) (EPA must "press for the development and application of improved technology rather than be limited by that which exists today" (quoting S. Rep. No. 91-1196 at 24 (1970)); *Int'l Harvester v. Ruckelshaus,* 478 F.2d 615, 640 (D.C. Cir. 1973) ("The driving preferences of hot rodders are not to outweigh the goal of a clean environment."). Because market forces are insufficient, Congress decreed that the Agencies "shall" set the standards needed to protect public health and welfare, 42 U.S.C. § 7521(a)(1), and conserve energy to the maximum degree feasible, 49 U.S.C. § 32902(a).

These congressional commands would be toothless if agency leaders could reject public-health and energy-conservation measures based on vague allusions to "uncertainty about consumer acceptance" and unwillingness to use regulations to "prop up" consumer demand for fuel-efficient vehicles. Indeed, the most significant advancement to date in vehicular emissions control—the catalytic converter—initially engendered pronounced consumer fears and industry opposition.[8] "Uncertainty about consumer acceptance" is inevitable whenever any product is introduced or changed.

Even if such a justification could suffice in theory, the Agencies did not rationally explain why, in *this* context, consumer preferences require weakening otherwise appropriate standards. To the contrary, they admitted that technologies needed to meet the prior standards are already in use on significant fractions of the new-vehicle fleet, years ahead of time. 85 Fed. Reg. at 25,131. The Agencies made no specific, credible finding that consumers would not purchase vehicles conforming to more stringent standards. State Br. 82–84.

B. The Extraordinary Weight The Agencies Assigned "Upfront Costs" Was Arbitrary And Unsupported

The Agencies stated that "[t]he costs to … automotive consumers would have been too high under the [prior standards]." 85 Fed. Reg. at 24,176. But the Rollback will *cost*, not *save*, consumers money—including billions of dollars annually in forgone fuel savings. Under the Agencies' own analysis (which significantly underestimates fuel costs, *see infra*, Part II.C), the Rollback will cost the average driver $678 over the lifetime of a model year 2030 vehicle, even after accounting for the projected reduction in the

[8] *E.g.*, Owen Ullmann, *Rush On for '74 Car Models*, TAMPA TIMES, Aug. 24, 1974, at 10 ("Consumer fears over catalytic converters—antipollution devices that will appear on most of the 1975 cars—are … contributing to the increased sales" of 1974 models); *id.* (quoting Dallas auto dealer's statement that customers are "scared to death" of the "catalytic converter muffler").

vehicle's purchase price. *Id.* at 24,180-81.[9] The Agencies nonetheless claimed that consumers have an extraordinary preference for "upfront" vehicle cost savings over later fuel-cost savings. *E.g.*, *id.* at 25,111, 25,210, 25,171. Their reasoning was flat wrong.

First, the Agencies had already accounted for the fact that purchase prices and fuel costs occur at different times (i.e., for the time value of money) by using a discount rate to convert future costs and benefits to their present value. 85 Fed. Reg. at 24,281; *see generally* JA_–_[EPA-HQ-OAR-2015-0827-0803_28-29]. By later assigning even more weight to upfront costs, the Agencies "double-discounted" future cost savings, violating long-established agency practice and guidance, economic theory, and common sense. *See, e.g.*, EPA, Guidelines for Preparing Economic Analyses 6-1 (2010), https://www.epa.gov/sites/production/files/2017-18/documents/ee-0568-50.pdf. Once discounted to present value, a dollar is a dollar and each has equal value to a consumer. The Agencies cannot conjure a consumer "super-preference" for lowering upfront costs. Indeed, the suggestion that consumers especially prefer lower upfront costs over fuel savings conflicts with the Agencies' own statement "that *both* increased fuel costs and increased upfront car prices will appear as 'losses,' so it is not obvious why potential buyers would react to the prospects of these different forms of losses in different ways." 85 Fed. Reg. at 24,611. The Agencies erred by adopting a view on

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[9] The Agencies suggested that the prior standards might impose certain "opportunity costs" on consumers, *see, e.g.*, 85 Fed. Reg. at 24177 n.10, such that their benefits are lower than those calculated. But the Agencies did not actually adopt, much less substantiate, this view. *See id.* at 24,587, 24,612–13, 25,099.

consumer valuation they themselves rejected elsewhere in the same rulemaking. *See Air Transport Ass'n of Am. v. DOT*, 119 F.3d 38, 43–44 (D.C. Cir. 1997).

Moreover, the Rollback's impact on "upfront" car prices will be negligible. The vast majority of consumers—85%, on the Agencies' account, 85 Fed. Reg. at 24,706—finance new-vehicle purchases through leases or installment loans. Those consumers do not experience changes in car prices entirely "upfront"; the costs are amortized over five or more years. *Id.* at 24,707 (average length of a new-vehicle loan is 68 months). In this very rulemaking, NHTSA projected that the prior standards paid for themselves in fuel savings over that duration. *Id.* at 25,183; *see also* 77 Fed. Reg. at 62,928 (finding that fuel savings "immediately outweigh the cost of a credit purchase ... even in the first month of ownership"); JA_–_[EPA-HQ-OAR-2018-0283-7640_A-168_to_A-174]. NHTSA projected that, under the Rollback, the average consumer who finances her purchase would save only $215 in upfront costs compared to the prior standards—just 3.3% of estimated upfront costs—and would lose money overall. 85 Fed. Reg. at 24,995.[10]

C. The Agencies Disregarded Fuel-Price Increases Under The Rollback

The Agencies ignored tens of billions of dollars in increased consumer costs they acknowledge the Rollback will cause by raising fuel prices due to higher demand. The

[10] Upfront costs included a down payment of 11.7%, plus taxes and fees, which NHTSA estimated at $6,323 under its rule and $6,538 under the prior standards ($215/$6,538 = 3.3%). 85 Fed. Reg. at 25,176.

Agencies projected that the Rollback will cause 13 billion gallons (or 16%) in additional gasoline demand in 2050. *See* JA_–_[CO2_Ref_Annual_Societal_Effects_Summary_Report,https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system], col. K, rows 608 & 3056. And they knew that this increase would drive up gasoline prices. 85 Fed. Reg. at 24,722–24 (rejecting contrary claims of commenters as "directly at odds with … the economics of the world oil market"); *see also id.* at 24,214, 25,140 ("Future fuel prices are a critical input to the economic analysis … because they determine the value of fuel savings both to new vehicle buyers and to society …."). Yet the Agencies arbitrarily did not consider the ensuing additional consumer costs—roughly $50 billion, on their account (which, as shown below, understates the effect). *Cf. Business Roundtable v. SEC*, 647 F.3d 1144, 1153 (D.C. Cir. 2011) ("In weighing the rule's costs and benefits, … the Commission arbitrarily ignored the effect of the final rule upon the total number of election contests.").

The Agencies chose to ignore consumer costs from higher fuel prices in their cost-benefit analysis because they are largely "pecuniary" transfers from U.S. consumers to U.S. oil companies. 85 Fed. Reg. at 24,724. But even if that choice were supportable in the context of a cost-benefit analysis, the Agencies acted arbitrarily by entirely disregarding tens of billions of dollars of consumer costs while touting alleged financial benefits to those same consumers as a principal justification for the Rollback.

The Agencies compared fuel prices in two situations: a reference case assuming compliance with the prior standards, and a second case approximating the Rollback's effect. 85 Fed. Reg. at 24,591. They should have used the reference-case fuel prices to calculate fuel costs under the prior standards, and the Rollback-case fuel prices (which are higher due to increased demand) to calculate fuel costs under the Rollback. Instead, the Agencies used the higher fuel prices to calculate fuel costs in both cases. *Id.* at 24,593. Correcting this overt error increases net consumer gasoline expenditures under the Rollback by $51.8 billion.[11] For example, it increases the average model year 2030 vehicle owner's lifetime net costs from the Rollback to $815 (compared to $678 before the error is corrected). *See id.* at 24,995.[12]

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[11] This number reflects model year 1978–2050 light-duty vehicles for calendar years 2021–2089. The broad range of model years reflects the fact that *all* drivers will face higher gasoline prices under the Rollback. The figure is calculated by multiplying the projected fuel-price increase for each calendar year by projected total gasoline consumption in that year, *see* JA_–_[CO2_Ref_Annual_Societal_Effects_Report,https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system], discounted to 2019 dollars. Gasoline prices are taken from EIA's *Annual Energy Outlook 2019*, Table: Petroleum and Other Liquids Prices, https://www.eia.gov/outlooks/aeo/data/browser/#/?id=12-AEO2019&region=0-0&cases=ref2019&start=2017&end=2050&f=A&linechart=ref2019-d111618a.30-12-AEO2019&map=&ctype=linechart&sourcekey=0 (discussed at 85 Fed. Reg. at 24,591), for the prior standards, and from JA_–_[EPA-HQ-OAR-2018-0283-7678_NEMS_SAFE_rule_api_Output] for the Rollback standards. The Agencies assumed that fuel prices remain constant after 2050. *See* JA_–_[central_analysis_parameters_ref,https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system], Fuel Prices tab, col. C, rows 82–131.

[12] These figures reflect the method described in note 11, *supra*, except that only model year 2030 vehicles are included; annual costs are discounted to 2030 (the purchase year, consistent with the Agencies' approach); and total cost is divided by the number of model year 2030 vehicles sold. JA__[consumer_costs_report,https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system], col H, row 121.

Even these figures likely underestimate the Rollback's consumer costs because the Agencies further erred in quantifying its effect on fuel prices. Without asserting that the Rollback will reduce electric-vehicle battery costs, the Agencies assumed lower electric-vehicle battery costs in the Rollback case than in the reference case. 85 Fed. Reg. at 24,591. That unsupported assumption inflated electric-vehicle penetration, and thereby depressed modeled gasoline demand, under the Rollback; the inflated levels of electric vehicles offset a large portion of the demand increase caused by weakening standards. The Agencies' fuel-price modeling consequently showed the Rollback increasing gasoline demand by a maximum of 6.5%, far less than the 16% increase their central analysis projected to occur in 2050. JA_–_[CO2_Ref_Annual_Societal_Effects_Summary_Report,https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system].[13]

The Agencies found that weakening the standards would increase fuel prices by only up to 2%, an effect they describe as "small." 85 Fed. Reg. at 24,724. But even this level of increase will result in massive consumer costs when multiplied by the enormous

[13] The 6.5% figure is calculated by subtracting gasoline consumption in the EIA 2019 reference case from gasoline consumption in the Rollback case. *Compare* EIA, *Annual Energy Outlook 2019*, Reference Case Table, Energy Use: Transportation: Motor Gasoline, https://www.eia.gov/outlooks/aeo/data/browser/#/?id=2-AEO2019&region=1-0&cases=ref2019&start=2017&end=2050&f=A&linechart=ref2019-d111618a.58-2-AEO2019.1-0~~&map=ref2019-d111618a.5-2-AEO2019.1-0&ctype=linechart&sourcekey=0, *with* JA_[EPA-HQ-OAR-2018-0283-7678_NEMS_SAFE_rule_api_Output], line 94. A 6.5% increase in demand occurs in 2034.

amount of fuel consumed under the Rollback by drivers of all vehicles. More importantly, had the Agencies used the gasoline demand increases they projected the Rollback would *actually* cause—up to 16%—the fuel-price increases and accompanying consumer costs would have been much larger.

In sum, the Agencies arbitrarily underestimated the Rollback's consumer costs in several respects. Whether $51.8 billion or a much higher amount, the Agencies irrationally ignored this enormous consumer cost despite justifying the Rollback based on consumer impacts.

III. THE AGENCIES' ANALYSIS OF THE ROLLBACK'S COSTS AND BENEFITS CONTAINED BLATANT AND SIGNIFICANT ERRORS

Even apart from the legal and analytical defects described above and in the State and Local Government Petitioners' brief, the Rollback's overall cost-benefit analysis was filled with clear-cut, undeniable, and consequential data and computational errors—i.e., mistakes—that undercut the Agencies' justifications for their rules.

The Agencies initially proposed to freeze their standards at model year 2020 levels, "in part, because it maximize[d] net benefits compared to the other alternatives analyzed." 83 Fed. Reg. 42,986, 42,997 (Aug. 24, 2018). But those purported benefits ($141-201 billion) stemmed largely from the Agencies' astonishing projection that weakening standards would reduce the size of the fleet and, as a result, reduce driving nationally by hundreds of billions of miles—allegedly averting numerous traffic accidents, fatalities, and other driving-related costs. The Agencies abandoned that rationale after commenters exposed its many flaws. But that negated the Rollback's concomitant "benefits," resulting in rules whose net societal benefits, even under the Agencies' analysis, were "directionally uncertain," 85 Fed. Reg. at 25,099, because they "straddle[d] zero," *id.* at 24,176.

The Agencies' conclusion of directional uncertainty in the cost-benefit analysis was central to their choice of standards. *See*, *e.g.*, 85 Fed. Reg. at 24,279, 25,120, 25,131. Because costs and benefits seemed to be a wash, the Agencies felt free to prioritize reducing "up-front" consumer costs and "immediate" economic costs over other goals. *See, e.g.*, *id.* at 25,120, 25,185. We have explained the legal problems with that prioritization elsewhere, but, in any event, the Agencies' cost-benefit calculations were flat wrong. Fixing a handful of blatant computational errors reveals that the Rollback is massively detrimental to society and accordingly eliminates an important premise of the Agencies' justifications for their rules.

In particular, the Agencies overstated the monetary value of reducing traffic congestion by almost $30 billion. They made computer coding mistakes in analyzing a key compliance technology and automakers' use of credits, which significantly inflated the projected compliance costs of the prior standards. The Agencies also clearly underestimated the Rollback's fuel-consumption and emissions impacts. Fixing these clear-cut errors alone shows that the Rollback does not have net benefits that "straddle zero"; it costs society tens of billions of dollars.

A. The Agencies' "Congestion Benefits" Calculations Contained Multiple, Massive Errors

Because the Rollback reduces new vehicles' fuel efficiency, it increases the cost of driving. *See* 85 Fed. Reg. at 24,215. The Agencies expect car owners to respond by reducing how much they drive, thus reducing traffic congestion and saving drivers' time. The value assigned to these "congestion benefits" constitutes $60.2 billion in putative benefits of EPA's rule, or roughly 20% of overall purported benefits. *See id*. at 24,201, 24,203, 24,205. The Agencies' underlying calculations are plainly wrong and vastly inflate the Rollback's congestion benefits.

The Agencies undertook to calculate congestion benefits by multiplying the projected reduction in miles driven by an estimate of the per-mile marginal cost of congestion. They derived the latter value from a 1997 Highway Cost Allocation Study by the Federal Highway Administration (1997 Study), with three variables "updated": the value of vehicle occupants' time, the number of occupants per vehicle, and the traffic volume per mile of highway. 85 Fed. Reg. at 24,736–37 & nn.1934 & 1939–41. These changes increased the 1997 estimate of per-mile marginal congestion costs by 153%. *Compare* JA_[2018_NPRM_Central_Analysis_Parameters_Ref,https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system] (Economic Values tab, cols. B–D, row 32), *with* JA__[Central_Analysis_Parameters_Ref,https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system] (Economic Values tab, cols. B–E, row 41). The Agencies committed four serious errors in modifying these values.

First, in calculating the value of time lost to congestion, the Agencies failed to adjust for inflation. The Agencies divided $16.10 (the estimated value of 2017 travelers' time in *2017* dollars) by $8.90 (the estimated value of 1997 travelers' time in *1995* dollars), yielding an 82% increase in the value of time lost in traffic since the 1997 Study. 85 Fed. Reg. at 24,737 n.1941 (citing Department of Transportation guidance documents). This calculation was obviously wrong because it failed to use inflation-adjusted (or "constant") dollars for comparisons across time. *See* Office of Mgmt. & Budget, Exec. Office of the President, Circular A-94, at 8 (1992) (observing that constant dollars are needed for "[l]ogical consistency"). Adjusting the 1997 and 2017 travel-time values to reflect 2018 dollars using the Agencies' inflation calculator, *see* JA_[EPA-HQ-OAR-2018-0283-7671_1025] n.1991, reveals that the value of lost time increased only 21% between 1997 and 2017—only one-fourth the 82% increase the Agencies claimed.

Second, the Agencies miscalculated the increase in vehicle traffic between 1997 and 2017. Citing Federal Highway Administration statistics, the Agencies asserted that "traffic volumes, as measured by the annual number of vehicle-miles traveled per lane-mile of roads and highways nationwide, rose by 53 percent" in that period. 85 at 24,737 n.1939. But those statistics plainly show that traffic volumes increased by only 16% during that period.[14]

The Agencies seem to have compared apples (vehicle miles for *passenger cars* per interstate lane miles in 1997) and oranges (vehicle miles for *short-wheelbase light duty vehicles* per interstate lane miles in 2017). That calculation was doubly flawed. First, the Agencies directly compared a 1997 figure for passenger cars to a 2017 figure for short wheelbase light-duty vehicles, which includes passenger cars *and* some vans and sport-utility vehicles. Second, as the Agencies recognized, passengers experience congestion on *all* roads, not just interstates, so the calculation should have included traffic on all roads. 85 Fed. Reg. at 24,737 & n.1939. The Agencies offered no reason for calculating marginal congestion costs solely by reference to cherry-picked subsets of vehicles and roads.

Third, the Agencies miscalculated vehicle occupancy. They asserted that vehicle occupancy rose by 18% from 1995 to 2017, citing data from the Federal Highway Administration's Nationwide Personal Transportation Surveys. 85 Fed. Reg. at 24,737

[14] This percentage is calculated by subtracting the ratio of "total urban and rural" vehicle miles (Table VM-1) to all highway lane-miles (Table HM-46) in 1997 from the same ratio for 2017, and then dividing by the 1997 ratio. *See* Fed. Highway Admin., *Highway Statistics 2017*, https://www.fhwa.dot.gov/policyinformation/statistics/2017; Fed. Highway Admin., *Highway Statistics 1997*, https://www.fhwa.dot.gov/ohim/hs98/roads.htm. The Agencies cited the 1998 and 2018 statistics for this 1997 and 2017 data, 85 Fed. Reg. 24,737 n.1939, but that appears to have been a mistake, as 1997 and 2017 land-mile data are reported only in the Federal Highway Administration's Highway Statistics for those years. To correct the error, we used the 1997 and 2017 statistics, which enabled us to calculate traffic volumes for those years, as the Agencies claimed to have done. The results are substantially the same if 1998 and 2018 statistics are used.

n.1941. If that were true, each vehicle slowed by congestion would impose greater overall lost-time costs. But the Agencies' figures are wrong. To calculate occupancy changes, the Agencies should have compared, for 1995 and 2017, the ratio of (1) total person-miles in privately owned or operated vehicles for individuals 16 and older, to (2) total miles traveled by the same privately owned or operated vehicles. That would yield an occupancy decrease of 3% using the "online table designer" the Rollback cites. 85 Fed. Reg. at 24,737 n.1941. The Federal Highway Administration's own analysis and summary of its data explains that "vehicle occupancy estimates, measured as person miles per vehicle mile, seems to have stayed about the same" and that "[w]hile there are small nominal differences between the 2017 and earlier estimates, these differences are all within the margins of error." Fed. Highway Admin., *Summary of Travel Trends: 2017 National Household Survey*, https://www.fhwa.dot.gov/policyinformation/documents/2017_nhts_summary_travel_trends.pdf. It is unclear how the Agencies calculated an 18% occupancy increase, as they did not show their work—an arbitrary and capricious omission in its own right—but a comparison of the documents released by the Agencies with the aforementioned table designer reveals at least one obvious mistake: The Agencies compared occupancy of vehicles in 2017 with occupancy for all modes of transit (including walking, cycling, and flying) in 1995. JA_–_[NHTSA_Materials_Attached_to_Littleton_Letter_Filed_01.14.21].

Fourth, the Agencies mistakenly applied the higher marginal congestion cost developed for passenger cars to vans and sport-utility vehicles instead of the lower marginal congestion cost that the 1997 Study applies to vans and sport-utility vehicles. If the 1997 Study is to accurately forecast congestion costs in 2020, the Agencies must carry forward its key premises, including that different vehicle types produce different marginal congestion costs according to their usage. *See* 85 Fed. Reg. at 24,736. But the Agencies applied the congestion costs for cars to vans and sport-utility vehicles, which the 1997 Study defined as "trucks" for this purpose. JA_, _[Fed._Highway_Admin.,1997FederalHighwayCostAllocationStudy_tbls._I-1,V-23,https://www.fhwa.dot.gov/policy/hcas/final/toc.cfm].

The aggregate impact of these four mistakes was enormous. Correcting them reduces the Rollback's congestion benefits by more than $27 billion at a 3% discount rate, nearly half the congestion benefits claimed by the Agencies, and reduces total net benefits by $17.3–27.6 billion—itself enough to render the Rollback net costly under a discount rate of either 3% or 7%.[15]

[15] The range $17.3–27.6 billion expresses the sum of congestion-related errors calculated under EPA's rule and NHTSA's rule, respectively, using 3% and 7% discount rates, and the same approach is used in reporting the effects of the other errors described below. Each rule is clearly net costly for society irrespective of the discount rate. The two rules' estimated impacts diverge for various reasons, including the standards' differing scope and statutory charges (e.g., only EPA's standards cover air conditioning refrigerants, and NHTSA cannot consider automakers' use of compliance credits).

B. Other Blatant Errors Undercut The Agencies' Cost-Benefit Analysis

The Agencies committed many other plain errors that skewed the cost-benefit analysis in favor of the Rollback, including the following:

- The Agencies inadvertently excluded certain high-compression-ratio engines from their analysis of compliance costs. State Br. 63–70. Contrary to the Agencies' explanation of how their modeling should work, the model blocked application of high-compression-ratio technologies, which are highly cost-effective, on 40% of the vehicles that the Agencies stated should be allowed to deploy them. This error exaggerated the apparent costs of the prior standards and inflated the Rollback's net benefits by $2.8–6.0 billion.[16]
- The Agencies' modeling mistakenly blocked automakers from utilizing 27% of their banked credits for compliance with EPA's standards. *See* State Br. 75–76. Contrary to the Agencies' explanation of how credits could be used, the model disallowed automakers from using credits earned in model year 2016. This error exaggerated the apparent costs of the prior standards and inflated the net benefits of EPA's rule by $5.3–7.1 billion.[17]

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[16] To calculate this error's effect, we ran NHTSA's Volpe Model after removing the hard-coded technology blocks from the engines identified by State and Local Government Petitioners (Br. 64–65) in model input file market_ref_proper_hcr.xlsx (JA__).

[17] To calculate this error's effect, we changed lines 157-166, 288, and 302 of the file Volpe.Cafe.IO.InputParsers.XIMarketDataParser.cs (JA__) to reflect a credit-bank final year of 2016, not 2015 (e.g., md.BankedCO2CreditsMaxYear=2016).

- The Agencies understated the increase in fuel consumption from the Rollback by not accounting for gasoline's ethanol content. In a reversal from EPA's 2016 Technical Assessment Report, *see* JA_[EPA-HQ-OAR-2015-0827-0926_10-1], the Agencies ignored that retail gasoline contains 10% ethanol, which reduces real-world fuel efficiency because ethanol has 35% less energy than gasoline. Accounting for ethanol content lowers the fuel efficiency of the modeled fleet, which further increases gasoline consumption and emissions under the Rollback. The error inflated the Rollback's net benefits by $3.5–6.0 billion.[18]
- The Agencies undervalued harms from additional emissions under the Rollback by erroneously monetizing both refinery pollution and power-plant pollution using refinery harm values, even though power-plant pollution produces only about

[18] To calculate this error's effect, we multiplied the Rollback's impacts on annual retail fuel costs and fuel-tax revenues (which are proportional to fuel consumption) by 1.039—the ratio of the Agencies' 80% conversion factor between tested and on-road fuel economy, 85 Fed. Reg. at 24281 n.343, to the previously used 77% conversion factor that accounts for ethanol's energy content, JA__[EPA-HQ-OAR-2015-0827-0926_10-1]. We then deducted fuel taxes from fuel costs, consistent with the Agencies' approach. *See* JA__[CO2_Ref_Annual_Societal_Effects_Report,https://www.nhtsa.gov/corporate-average-fuel-economy/compliance-and-effects-modeling-system], cols. L–M.

half as much health damage. *See supra*, Part I.B.2. This error reduced the Rollback's pollution impacts and inflated its net benefits by $2.2–6.6 billion.

C. The Rollback's Flawed Cost-Benefit Analysis Renders It Arbitrary And Capricious

The effects of the errors discussed in this Part III on overall costs and benefits are summarized in the table on the next page, with figures in billions of current dollars.

	NHTSA fuel-economy program		EPA GHG program	
	3% discount rate	7% discount rate	3% discount rate	7% discount rate
Agencies' claimed net benefits	-13.1	16.1	-22.0	6.4
Effect of correcting the errors:				
Congestion errors	*-27.1*	*-17.3*	*-27.6*	*-17.4*
High Compression Ratio error	*-6.0*	*-5.0*	*-2.9*	*-2.8*
Model Year 2016 Credit Bank error	*	*	*-7.1*	*-5.3*
Ethanol error	*-6.0*	*-3.7*	*-5.7*	*-3.5*
Power-plan harm values error	*-6.6*	*-3.5*	*-3.9*	*-2.2*
Sum of error effects†	-45.7	-29.5	-47.2	-31.2
Revised net benefits†	-58.8	-13.4	-69.2	-24.8

* Because NHTSA's modeling for its standard-setting excluded use of credits after 2020, the credit-bank error did not affect the analysis of fuel-economy standards.

† Modeling interactions among different errors could make their combined effect somewhat different than the sum of individual effects. Regardless, correcting the congestion-cost errors alone reveals that the Rollback is net costly.

As the foregoing table shows, correcting the errors reveals that the net economic effects of the Rollback are unambiguously negative, causing tens of billions of dollars in net harms regardless of whether present values are calculated using a 3% or 7% discount rate. Because the Rollback was premised on a claim of rough equivalence between societal costs and benefits, these basic computational errors are fatal. *See Nat'l Ass'n of Home Builders v. EPA*, 682 F.3d 1032, 1040 (D.C. Cir. 2012) ("[W]hen an agency decides to rely on a cost-benefit analysis as part of its rulemaking, a serious flaw undermining that analysis can render the rule unreasonable."). This Court generally grants considerable deference to agencies' technical judgments concerning regulatory costs and benefits, but it vacates actions resting on unambiguously flawed cost-benefit analyses. *See Business Roundtable*, 647 F.3d at 1148-49, 1155; *City of Portland v. EPA*, 507 F.3d 706, 713 (D.C. Cir. 2007); *Owner-Operator Indep. Drivers Ass'n v. FMCSA,* 494 F.3d 188, 206 (D.C. Cir. 2007); *see also* Cass Sunstein, THE COST-BENEFIT REVOLUTION 157–59 (2018) (discussing courts' duty to scrutinize cost-benefit analyses for "funny numbers").

The Agencies did not state that the Rollback would be justified if it cost society tens of billions of dollars. Yet that is the result after correcting the Agencies' many analytical errors. A policy with costs far exceeding benefits—that does "significantly more harm than good" *Michigan*, 576 U.S. at 752–53—at minimum requires substantial justification. Because the Agencies did not attempt to justify a net costly policy change—one that also will vastly increase pollution and fuel consumption, counter to the Agencies' central statutory objectives—the Rollback should be vacated.

IV. NHTSA'S RELIANCE ON DIFFERENT FUEL-ECONOMY PROJECTIONS FOR FLEETWIDE STANDARDS AND MINIMUM DOMESTIC PASSENGER-CAR STANDARDS WAS ARBITRARY AND UNLAWFUL

EPCA requires that domestically manufactured passenger cars meet a minimum average fuel economy of not less than "92 percent of the average fuel economy projected by [NHTSA] for the combined domestic and non-domestic passenger automobile fleets…, which projection shall be published in the Federal Register when the standard for that model year is promulgated." 49 U.S.C. § 32902(b)(4)(B). NHTSA published *two* projections of average fuel economy for the combined passenger car fleet—one as part of the Agencies' analysis of the fleetwide fuel-economy and GHG standards; and a second, more lenient, "adjusted" projection for setting the minimum domestic-car standard for average fuel economy.

NHTSA defended using an adjusted projection for the domestic-car standard by asserting that its projections of average fuel economy in prior rulemakings proved to be somewhat too high. Those prior projections underestimated demand for larger passenger cars, which have lower fuel economy, meaning that the minimum domestic standards were 1.9% more stringent than if they had been calculated based on subsequent actual sales. 85 Fed. Reg. at 25,126–27. Consequently, NHTSA "offset" its actual projection of average passenger-car fuel economy by 1.9% and used the adjusted projection to set minimum domestic passenger-car standards. *Id.* at 25,217.

The inconsistent projections are arbitrary, capricious, and contrary to law. NHTSA either believes the projections underlying its core analysis of the fleetwide standards, or it does not. NHTSA cannot rely on one projection to justify and project costs and benefits of its fleetwide standards and then rely on another, inconsistent projection to support the statutorily required minimum domestic passenger-car standard. *See Gas Appliance Mfrs. Ass'n v. DOE*, 998 F.2d 1041, 1048 (D.C. Cir. 1993) ("[The agency] cannot use one set of conditions for the standard itself, and another, more favorable set, to estimate the proposed compliance method's likely achievements for cost/benefit purposes."). Had NHTSA used the "adjusted" fuel economy projection in its primary analysis, it would have reduced the net benefits of NHTSA's Rollback by $3.5 billion, as the less fuel-efficient fleet would mean higher fuel costs and higher emissions.[19]

If NHTSA's adjusted projection is correct, the Agencies' fleetwide standards rest on a flawed analysis; if the unadjusted projection is correct, the minimum domestic-car standard violates EPCA. Because this Court cannot make that choice in the first instance, it must set aside both standards.

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[19] To calculate this figure, we increased the footprint of all passenger-car models by 2.07%, the value that corresponds to a decrease in average fuel economy of 1.9% (from 47.7 miles per gallon to 46.8 miles per gallon in 2026), *see* 85 Fed. Reg. at 24,189, 25,128, and ran the Volpe Model with the larger footprints.

V. THE AGENCIES VIOLATED OTHER ENVIRONMENTAL STATUTES

A. The Agencies Violated The Endangered Species Act

The Endangered Species Act ("ESA") assigns "endangered species priority over the 'primary missions' of federal agencies" in order to "halt and reverse the trend toward species extinction, whatever the cost." *TVA v. Hill*, 437 U.S. 153, 184-85 (1978). The ESA imposes procedural and substantive duties on all federal agencies regarding species listed as endangered or threatened by the U.S. Fish and Wildlife Service or National Marine Fisheries Service (collectively, the "Services"), to "insure" that federal actions are "not likely to jeopardize the continued existence" of listed species or result in the "destruction or adverse modification" of their critical habitat. 16 U.S.C. § 1536(a)(2).

Section 7 of the ESA directs agencies to consult with the Services before carrying out "any action" that may "jeopardize" listed species or destroy or harm their critical habitat. 16 U.S.C. § 1536(a)(2). Consultation is required unless the acting agency finds, using "the best scientific and commercial data available," *id.*, that its action will have "no effect" on listed species or habitat. *Am. Fuel & Petrochem. Mfrs. v. EPA* (*AFPM*), 937 F.3d 559, 598 (D.C. Cir. 2019); *see also* 50 C.F.R. § 402.14(a).

Any discretionary action that "may affect" endangered or threatened species or their habitat requires consultation. 50 C.F.R. §§ 402.03, 402.14(a). The "may affect" bar is "low," *Nat'l Parks Conservation Ass'n v. Jewell*, 62 F.Supp.3d 7, 12–13 (D.D.C. 2014), and includes "[a]ny possible effect," 51 Fed. Reg. 19,926, 19,949–50 (June 3, 1986); *see* *also Karuk Tribe v. USFS*, 681 F.3d 1006, 1027 (9th Cir. 2012) (en banc) (requiring consultation for "actions that have any chance of affecting listed species or critical habitat").

Although the record establishes that the Rollback will adversely affect a range of listed species and their habitat, the Agencies neither consulted with the Services, 85 Fed. Reg. at 25,252; *see* Public Interest Organization Petitioners' Addendum (Add.) A-100 to A-101, nor validly found that the Rollback will have "no effect" on protected species or habitat. Instead, the Agencies claimed to "lack sufficient discretion" under the Clean Air Act and EPCA to trigger the duty to consult, 85 Fed. Reg. at 25,255–56, and claimed that "there is simply no way to 'connect the dots'" between the Rollback and effects on protected species and habitat, *id.* at 25,254. Both claims are invalid.

1. The Rollback was a discretionary action requiring ESA consultation

The ESA requires consultation for "all actions in which there is discretionary Federal involvement or control." 50 C.F.R. § 402.03. "[I]f an agency has *any* statutory discretion over the action in question, that agency has the authority, and thus the responsibility, to comply with the ESA." *Am. Rivers v. U.S. Army Corps of Eng'rs*, 271 F.Supp.2d 230, 251 (D.D.C. 2003) (emphasis added); *see also AFPM*, 937 F.3d at 598. The Agencies had sufficient statutory discretion to trigger that responsibility. Indeed, the Agencies professed to have *vast* discretion in setting GHG and fuel-economy standards. *See* 85 Fed. Reg. at 24,177 (NHTSA); *id.* at 24,222 (EPA); *see also Ctr. for Biological Diversity v. NHTSA* (*CBD*), 538 F.3d 1172, 1212–14 (9th Cir. 2008). Yet they conveniently disclaimed discretion when it came to their ESA duties. The Clean Air Act and

EPCA vest EPA and NHTSA, respectively, with sufficient discretion to require consultation for standards that may affect listed species or critical habitat.

2. Any uncertainty regarding the Rollback's effects on listed species and critical habitat did not relieve the Agencies of their consultation duties

The Agencies' purported inability to "connect the dots" between the Rollback and its effects on listed species and critical habitat did not exempt the Agencies from their duties to consult with the Services. Rather, it showed why Congress required agencies like EPA and NHTSA to consult with the Services--the experts in protection of endangered species. Claiming that an action's impacts are uncertain is not the same as determining that the action will have "no effect" on listed species or critical habitat. *AFPM*, 937 F.3d at 598 ("EPA['s] conclu[sion] that it is impossible to know whether the … Rule will affect listed species or critical habitat … is not the same as determining that the 2018 Rule 'will not' affect them."). Unless an agency can conclusively find that its action will *not* affect listed species or habitat, *see* 50 C.F.R. § 402.14(b), the ESA calls for formal or informal "assistance of" the Services, which possess the requisite biological expertise to determine the effects of federal actions (including national rules like the Rollback) on listed species and critical habitat, *see* 16 U.S.C. § 1536(a)(2), (c)(1); 50 C.F.R. §§ 402.13, 402.14. The Agencies' unilateral, non-expert determination that it is "impossible to know" the Rollback's effects on listed species or critical habitat is not a "no effect" determination.

3. The record contradicted the Agencies' claim of uncertainty

In any event, the record clearly shows the Rollback will cause massive emissions increases compared to the prior standards and that those increases "may affect" listed species and critical habitat. *See AFPM*, 937 F.3d at 597; 50 C.F.R. § 402.14(a).[20]

The Services recognize climate change as a current or potential threat for more than 70% of all species listed between 2012 and 2015. JA_[NHTSA-2018-0067-12378_25]. The Rollback will cause almost one billion tons of additional carbon dioxide emissions. *See supra*, Part I.A. These staggering emissions and resulting climate-change impacts are directly linked to harm to endangered species and habitat.

For example, the Rollback will further jeopardize the polar bear, listed as "threatened" due to climate change. *See* JA_–_[NHTSA-2018-0067-12378_12-16], JA_–_[NHTSA-2018-0067-12378_Attachment_Amstrup_GHG_Mitigation_Sea_Ice_Loss]; *see also* Add. A-11 to A-28. Contrary to the Agencies' assertions that the causal link

[20] The record is replete with examples of ways in which the Rollback will harm listed species. *See, eg.,* JA_–_[EPA-HQ-OAR-2018-0283-5078] and references therein (JA_–_[EPA-HQ-OAR-2018-0283-4133], _–_[EPA-HQ-OAR-2018-0283-6170], _–_[EPA-HQ-OAR-2018-0283-6474]; JA_–_[EPA-HQ-OAR-2018-0283-5075–15-17] and references therein (JA_–_[EPA-HQ-OAR-2018-0283-4398], _–_[EPA-HQ-OAR-2018-0283-6585], _–_[EPA-HQ-OAR-2018-0283-6851], _–_[EPA-HQ-OAR-2018-0283-6171], _–_[EPA-HQ-OAR-2018-0283-6172], _–_[EPA-HQ-OAR-2018-0283-6177], _–_[EPA-HQ-OAR-2018-0283-5705], _–_[EPA-HQ-OAR-2018-0283-6176]); and JA_–_[NHTSA-2018-0067-12378] and references therein (JA_–_[NHTSA-2018-0067-12378], _–_[NHTSA-2018-0067-12379], _–_[NHTSA-2018-0067-12380], _–_[NHTSA-2018-0067-12381], _–_[NHTSA-2018-0067-12382], _–_[NHTSA-2018-0067-12383], _–_[NHTSA-2018-0067-12384], _–_[NHTSA-2018-0067-12396]). Our citations to JA_–_[NHTSA-2018-0067-12378] incorporate the references cited therein.

between the Rollback's carbon dioxide emissions and effects on polar bears is too speculative, 85 Fed. Reg. at 25,253, the loss of sea ice—on which polar bears rely to hunt—and shorter sea-ice seasons are directly linked to specific increases in GHG emissions. *E.g.*, JA_–_[NHTSA-2018-0067-12380_Attachment_Notz2016]; Add. A-25 to A-27. For instance, the increased carbon dioxide emissions of 867–923 million tons through model year 2029 vehicles alone are projected to reduce the bear's summer sea-ice habitat by 1,004–1,069 square miles. JA_–_[NHTSA-2018-0067-12380_Notz2016]; Add. A-445 (calculations).[21]

The Agencies admit that the Rollback's increase in GHG emissions will harm ecosystems, including by fueling sea-level rise, acidifying oceans, and elevating temperatures. 85 Fed. Reg. at 25,163; JA_–_[NHTSA-2017-0069-0738_5-40_to_5-56]. Even small increases in ocean acidity or temperature injure listed species, like corals in the Florida Keys, as severe bleaching events have increased five-fold in the last few decades. JA_–_[NHTSA-2018-0067-12378_16-23]; JA_–_[NHTSA-2018-0067-12396_Attachment_Hughes2016_1-2]; JA_–_[NHTSA-2018-0067-12384_Attachment_Veron2009]. Increasing temperatures and sea-level rise also threaten species that nest or live on coasts, including loggerhead sea turtles in Florida and piping plovers on Massachusetts

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[21] Using the Agencies' projections, the Rollback will increase carbon dioxide emissions by 7.8 billion tons through 2100 (JA_–_[NHTSA-2017-0069-0738_5-34_to_5-35]), leading to a loss of at least 9,035 square miles of summer sea-ice habitat and further shortening their hunting season. JA_–_[NHTSA-2018-0067-12378_13-15], _–_[NHTSA-2018-0067-12380_Attachment_Notz2016]; *see also* Add. A-26 to A-27, A-445 to A-446 (explaining calculations).

beaches being "swallow[ed]" by rising seas. *Massachusetts*, 549 U.S. at 522-23; *see also* JA_–_[NHTSA-2018-0067-12378_23-25], _–_[NHTSA-2018-0067-12382_Attachment_Reece2013].

The Agencies further project that the Rollback will increase emissions of sulfur and nitrogen oxides, 85 Fed. Reg. at 25,057-60, 25,064-65, and emissions are likely to be higher than the Agencies project, *see supra,* Part I.B. Sulfur and nitrogen pollution cause downwind acid deposition, creating inhospitable conditions for many plants and animals. 85 Fed. Reg. at 24,871; JA_–_[NHTSA-2018-0067-12378_31-37]. Sulfur pollution, for example, causes increased acidification of forest ecosystems, like those in Virginia, where the last Shenandoah salamanders live. JA_[NHTSA-2018-0067-12378_36], _–_[NHTSA-2018-0067-12383_Attachment_USEPA2017IRP_2-3_to_2-5]. Deposition of atmospheric nitrogen from tailpipes and refineries reduces abundance of native plants that serve as habitats and food sources for myriad listed species, including desert tortoises. JA_–_[NHTSA-2018-0067-12383_31-34]; *see also* Add. A-47 to A-61. Tailpipe emissions of nitrogen oxides and ammonia are directly tied to decreases in endangered Bay checkerspot butterfly populations, JA_, _–_[NHTSA-2018-0067-12383_6,31-32], _–_[NHTSA-2018-0067-12384_Attachment_Weiss]; *see also* Add. A-331 to A-334.

Accordingly, the Agencies' failure to consult with the Services despite ample evidence of harm to listed species and critical habitat was both unlawful and prejudicial.

B. NHTSA Violated The National Environmental Policy Act

NEPA requires NHTSA to thoroughly assess the environmental consequences of a proposed action to ensure a "fully informed and well-considered decision." *Theodore Roosevelt Conservation P'ship v. Salazar* (*TRCP*), 661 F.3d 66, 68 (D.C. Cir. 2011). The agency violated NEPA in two ways. First, NHTSA considered only options that would weaken its prior fuel-economy standard for model year 2021, excluding alternatives that would strengthen that standard and reduce harmful environmental impacts. Second, when considering the cumulative impacts of its rule along with related actions, NHTSA ignored the substantial additional impacts of the Agencies' recent actions invalidating state zero-emission-vehicle laws.

1. NHTSA did not adequately consider a reasonable range of action alternatives

NHTSA must "[r]igorously explore and objectively evaluate" the environmental impacts of not only its proposed action but also a reasonable range of alternatives. 40 C.F.R. § 1502.14(a) (2005), *modified by* 85 Fed. Reg. 43,304 (July 16, 2020)); *see also* 42 U.S.C. § 4332. The available alternatives here included increases, as well as decreases, in fuel-economy standards. Yet the most environmentally beneficial alternative NHTSA evaluated was the "no action" alternative, i.e., leaving existing model year 2021 standards intact and finalizing model year 2022–2025 augural standards. *See* State Br. 20. All seven action alternatives NHTSA considered are undisputedly worse for the environment than that baseline. JA_[NHTSA-2017-0069-0738_at_2-4].[22] NHTSA violated NEPA by "limit[ing] itself to only one end of the spectrum of possibilities," *Oceana, Inc. v. Evans*, 384 F.Supp.2d 203, 240, *clarified by* 389 F.Supp.2d 4 (D.D.C. 2005), and not considering in detail any alternative that "would avoid or minimize adverse impacts" compared to the baseline, *TRCP*, 661 F.3d at 69 (quoting 40 C.F.R. § 1502.1).

"Consideration of more stringent fuel-economy standards that would *conserve more energy*" than the baseline existing standards "is clearly reasonably related to the purpose of [NHTSA's] standards." *CBD*, 538 F.3d at 1219. Though EPCA affords NHTSA a degree of discretion to balance the statutory factors to determine "maximum feasible" average fuel-economy standards, *see* 85 Fed. Reg. at 25,185 n.3002, EPCA's "overarching goal [is] fuel conservation," *CAS*, 793 F.2d at 1340; *accord* JA_[NHTSA-2017-0069-0738_at_1-4] n.26. NHTSA's selection of reasonable alternatives must comport with that goal. *See Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 196 (D.C. Cir. 1991).

NHTSA asserted that more stringent standards necessarily would fall outside the "spectrum of possible standards NHTSA could determine was maximum feasible based on the different ways the agency could weigh EPCA's four statutory factors." 85 Fed. Reg. at 25,162; *see also* JA_[NHTSA-2017-0069-0738_S-2]. But NHTSA's "hands are

[22] Notably, each action alternative would increase criteria pollution, thus jeopardizing attainment of federal air quality standards, contrary to the Clean Air Act's requirement that agencies avoid doing so. *See* 42 U.S.C. § 7506(c)(1). NHTSA failed to consider that risk. State Br. 38–40.

not tied." *CBD*, 538 F.3d at 1212 (rejecting similar NHTSA attempt to evade NEPA); *see also Am. Oceans Campaign v. Daley*, 183 F.Supp.2d 1, 21 (D.D.C. 2000) (approach like NHTSA's "subverts the very purpose of NEPA," "to ensure that … final decision-making will be informed by a full understanding of relevant environmental impacts"). NHTSA's discretionary weighing of EPCA's four statutory factors did not limit the range of action alternatives it had to consider. *CBD*, 538 F.3d at 1212–13, 1217–20.

Finally, NHTSA's "initial screening exercise" in the "Alternatives Considered but Not Analyzed in Detail" section does not satisfy the duty to fully consider a more protective alternative. JA_–_[NHTSA-2017-0069-0738_2-9_to_2-10]; *see also* 85 Fed. Reg. at 24,258–62. NHTSA's conclusion that a stronger alternative would not provide a "dramatic acceleration of energy and environmental benefits" was not supported by its environmental analysis. JA_[NHTSA-2017-0069-0738_at_2-10]. Robust development of a stronger alternative, rather than just a screening exercise, would have "inform[ed] both the public and the decisionmaker" by "sharply defining the issues and providing a clear basis for choice among options." *Union Neighbors United, Inc. v. Jewell*, 831 F.3d 564, 577 (D.C. Cir. 2016); *see also* JA_[EPA-HQ-OAR-2018_0283-0664_S-51] (NHTSA's prior standards informed by consideration that stronger alternative "would be an important contribution to reducing the risks associated with climate change").

2. NHTSA did not adequately consider cumulative impacts

NHTSA unlawfully ignored the Rollback's impacts in concert with the impacts of its own action—and that of EPA—invalidating state zero-emission-vehicle laws in

2019. *See* 84 Fed. Reg. 51,310 (Sept. 27, 2019). Although those state laws had reduced pollution above and beyond federal and state GHG standards and federal fuel-economy standards, NHTSA refused to analyze the impacts of the invalidation of the state laws in concert with the Rollback because that invalidation was "the subject of a separate final action." JA_, _, _[NHTSA-2017-0069-0738_at_10-81,10-112,10-342].

NHTSA must analyze "the incremental impact of [its] action when added to other past, present, and reasonably foreseeable future actions." 40 C.F.R. § 1508.7 (2005) (subsequently modified); 49 C.F.R. §§ 520.5(a), 520 att. 1, 3.a(2); *see also CBD*, 538 F.3d at 1216–17 (NHTSA required to analyze cumulative impacts of fuel-economy standards in light of other fuel-economy rulemakings). All the more so where (as here) actions were taken "concurrent[ly]" by the same agencies and had "cumulative or synergistic" effects. *Kleppe v. Sierra Club*, 427 U.S. 390, 410 (1976). Preempting state zero-emission-vehicle laws had cumulative effects when added to the Rollback, including reduced investment in zero-emission-vehicle technology and reduced deployment of zero-emission vehicles, and corresponding increases in vehicular emissions of GHGs and criteria pollutants. *See e.g.,* JA_–_, _–_, _–_[EPA-HQ-OAR-2018-0283-5054_67-69_294-302_307-309], _–_[EPA-HQ-OAR-2018-0283-7623_6-7], _–_[EPA-HQ-OAR-2018-0283-1060_pdf5-6].

CONCLUSION

The Rollback defied the clear intent of the Agencies' authorizing statutes, was arbitrary and capricious in myriad respects, and will greatly harm public health, the environment, and consumers. It should be vacated. *See Bhd. of Locomotive Eng'rs & Trainmen v. Fed. R.R. Admin.*, 972 F.3d 83, 117 (D.C. Cir. 2020) (vacatur is the "normal remedy" for "unsustainable agency action").

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CERTIFICATE OF COMPLIANCE

This brief was prepared in 14-point Garamond font using Microsoft Word 365 (Nov. 2020 ed.), and it complies with the typeface and typestyle requirements of Federal Rule of Appellate Procedure 32(a). The brief contains 11,294 words and, in conjunction with the briefs filed by other Coordinating Petitioners, it complies with the type-volume limitations imposed by this Court's order of October 19, 2020. ECF No. 1867064.

/s/ Matthew Littleton
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CERTIFICATE OF SERVICE

I certify that on January 14, 2021, I electronically filed the foregoing brief using the Court's CM/ECF system. All counsel registered as CM/ECF users will be served by that system. I further certify that service will be accomplished via email for the following case participant:

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No. 20-1145

Consolidated with Cases No. 20-1167, -1168, -1169, -1173, -1174, -1176, -1177 & -1230

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

COMPETITIVE ENTERPRISE INSTITUTE et al.,

Petitioners,

v.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION et al.,

Respondents,

ALLIANCE FOR AUTOMOTIVE INNOVATION et al.,

Intervenors for Respondents.

PUBLIC INTEREST ORGANIZATION PETITIONERS' ADDENDUM OF STANDING AND EXPERT DECLARATIONS

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DECLARATION OF ROBERT AKE

I, Robert Ake, declare as follows:

1. I am over the age of 18, competent to testify, and have personal knowledge of the following facts.

2. I live at 6603 Catherine Street in Norfolk, Virginia on an alcove off the Lafayette River. I have lived here for over 23 years. I have lived in Virginia for over fifty years, and in my free time I enjoy birding. I lead bird tours and trips and conduct surveys for the Fish and Wildlife Service in the Hampton Roads area, including in Back Bay National Wildlife Refuge.

3. I am a member of the Chesapeake Bay Foundation. I have been a member since 2006. I am aware of CBF's mission to "Save the Bay" and I support this mission. The Chesapeake Bay Foundation works to restore water quality and habitat, which I support because of my interest in birds and fish that live in the Bay and its watershed. I have participated in CBF's oyster gardening program by growing oysters off my dock.

4. I have lived in my home for 23 years and have seen first-hand what happens when large storms like hurricanes and northeasters hit my community. These storms can bring high winds, storm surges, and rains, which have resulted in my yard being flooded on multiple occasions, and one storm that brought water

levels all the way up to our home's foundation. We were forced to raise our furniture off the floor to prepare for possible flooding.

5. I understand that climate change is making these sorts of storms increasingly likely and I have significant concerns about damage to my home and property value.

6. Flooding has also become a regular occurrence in my community and affects routine activities. Flooding is something I always have to take into account now as I travel in and around the Hampton Roads area. Hampton Boulevard, much of downtown Norfolk, and one of the roads I frequently use are particularly susceptible to this flooding. There are times when I have to take alternate routes due to flooded roads, and times when I must abandon my travel altogether.

7. In addition to impacts to my personal property and community, sea level rise has had a significant impact on my ability to observe birds and conduct surveys for Fish and Wildlife Service—two activities I value and enjoy.

8. There is a small saltwater marsh adjacent to my property that provides important habitat for birds, including Clapper Rails and Marsh Wrens. The marsh provides breeding habitat for these birds, as well as a food source. Unfortunately, in the 23 years I have lived here, the marsh has been reduced to almost half its size due to rising water levels. The rising water levels inundate the marsh, killing the

grasses and eventually destroying the habitat. I expect that the marsh will be completely gone in the next 15 years or so.

9. This issue is not unique to my property. I have seen these same impacts to saltwater marshes occurring all along Virginia's coast. For example, I have observed and understand that marsh habitat is being destroyed in Chincoteague due to sea level rise, posing significant threats to a large Laughing Gull population.

10. I also perform bird surveys for the Fish and Wildlife Service in the Back Bay National Wildlife Refuge, the Eastern Shore of Virginia National Wildlife Refuge, and other marsh habitats on Virginia's Eastern Shore. I have done this work for over 40 years. During the course of this work, I have observed and understand that rising sea levels are reducing the quality and quantity of saltwater marshes in these locations. For example, Black Rails are a species of bird that require this type of tidal marsh habitat and they have virtually disappeared from Virginia due to the loss of tidal marsh habitat.

11. As sea levels continue to rise, the quality and quantity of marshes all along Virginia's coast will continue to decline, further threatening the feeding and breeding habitat for these birds and many others. Eventually, many of the marshes will simply disappear, as will the wildlife populations that depend on them. These

losses will interfere with or entirely prevent me from engaging in the birding activities I value and enjoy.

12. I understand that impacts from sea level rise are directly tied to greenhouse gas emissions, including tailpipe exhaust from motor vehicles.

13. I understand that EPA has issued the SAFE Part One Rule, which removes the ability of states to adopt greenhouse gas emissions and zero emission vehicle standards for passenger cars and trucks. I understand that EPA and NHTSA have also issued the SAFE Part Two Rule, which weakens fuel economy standards and greenhouse gas emission standards for passenger cars and trucks.

14. The SAFE Rules, individually and collectively, allow an increase in emissions of carbon dioxide and other greenhouse gases from tailpipes. I know that emissions of carbon dioxide and other greenhouse gases contribute to climate change, which leads to sea level rise and increased storms that harm my interests.

15. I am aware that the Chesapeake Bay Foundation has filed petitions with the D.C. Circuit challenging the SAFE Rules. I support CBF’s challenges because I am experiencing harm from climate change, and the Agencies’ actions directly contribute to this harm by preventing states from reducing climate-harming greenhouse gas emissions from cars and trucks and by weakening the federal standards for greenhouse gas emissions from tailpipes. Decisions from the

Court that strike down the SAFE Rules and revive existing programs and standards aimed at reducing greenhouse gas pollution from cars would alleviate my harm.

I declare under penalty of perjury and based on personal knowledge that the foregoing is true and correct to the best of my knowledge and belief.

Executed on the 27 day of May 2020.

Robert L Ake

Robert Ake

DECLARATION OF STEVEN AMSTRUP

FOR THE CENTER FOR BIOLOGICAL DIVERSITY

I, Steven Amstrup, state and declare as follows:

1. The facts set forth in this declaration are based upon my personal knowledge. If called as a witness, I could and would testify to these facts. As to those matters which reflect an opinion, they reflect my personal opinion and judgment on the matter.

2. I am submitting this declaration on behalf of myself and the member declarants of the Center for Biological Diversity.

3. I live in Kettle Falls, Washington. I hold a Bachelor of Science in Forestry from the University of Washington (1972), a Master of Science in Wildlife Management from the University of Idaho (1975), and a Ph.D. in Wildlife Management from the University of Alaska, Fairbanks (1995).

4. I am one of the world's foremost experts on polar bear ecology and conservation.

5. Since 2010, I have served as the chief scientist for Polar Bears International (PBI). PBI is a non-profit organization dedicated solely to the research and conservation of wild polar bears. At PBI, I engage in outreach activities with other conservation organizations, the public, media, and

policymakers, including communicating about the threats that global warming poses to polar bears and the sea ice and coastal habitats they depend on. I also identify key research gaps and participate in studies related to polar bear survival and conservation.

6. Since 2006, I have also served as an Adjunct Full Professor at the University of Wyoming in Laramie.

7. Prior to working with PBI, I was a research wildlife biologist with the United States Geological Survey (USGS) at the Alaska Science Center in Anchorage for 30 years, where I led polar bear research in Alaska as Leader of the Ursid and Arctic Marine Research Team. As part of my duties in that position, I led research on all aspects of polar bear ecology in the Beaufort Sea from 1980 to 2010.

8. While at USGS, in 2007, I led a research team in the production of nine reports that provided the scientific basis for the U.S. Secretary of Interior's determination in 2008 that polar bears should be declared "threatened" under the U.S. Endangered Species Act due to threats from human-caused global warming.

9. In 2012, I received both the Indianapolis Prize and the Bambi Award for my work on behalf of polar bear conservation. I am a past chairman of the International Union for Conservation of Nature (IUCN) Polar Bear Specialist Group and have been an active member of the group since 1980.

10. I have authored or coauthored over 150 peer-reviewed articles on the movements, distribution, and population dynamics of large mammals. Approximately 140 of those research articles are related to polar bears.

11. My research on polar bears has investigated polar bear movement, distribution, maternity denning, demography (including recruitment and survival rates), and population dynamics (including estimating changes in polar bear population size), with a focus on polar bears in the Beaufort Sea of Alaska and Canada. My 1995 Ph.D. dissertation was titled "Movements, Distribution, and Population Dynamics of Polar Bears in the Beaufort Sea," and my subsequent scientific articles have expanded on the findings of that original research. I have coauthored research papers focused on polar bear populations in the Chukchi Sea of Alaska and Canada's Northern Beaufort Sea and Western Hudson Bay populations, and I have coauthored two major papers projecting the future global status of polar bears.

12. I plan to continue my research and public advocacy work and will return to Churchill, Canada, for the 2021 season, if the COVID pandemic has abated and it is safe to travel.

13. During my 40-year research career with polar bears from 1980 to the present, increasing greenhouse gas emissions and resulting human-caused global warming have become the primary threat to polar bear populations worldwide. The

harms have become so severe that in 2008, polar bears were listed as "threatened" with extinction under the Endangered Species Act.

14. As a result of global warming, the Arctic sea ice that polar bears depend on for survival has decreased markedly in extent, duration, and thickness. My research has detected significant, widespread, and worsening impacts to polar bears from increasing sea ice loss driven by greenhouse gas emissions—both at present and in the future. One of my most important research contributions has been showing that rapid and immediate reductions in greenhouse gas emissions are essential for protecting polar bears from extinction.

15. I am aware that the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) have issued a rule that weakens the standards for greenhouse gas emissions and criteria pollutants from passenger cars and light trucks (SAFE II Rule). I have learned that EPA and NHTSA estimate that the SAFE II Rule will increase carbon dioxide (CO_2) emissions by nearly one billion metric tons through model year 2029, and by 7.8 billion metric tons between 2021 and 2100, worsening human-caused global warming. In addition, I understand that the SAFE II Rule will increase the emissions of two other potent greenhouse gases, methane and nitrous oxide, which will further worsen the impacts of global warming. The greenhouse gas emissions resulting from this rule may be higher than the agencies' estimates. But even the

immense emissions projected by the agencies pose serious risks to polar bears.

16. I have ongoing personal and professional interests in protecting polar bears, which will be harmed by the SAFE II Rule. I have loved polar bears since I was young, and my research and public education work depend on being able to observe and study polar bears. Global warming is indeed global, and its effects on polar bears are only an early and easy-to-discern sign of global impacts. Therefore, the SAFE II Rule will harm livelihoods and economies around the world.

17. My personal interest in studying bears began when I was a child. I have been enamored with these animals for as long as I can remember. As a kid, bears were synonymous with "wild country." If there were bears, I thought, there would be everything else wild too, and I loved bears from my earliest sentient days. I read everything about bears I could get my hands on, from *Field and Stream* magazine to library books. I must have said something in a group of relatives about my career ambitions very early on, as I recall on a later trip to visit distant family, my aunt patted me on top of the head and asked if I still wanted to "go into the woods and study bears?" My answer to my aunt's question was a simple "yes."

18. My deep interest in polar bears, with roots in my youth, has grown into a 40-year career studying and protecting these animals. During my decades of research, I documented the comeback of polar bear populations from excessive

trophy hunting, only to see and document them declining anew due to another human-caused threat: global warming. The increase in greenhouse gas emissions resulting from the SAFE II Rule stands to worsen all of the climate change responses to a warming world, including sea ice loss and its related harms to polar bears.

Greenhouse Gas Emissions Pose an Existential Threat to Polar Bears

19. My research on polar bears over 40 years, along with numerous studies and analyses by other scientists and research groups, has established that rising greenhouse gas emissions and the resulting loss of Arctic sea ice jeopardize the polar bear's continued existence. The projected range-wide decline of polar bear populations resulting from global warming and associated sea ice loss was the principal reason that the U.S. Fish and Wildlife Service declared the polar bear a threatened species across its range in 2008.

20. Global warming—and the greenhouse gas emissions that drive it—threaten the polar bear's very existence because these bears depend entirely on sea ice for survival. First and foremost, polar bears need sea ice to catch their prey. They derive most of their nutrition from two species of seals that they can only predictably catch from the sea ice surface. Polar bears also rely on sea ice to travel, find mates, teach their cubs how to live, and in some populations, for maternity

dens, where polar bear mothers give birth and rear young cubs.

21. The Arctic is on the front lines of climate change as one of the fastest-warming regions on Earth. As temperatures rise due to increasing greenhouse gas emissions, the Arctic sea ice on which polar bears rely has plummeted in extent, duration, and thickness. Sea ice is declining in every region of the Arctic and in all seasons, with especially rapid losses of summer sea ice. Despite year-to-year variation, satellite data shows that September sea ice extent has declined by more than 13 percent per decade since the satellite record began in 1979. Without a reduction in greenhouse gas emissions, state-of-the-art climate models continue to project the first "ice-free" Arctic summer by or before mid-century.

22. As sea ice extent is diminishing in all seasons, it also is forming later in the fall and breaking up earlier in the summer, resulting in fewer days during which polar bears are able to feed and more days during which they are food deprived. The harms to polar bears from declining sea ice are well-studied and well-documented. Research across the Arctic has shown that sea ice loss results in declining polar bear physical stature and weight, declining body condition, poorer survival of adults and cubs, and declining population size.

Loss of Sea Ice Deprives Polar Bears of Food, Leading to Numerous Harms Including Reduced Weight, Poorer Survival and Reproduction, and Shrinking

<u>Populations</u>

23. My research on polar bears in the Beaufort Sea of Alaska and Canada, and that of my colleagues, has documented the widespread and adverse impacts of sea ice loss, resulting in a recent ~40 percent decline in the Southern Beaufort Sea polar bear population (Bromaghin et al. 2015) (Please see Exhibit A for a full list of citations).

24. One of the earliest harms documented for the Southern Beaufort Sea population was the increasing frequency of long-distance swims by polar bears as the summer and fall sea ice retreats earlier from the coast (Pagano et al. 2012). Research shows that swimming is much more energetically costly for polar bears than walking. Long swims also increase the risks of drowning (Monnett and Gleason 2006) and are dangerous for young cubs, who will die if they are too cold for too long (Blix and Lentfer 1979). The most extreme record was an adult female that swam for 427 miles (687 kilometers) over 9 days to reach the distant sea-ice edge in the Beaufort Sea, followed by another 54 days of walking and swimming an additional 1,118 miles (1,800 kilometers). During this time, this mother bear lost her cub and 22 percent of her body mass, illustrating the heavy costs of long-distance swimming (Durner et al. 2011).

25. We also made unprecedented observations of cannibalism by male polar bears, which we hypothesize was driven by nutritional stress due to the

decline of sea ice (Amstrup et al. 2006, Regher and Amstrup 2006). In one case, we recorded a male that stalked and killed a mother polar bear in her den. This kind of behavior had not been observed during decades of previous research, and likely occurred because of food stress. As polar bears cannot hunt seals without sea ice, they are facing longer and longer stretches during which hunting is not possible.

26. Our research has documented other ways that sea ice loss increases energetic stress on polar bears. For example, we found that polar bears in the Beaufort and Chukchi Seas are covering greater daily distances to compensate for the higher drift rates of Arctic sea ice, as sea ice declines. This increases energetic costs for polar bears (Durner et al. 2017), forcing them to expend more energy without a corresponding increase in nutritional intake.

27. Other researchers have also demonstrated increasing nutritional deprivation in polar bears. Research by colleagues documented an increased proportion of food-deprived polar bears in the Southern Beaufort Sea during late winter, corresponding with the loss of sea ice (Cherry et al. 2008). Our research showed that Southern Beaufort Sea bears do not have the ability to undergo any special energy-saving or "adaptive" fasting during the summer, when sea ice is not available. Instead, polar bears show familiar signs of food deprivation such as declines in activity and body temperature that are "typical" for animals that are

food deprived. This research confirms that polar bears do not have any special adaptations that could make them less vulnerable to deleterious declines in body condition during ever more prolonged periods of summer food deprivation due to sea ice loss (Whiteman et al. 2015, 2018).

28. As food deprivation has increased, our research has documented the declining body size of polar bears in the Southern Beaufort Sea linked to nutritional stress from sea ice loss. Between 1982 and 2006, we found decreases in skull size and body length of polar bears three years and older (Rode et al. 2010).

29. Our research has also found that more polar bear mothers are denning on land, rather than sea ice, as stable sea ice habitat declines and autumn ice freeze-up is delayed (Fischbach et al. 2007). Meanwhile, denning habitat along the Alaska coast is being threatened by increasing coastal erosion due to sea ice loss and the thawing of permafrost due to global warming (Durner et al. 2006).

30. In terms of population-level impacts, we have documented that polar bear survival and reproductive success in the Southern Beaufort Sea are declining with the loss of sea ice. Female survival, breeding rates, and cub litter survival declined as the ice-free period increased during the period of 2001 to 2006 in the Southern Beaufort Sea (Regehr et al. 2010). In a subsequent study in the Southern Beaufort Sea, extending from 2001 to 2010, only 2 of 80 cubs tagged during the years 2003 to 2007 were ever seen again. This exceptionally poor survival rate was

linked to unfavorable ice conditions that limited access to prey during multiple seasons (Bromaghin et al. 2015).

31. In this 2015 study, we documented a 25 to 50 percent decline in population size for Southern Beaufort Sea polar bears—linked mainly to a significant reduction in ice availability between 2004 and 2007 (Bromaghin et al. 2015). Our population estimate of 900 bears in 2010, from this same study, was significantly lower than our estimate of 1,800 animals in 1986 (Amstrup et al. 1986), and this decline appeared to be driven by the increase in ice-free days during this period. A more recent study suggested relative stability at this lower population size through 2016 (Atwood et al. 2020); yet the fact that cub survival in most years after 2001 was well below historic levels (Amstrup and Durner 1995) suggests the apparent stability may reflect the inability of estimation procedures to capture true trends rather than real population stability.

32. Polar bear research has shown that adverse impacts from sea ice loss are affecting other polar bear populations, as well as the one in the Southern Beaufort Sea. In the Northern Beaufort Sea, for example, research indicates that the survival of polar bears of all age classes decreased with declines in the sea-ice concentration over shallow continental shelf waters (Stirling et al. 2011).

33. In Canada's Western Hudson Bay, another area with rapid sea ice loss, we documented that the survival of juvenile, subadult, and older bears

declined between 1984 and 2004, and that the Western Hudson Bay polar bear population suffered a 22 percent or greater decline after the early 1980s (Regehr et al. 2007). This was linked to the annual sea-ice breakup occurring earlier in the year (Regehr et al. 2007).

34. An unavoidable consequence of frequent and/or long term reductions in survival is declining population size. Prolonged periods of food deprivation resulting from growing ice-free seasons during the same time frame are the only plausible explanation for these trends.

Without Significant Reductions in Greenhouse Gas Emissions, Most of the World's Polar Bears May Be Lost by 2050

35. Multiple publications based on the large body of my research and that of my colleagues provide unequivocal evidence of the dire threat of global warming to future polar bear persistence. The evidence is unequivocal that aggressive reductions in greenhouse gas emissions are critical for saving polar bears from extinction.

36. As noted above, in 2007 I led a USGS research team in the production of nine reports to inform the U.S. Fish and Wildlife Service decision on whether to list polar bears as a threatened species under the U.S. Endangered Species Act. The USGS team included scientists from within USGS, polar bear scientists from

Canada, and scientists from academia, the private sector, and other federal agencies.

37. I was the lead author on the synthesis report titled "Forecasting the Range-wide Status of Polar Bears at Selected Times in the 21st Century" that forecast the status of the world's polar bear populations 45, 75, and 100 years into the future. We applied the best available information about predicted changes in sea ice in the 21st century to current knowledge of polar bear populations and their ecological relationships to the sea ice to understand how the range-wide population of polar bears might change. I developed the concept, now universally adopted, that the world's 19 polar bear subpopulations can be grouped into 4 ecological regions based on current sea ice conditions and how the bears respond to them. These "ecoregions" are the (1) Seasonal Ice Ecoregion, which includes Hudson Bay, and occurs mainly at the southern extreme of the polar bear range, (2) the Archipelago Ecoregion of the Canadian Arctic, (3) the Polar Basin Divergent Ecoregion, which includes the two Alaska polar bear populations, and (4) the Polar Basin Convergent Ecoregion. We incorporated projections of future sea ice in each ecoregion, based on 10 general circulation models, into two models of polar bear habitat and potential population response.

38. Our modeling indicated that, if global warming is allowed to continue, future sea ice declines will result in the loss of approximately two-thirds of the

world's current polar bear population by the mid-21st century, including all of Alaska's polar bears. Because the observed trajectory of Arctic sea ice decline appears to be underestimated by currently available models, we warned that this assessment of future polar bear status may be conservative. Our projected declines in polar bear populations across the Arctic provided the scientific basis for the U.S. Secretary of Interior's determination in 2008 that polar bears should be declared threatened under the U.S. Endangered Species Act due to threats from sea ice loss driven by greenhouse gas emissions.

39. Building on this research, in the December 2010 issue of the journal *Nature*, six coauthors and I published a study titled "Greenhouse gas mitigation can reduce sea-ice loss and increase polar bear persistence," where we quantified the range-wide costs to polar bears of continued greenhouse gas emissions and assessed the value of greenhouse gas mitigation. Our study (Amstrup et al. 2010) concluded that preserving polar bears depends on reducing greenhouse gas emissions.

40. Specifically, our research showed that substantially more sea-ice habitat would be retained in scenarios where greenhouse gas emissions are reduced below a business-as-usual scenario. We showed that implementing aggressive reductions in greenhouse gas emissions means that polar bears could persist throughout the century in greater numbers and more areas than in the business-as-

usual emissions case.

41. Furthermore, we detected a linear relationship between increasing global mean surface air temperature and decreases in sea ice habitat and found no evidence for a "tipping point" threshold beyond which sea ice loss would be irreversible. Because sea-ice habitat decreases are driven by increases in mean global temperature in a largely linear fashion, the loss of sea-ice habitat and corresponding declines in polar bear distribution and numbers are not unavoidable—if immediate and rapid greenhouse gas reductions are implemented.

42. Similar to our 2007 study, this study projected that by mid-century we could lose two-thirds of the world's polar bears—including all the bears in Alaska—under a business-as-usual emissions scenario.

43. Most recently, in a paper released in July 2020 (Molnár et al. 2020, attached as Exhibit B), my colleagues and I refined our 2010 findings and projected, for the first time, when sea ice loss would begin to impact polar bears in different subpopulations around the Arctic. Our paper titled "Fasting season length sets temporal limits for global polar bear persistence," which I conceived and coauthored, appeared in the journal *Nature Climate Change*, and corroborated the global trends we projected in 2010. These "population by population" projections for the future collapse of polar bears are dire, and once again demonstrate that aggressively reducing greenhouse gas emissions is the key to the polar bear's

future survival.

44. In our 2020 study, we determined how many days polar bears can fast, depending on body condition, before cub recruitment and/or adult survival are impacted and decline rapidly. We then used anticipated increases in ice-free days in different regions, under different greenhouse gas emissions scenarios, to project when these reproduction and survival thresholds will be exceeded in different polar bear populations across the Arctic.

45. Therefore, in this study, we explained that polar bears across their range ultimately will decline due to reaching their energetic fasting limit if we don't rapidly halt warming. We answered questions pertinent to particular locales such as: "When will each population cross these critical fasting thresholds and begin to disappear?" We also projected that declines may be reduced if greenhouse gas emissions are mitigated.

46. Our projections for the future collapse of polar bear populations are dire and disturbing, yet, like our 2010 projections, are probably optimistic (see discussion below). Our model captures demographic trends observed during the years 1979 to 2016, showing that reproduction and survival impact thresholds are "likely" to have been crossed already in the Western Hudson Bay, Southern Hudson Bay, and Davis Strait populations.

47. Our model projections suggest that under a business-as-usual

greenhouse gas emissions scenario, many polar bear populations, including the Southern Beaufort Sea and Chukchi Sea populations in Alaska, will cross reproduction and survival thresholds by mid-century, and could indeed be extirpated in just a few decades. Following the current trajectory of atmospheric greenhouse gas concentrations, steeply declining reproduction and survival will jeopardize the persistence of all but a few high-Arctic subpopulations by 2100. That means that without aggressive efforts to reduce greenhouse gas emissions, polar bears will be extirpated throughout the vast majority of their range by or before the end of the century. Some polar bears will potentially persist in a few areas of far northern Canada where the last remaining summer sea ice will be found—before it also disappears. Without aggressive greenhouse gas mitigation, however, polar bears will be largely eliminated from most of their current range, including Alaska.

48. The Beaufort Sea of Alaska illustrates that the dire projections of our 2020 paper should, in fact, be considered optimistic. We projected declines in the reproduction in the Southern Beaufort Sea are currently "possible." However, lower cub survival and an approximately 40 percent population size reduction during the first decade of the 2000s indicates those "possible" impacts are already occurring.

49. Optimistic projections result for three reasons. First, our "Timelines of

Risk" are based on the broadest range of possible body conditions at which bears could enter future fasting periods. Yet, we know that the frequency of "bad" ice years, with shorter on-ice foraging periods and longer periods of food deprivation, can only increase as global warming continues. Becoming very fat in advance of increasingly more prolonged annual fasting seasons will be ever more difficult. Therefore, thresholds are most likely to be crossed in the early part of our projected time frames.

50. Second, we applied conservative estimates of energetic costs for basic body maintenance, yet energetic costs may be much higher in a declining ice environment, when less ice will be stable enough for easy walking, and more swimming, which is energetically more demanding than walking, will be required.

51. Third, our estimates didn't explicitly take into account local differences in environmental productivity or historic differences in acclimation to seasonal ice cycles. For example, nearly the entire Seasonal Ice Ecoregion lies over productive shallow waters. The length of the summer fast is increasing, but the environment is still very productive, and these bears are facing a relatively gradual decline in their on-ice foraging. In contrast, productivity in the Alaskan Beaufort Sea, within the Divergent Ice Ecoregion, is limited to a narrow band of shallow continental shelf waters near the arctic Alaska shoreline. Despite having access to a smaller area of productive habitat, polar bears used to flourish in the Beaufort Sea

because they could forage through the summer on ice that historically covered that narrow but productive continental shelf. Unlike polar bears in western Hudson Bay, these Alaskan bears reached peak body weights by autumn (Durner and Amstrup, 1996), after spending most of the summer hunting on the productive ice near shore. However, the sea ice over the Alaskan continental shelf is now gone by mid-summer. The impact of this summer ice loss from the most productive portion of the Beaufort Sea, when the bears there are still thin, is likely greater than that currently felt by bears in the Seasonal Ice Ecoregion, where historically bears are closing in on maximum body weight as the summer fast approaches.

52. The greater impact of early ice loss may make polar bears of the Alaskan Beaufort Sea the most imperiled of all polar bears, and explains their recent catastrophic decline. The degree of peril these Alaskan bears face is emphasized by the fact that the population has declined to only half of its former size, and cub survival appears to be far below historic levels (Bromaghin et al. 2015). Yet, because our 2020 projections were based on estimated body weights from Hudson Bay, where bears facing more prolonged fasts are closer to their normal seasonal maximums, we described bears of the Alaskan Beaufort Sea as only "possibly" experiencing reproductive failure at this time, rather than reproductive failure currently being "highly likely" or "inevitable," which current observations suggest.

53. In our 2020 paper, we determined that "moderate" emissions mitigation would slow progressive extirpation, prolonging the persistence of some, but not all, polar bear populations through this century. But with modest mitigation, global warming continues beyond this century, continuing to threaten long-term polar bear persistence.

54. The need to halt the rise of atmospheric concentrations of CO_2 and other greenhouse gases is more urgent than our results may suggest, because it will take approximately 30 years for sea ice to stabilize after atmospheric CO_2 concentrations are stabilized (Amstrup et al. 2010). This means that regardless of which emissions scenario society follows in the near term, fasting periods for polar bears will continue to lengthen for decades. In sum, our study concluded that aggressive greenhouse gas mitigation will be required to save polar bears from extinction, and the sooner we halt CO_2 rise, the more likely polar bears will survive in greater portions of their current range.

The SAFE II Rule Directly Threatens Polar Bears by Increasing Greenhouse Gas Emissions.

55. Our 2007 reports to the Secretary of Interior provided ample evidence that the global warming resulting from increasing greenhouse emissions threatens polar bears. The relationship between warming and polar bear habitat loss

underpinned the polar bear's Endangered Species Act listing. However, I'm aware that in 2008, when polar bears were listed as a threatened species, the then-Solicitor of the Department of Interior, David Bernhardt, issued a memo concluding that it was impossible to connect the dots between greenhouse gas emissions from a specific project and harm to polar bears. While the connection was not in doubt a decade ago, our latest research identifies quantifiable, direct links between emissions and harm. The research findings in our 2020 paper establish that the number of ice-free days polar bears face each year determines their reproductive and survival potential. Follow-up research allows us to draw a direct link between individual greenhouse gas emissions increases and the ice-free days that threaten polar bear persistence. This link between emissions and increases in the number of ice-free days shows unequivocally that the SAFE II Rule will harm the already-threatened polar bear.

56. Our analysis shows that polar bears in Alaska face an additional ice-free day—during which they are food deprived—for each 9.0 billion metric tons of CO_2 emitted from fossil fuel combustion and industrial processes (Cecilia Bitz, in Preparation) (See Exhibit C). This is crucial because our 2020 paper established that risks of recruitment and survival failure are determined by the number of days that are sea-ice free within the range of each polar bear population.

57. As noted above, rates of recruitment and survival ultimately determine

the persistence probabilities of each polar bear population. And now we know the causal connection between CO_2 emissions and the vital rates of recruitment and survival (with each additional ice-free day pushing polar bears closer to extirpation). Compared with the prior rule, the SAFE II Rule alone, among all the other actions being taken around the world, will add nearly a full ice-free day, by 2100, to the period of food deprivation season faced by polar bears in Alaska, and in many other areas. Thus, because the SAFE II rule will nearly add another ice-free day on top of the already growing number polar bears are facing, it is clear that the emissions that result from the SAFE II rule will negatively impact polar bears.

58. Because of the direct negative impact the SAFE II Rule will have on polar bears in Alaska and around the world, it must not be upheld. The SAFE II Rule will significantly increase greenhouse gas emissions, which in turn will increase their period of food deprivation causing direct harms to polar bear populations and increasing the likelihood that the vast majority of the world's polar bear populations will be extirpated before the end of the century.

59. The agencies' failure to consult with the wildlife services under the Endangered Species Act prior to finalizing the SAFE II Rule virtually ensures the harms from the SAFE II Rule will occur, while consultation could have helped the agencies identify and mitigate these threats. I am deeply saddened at the damage,

including possible extinction of these magnificent creatures, to which the SAFE II Rule will contribute. Vacating the SAFE II Rule is an important step needed to protect the polar bear and the Arctic ecosystem.

Pursuant to 28 U.S.C. § 1746, I declare, under penalty of perjury, that the foregoing is true and correct.

Executed on January 6th, 2021, at Kettle Falls, Washington.

STEVEN AMSTRUP

Exhibit A: List of References

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EXHIBIT B

LETTERS
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nature climate change

Fasting season length sets temporal limits for global polar bear persistence

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Polar bears (*Ursus maritimus*) require sea ice for capturing seals and are expected to decline range-wide as global warming and sea-ice loss continue[1,2]. Estimating when different subpopulations will likely begin to decline has not been possible to date because data linking ice availability to demographic performance are unavailable for most subpopulations[2] and unobtainable a priori for the projected but yet-to-be-observed low ice extremes[3]. Here, we establish the likely nature, timing and order of future demographic impacts by estimating the threshold numbers of days that polar bears can fast before cub recruitment and/or adult survival are impacted and decline rapidly. Intersecting these fasting impact thresholds with projected numbers of ice-free days, estimated from a large ensemble of an Earth system model[4], reveals when demographic impacts will likely occur in different subpopulations across the Arctic. Our model captures demographic trends observed during 1979–2016, showing that recruitment and survival impact thresholds may already have been exceeded in some subpopulations. It also suggests that, with high greenhouse gas emissions, steeply declining reproduction and survival will jeopardize the persistence of all but a few high-Arctic subpopulations by 2100. Moderate emissions mitigation prolongs persistence but is unlikely to prevent some subpopulation extirpations within this century.

Polar bears occur in 19 subpopulations across four arctic ecoregions[1,2] (Fig. 1). In the southernmost ecoregion (that is, the Seasonal Ice Ecoregion (SIE)), complete sea-ice melt forces bears ashore each summer[1,2], where they rely on body energy reserves for survival and lactation due to the absence of energetically adequate food[5]. Prolonged ice absence from productive continental shelf waters now also forces increasingly long fasts in parts of the other ecoregions (that is, the Divergent Ice Ecoregion (DIE), Convergent Ice Ecoregion (CIE) and Archipelago Ecoregion (AE))[6]—areas where bears historically continued foraging on perennial ice through summer[1]. Although polar bears can fast for months, limits are imposed by the amount of energy bears can store in body reserves before periods of food deprivation[3,5,7]. Lengthening fasts have already lowered body condition, reproduction, survival and abundance in some SIE and DIE subpopulations[8–13], and similar trends are expected throughout the Arctic as ice loss continues[1,2]. However, it remains unclear how long bears can fast before substantial declines in lactation (and therefore cub recruitment) and/or adult survival occur. Information on when such fasting thresholds might be exceeded in different subpopulations, or how rapidly demographic rates would decline following threshold exceedance, is also lacking.

Estimating timelines for the anticipated declines is challenging because data quantifying sea ice–demography relationships are lacking in most subpopulations[2]. Indeed, even in the best-studied subpopulations, abundance projections currently rely on extremely limited data (for example, in the Southern Beaufort Sea, where projections used a threshold of 127 ice-free days to distinguish between good and bad years, based on only 5 years of demographic data[14]). Moreover, today's sea-ice conditions differ substantially from anticipated low ice extremes, thus precluding empirical measurements of how reproduction and survival will change before these changes occur[3]. Previous projections for the future range and abundance of polar bears attempted to overcome such data gaps with expert judgement[1] and/or extrapolations from a few well-studied subpopulations[2], and consequently could only offer limited spatial and temporal forecast resolution with large uncertainties.

Timelines for declining survival and recruitment can be projected, however, even in subpopulations where demographic information is absent, by calculating the energetic needs of fasting polar bears and estimating when longer fasts will preclude meeting those needs[3,15]. Molnár et al. used such energy budget calculations to estimate the likely magnitude of future litter size[15] and adult male survival declines[3] in the Western Hudson Bay subpopulation, but other projections[16,17] incorrectly applied the estimates of Molnár et al., assuming, for example, a universal 180-d persistence threshold, without performing the necessary energy budget calculations, model tests or uncertainty analyses, to justify this choice and/or extrapolations beyond the Western Hudson Bay subpopulation. Here, we describe dynamic energy budget (DEB) estimates of fasting thresholds that limit offspring recruitment and adult survival. We test whether our estimated thresholds capture reported demographic changes in subpopulations where observations are available, project likely timelines for recruitment and survival declines in all SIE, DIE and CIE subpopulations (~80% of Earth's polar bears; Fig. 1) and evaluate the uncertainty surrounding these timelines.

The impacts of fasting on recruitment and survival depend on: the energy reserves of bears at fast initiation; their energy expenditures while fasting; and fast duration. We established baselines for each of these with measurements from bears that were already forced to fast annually for extended periods in the Western Hudson Bay subpopulation (SIE; Fig. 1), and applied sensitivity analyses to these baselines to assess associated uncertainties and

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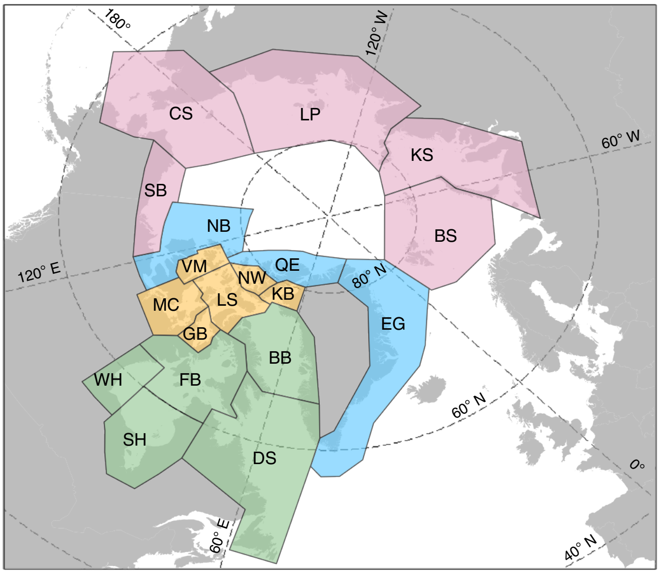

Fig. 1 | Polar bear ecoregions and subpopulations. Ecoregions were defined by temporal and spatial patterns of ice melt, freeze and advection, and by observations of how polar bears respond to those patterns[1]. Subpopulation boundaries follow ref. [1] and include only productive continental shelf waters of the Southern Beaufort Sea to maintain consistency with previous analyses of this subpopulation. Subpopulations in the AE were excluded from our analyses due to inadequate resolution of sea ice in both the PMW and CESM1 (Supplementary Fig. 1). SIE subpopulations (green): BB, Baffin Bay; DS, Davis Strait; FB, Foxe Basin; SH, Southern Hudson Bay; WH, Western Hudson Bay. DIE subpoopulations (red): BS, Barents Sea; CS, Chukchi Sea; KS, Kara Sea; LP, Laptev Sea; SB, Southern Beaufort Sea. CIE subpopulations (blue): EG, East Greenland; NB, Northern Beaufort Sea; QE, Queen Elizabeth Islands. AE (yellow): GB, Gulf of Boothia; KB, Kane Basin; LS, Lancaster Sound; MC, M'Clintock Channel; NW, Norwegian Bay; VM, Viscount Melville Sound.

account for known and potential among-subpopulation differences and within-subpopulation trends. Fast duration was defined as 24 d shorter than the summer period with ice extent below 30% (Extended Data Figs. 1 and 2), with ice extent estimated from passive microwave (PMW) satellite data[18] for the observational period and from large ensemble projections with the Community Earth System Model version 1 (CESM1)[4] for the future (Extended Data Fig. 3). The metabolic requirements of fasting were estimated from mass loss rates observed during the summer on-shore fast in Western Hudson Bay, and a DEB model[3,15] was used to estimate fast duration thresholds beyond which impaired lactation (and hence cub recruitment) and/or adult survival declines are likely (Fig. 2 and Extended Data Fig. 4). Thresholds depend on a subpopulation's distribution of body masses (M_0) and body lengths (L_0) at fast initiation in a given year, $G_{(M_0,L_0)}$(subpop,year), as these variables jointly determine each bear's energy reserves[3]. Data gaps regarding past and present $G_{(M_0,L_0)}$ distributions and the difficulties of reliably anticipating future $G_{(M_0,L_0)}$ (especially for subpopulations not yet experiencing prolonged fasts[3]) were overcome in two steps. First, we established thresholds for the Western Hudson Bay subpopulation during a 1989–1996 reference period (WH_{89-96}), using a representative sample of 76 adult males, 41 solitary adult females and 61 (22) females with dependent cubs (yearlings), to estimate $G_{(M_0,L_0)}(\mathrm{WH}_{89-96})$ (Fig. 2a–e). Likely thresholds for other time periods and subpopulations were estimated by systematically varying the $G_{(M_0,L_0)}(\mathrm{WH}_{89-96})$ baseline (Fig. 2f,g and Table 1) to account for among-subpopulation differences, within-subpopulation trends (Fig. 3) and uncertainties regarding future $G_{(M_0,L_0)}$ distributions (Fig. 4). Model performance was evaluated by intersecting estimated recruitment and survival thresholds with fasting period estimates for 1979–2016 and comparing the resultant demographic impact hindcasts against observations (Fig. 3). Estimates of future demographic impacts were obtained by intersecting projected fasting periods with the full range of biologically feasible impact thresholds, yielding timelines of risk for each subpopulation that account for the uncertainty arising from unknown future $G_{(M_0,L_0)}$ distributions (see below; Fig. 4).

Our DEB model suggests that prolonged fasting impacts cub recruitment first. Survival declines in yearlings, adult males and adult females with offspring follow, while solitary adult females succumb last (Table 1). High rates of recruitment and survival failure following threshold exceedance (Table 1 and Fig. 2) ensure that soon after thresholds are crossed population persistence will be jeopardized. Mother bears cannot fast as long as solitary females due to their reproductive burden; males cannot fast as long as solitary females due to the higher maintenance requirements and lower storage energy of their leaner bodies[3]; and cubs are more vulnerable than yearlings due to their higher reliance on maternal energy reserves[19]. With $G_{(M_0,L_0)}(\mathrm{WH}_{89-96})$, for example, impaired cub recruitment is expected when fasts exceed 117 d, followed by declines in yearling recruitment (185 d) and the survival of mother bears (as early as 117 d and no later than 228 d), adult males (200 d) and solitary adult females (255 d) (Table 1, Fig. 2 and Extended Data Fig. 4). These thresholds may vary by months depending on a subpopulation's $G_{(M_0,L_0)}$ (Extended Data Fig. 5), thus also highlighting the inaccuracy of previous projections[16,17] that relied on a universal 180-d threshold.

Model hindcasts capture the timing and nature of observed demographic changes when between-subpopulation differences and within-subpopulation trends in $G_{(M_0,L_0)}$ are accounted for (Fig. 3). For the Western Hudson Bay subpopulation, where lengthening fasts have progressively lowered body conditions[7] and thus impact thresholds (Fig. 3), the DEB model suggests unimpaired recruitment and survival before and during our 1989–1996 reference period but decreased reproductive success since the first crossing of the recruitment impact threshold in the late 1990s (Fig. 3). Hindcasts also suggest stable adult survival during the initial reproductive declines but an increasing likelihood of adult mortalities in recent years: in 2015, the fasting period reached 153 d, approaching the conservatively estimated impact threshold for male survival (now ≤171 d; Fig. 3), and possibly also for the survival of females with offspring (between 98 and 192 d in 2007; now possibly lower; Fig. 3). Rates and timelines of actual and modelled declines mirrored one another, with the Western Hudson Bay subpopulation transitioning from high recruitment during the 1980s to declines in juvenile, subadult and senescent adult survival in the late 1990s/early 2000s, while prime-age adult survival remained unaffected[8] (Fig. 3). It remains unclear whether the resulting ~22% abundance decline[8] has continued in recent years or whether the population may have temporarily stabilized at a lower abundance[12,20], but recruitment remains low[20] and female survival appears to have decreased in recent low-ice years[12,20], as hindcasted (Fig. 3). Male survival also may have declined, but limitations of the most recent census prevented disentangling fasting-related and other mortalities[12].

Elsewhere in the SIE, bears are of similar length[21,22] but greater mass[23] than in the Western Hudson Bay subpopulation, possibly because of shorter ice-free periods (Foxe Basin and Baffin Bay; Fig. 3), comparatively later ice break-ups that allow for additional pre-fast foraging opportunities (Southern Hudson Bay and Foxe Basin)[24] and/or an increasing availability of harp seals (*Pagophilus groenlandicus*) (Davis Strait and Baffin Bay)[25,26]. Nonetheless, body mass declines similar to those in the Western Hudson Bay subpopulation have occurred throughout the SIE[10,13,27], except possibly

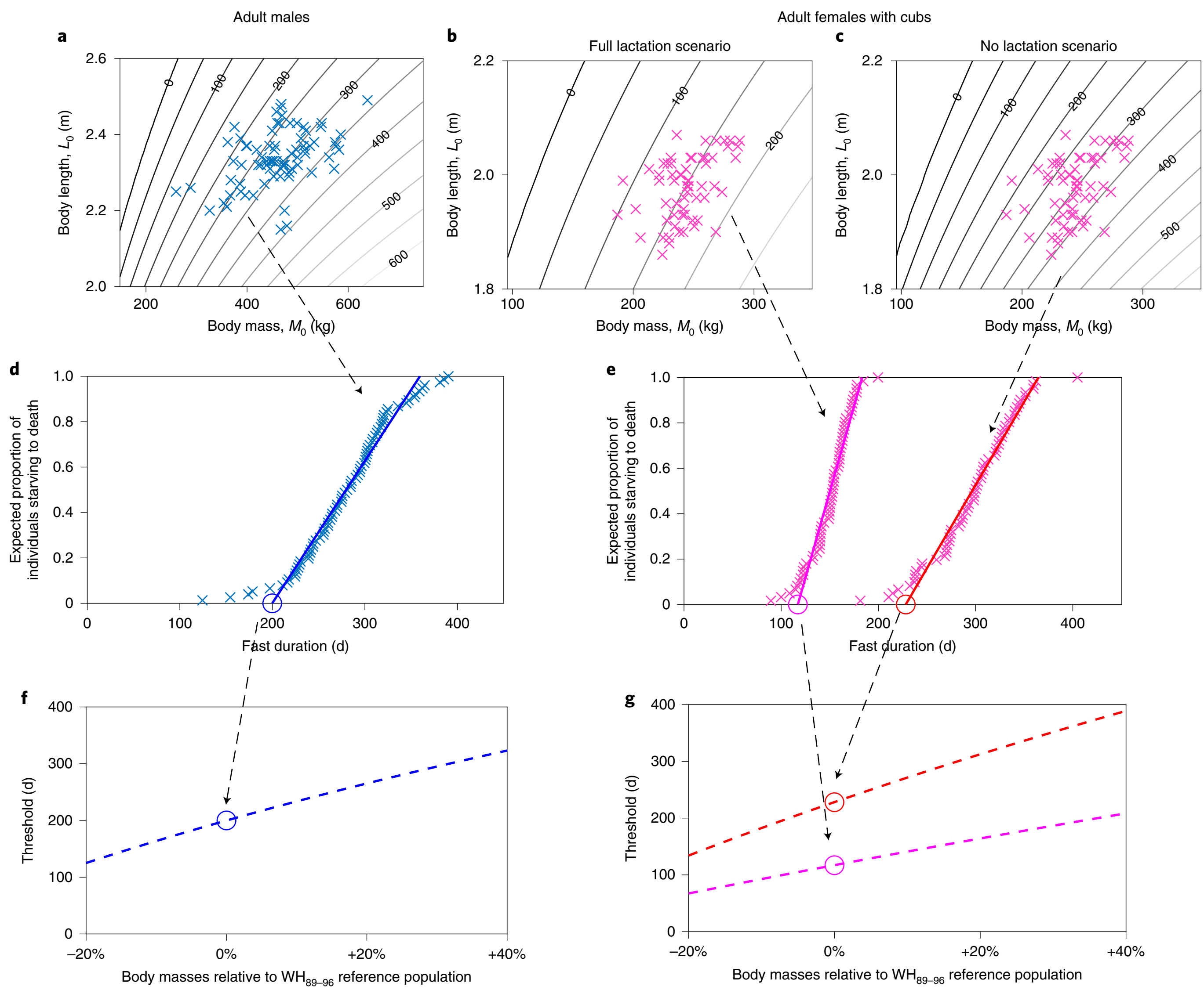

Fig. 2 | Method for estimating fasting impact thresholds beyond which cub recruitment and adult survival begin to decline rapidly. Thresholds were estimated by calculating the maximum number of fasting days that polar bears can survive, given their metabolic requirements and fast-initiating energy reserves. Arrows illustrate the logical flow of our analyses, progressing from individual samples to population-level threshold estimates. Threshold calculations are shown for adult males and adult females with cubs. Calculations for solitary adult females and females with dependent yearlings were performed the same way (Extended Data Fig. 4). **a**–**c**, Fast-initiating masses and lengths of adult males (**a**; blue crosses) and adult females with cubs (**b** and **c**; magenta crosses) in WH_{89-96}, relative to DEB estimates of the number of days to death by starvation (contour lines). Due to lacking data on how starvation impacts lactation, we estimated starvation times for females with cubs for two extreme strategies of reproductive investment that bracket the true time to female death: full lactation until death (**b**) and no lactation when fasting (**c**). **d**,**e**, Cumulative distributions of the estimated starvation times shown in **a**–**c**. *X*-intercepts (circles) of linear fits to the 5th to 95th percentiles of these distributions (solid lines) indicate: (**d**) a survival impact threshold for adult males (200 d) beyond which mortality increases by ~0.6% for each additional fasting day (regression slope); and (**e**) lower (magenta) and upper (red) estimates for the survival impact thresholds of females with cubs (117–228 d). In **e**, the lower estimate doubles as a recruitment impact threshold as longer fasts are only possible with reduced lactation, and thus compromised cub condition, growth and survival. **f**,**g**, Sensitivity analyses corresponding to **d** and **e**, respectively, illustrating the dependence of impact thresholds on the fast-initiating masses of bears, obtained by adjusting all WH_{89-96} masses upwards or downwards by a specified percentage within biologically reasonable bounds.

in Foxe Basin where stability is assumed[28]. After adjusting impact thresholds accordingly, our model hindcasts suggest modest but persistent reproductive impacts in Southern Hudson Bay since the late 1990s, larger reproductive impacts in Davis Strait, potential reproductive impacts in Baffin Bay, no reproductive impacts in Foxe Basin and no impacts on adult survival anywhere (Fig. 3). In agreement with simulations, females in Southern Hudson Bay appear to be sacrificing their body condition to maintain lactation[13], and cub survival also has declined in recent years[24]; in Davis Strait, cub recruitment is among the lowest of all SIE subpopulations while adult survival nevertheless remains high[25]; in Baffin Bay, offspring recruitment has decreased since the mid-1990s while adult survival has remained stable[27]; and in Foxe Basin, no demographic impacts are apparent[28].

Model hindcasts are more difficult to evaluate for the DIE and CIE, where a lack of sampling (Kara Sea, Laptev Sea, East

Table 1 | Fasting impact thresholds for polar bear recruitment and survival

Bear class	Recruitment impact threshold (number of fasting days)				Survival impact threshold (number of fasting days)				Estimated decrease in survival for each additional fasting day beyond the survival impact threshold
	−20%	0%	+20%	+40%	−20%	0%	+20%	+40%	
Adult males	NA	NA	NA	NA	125	200	265	323	−0.6% per day
Solitary adult females	NA	NA	NA	NA	158	255	342	420	−0.4% per day
Adult females with cubs	67	117	164	208	LB: 67	LB: 117	LB: 164	LB: 208	
					UB: 134	UB: 228	UB: 313	UB: 389	−0.7% per day
Adult females with yearlings	108	185	255	320	LB: 108	LB: 185	LB: 255	LB: 320	
					UB: 138	UB: 232	UB: 317	UB: 394	−0.8% per day

Four estimates are shown for each bear class and threshold, corresponding to scenarios where bears begin fasting 20% lighter (−20% threshold), the same (0% threshold), 20% heavier (+20% threshold) or 40% heavier (+40% threshold) than WH_{89-96} bears. Body conditions at the +40% limit are considered unrealistically high, but were included as a maximum conceivable upper bound under perfect conditions (see Extended Data Fig. 7). Due to uncertain energetic investment into lactation, the true survival impact threshold could only be bounded for females with dependent offspring (see Fig. 2e,g). LB, lower bound; UB, upper bound.

Greenland and Queen Elizabeth Islands) or predominantly spring sampling (Southern Beaufort Sea, Chukchi Sea, Barents Sea and Northern Beaufort Sea)[11,29,30] prevented reliable estimation of fast-initiating (late-summer) $G_{(M_0,L_0)}$ distributions[3,15] and, thus, of subpopulation-specific impact thresholds. Nonetheless, DEB hindcasts suggest possible declines in recruitment and, perhaps, adult survival for the Southern Beaufort Sea, Chukchi Sea, Kara Sea and Barents Sea from as early as the 1990s—if bears in these subpopulations are more reliant on a stable ice cover for hunting (Extended Data Fig. 6a), move more during fasting, and/or are lighter (lower energy reserves), longer (higher metabolic requirements), or both, than WH_{89-96} bears (Fig. 3). Correspondingly, in the Southern Beaufort Sea subpopulation (characterized by declining body conditions[9], possibly greater skeletal sizes[21], additional movement costs imposed by ice fragmentation and drift during on-ice fasting[31]), both recruitment and survival (both sexes and all age classes) decreased with recent low ice, causing a 25–50% abundance drop[11]. In contrast, in the neighbouring Chukchi Sea subpopulation, demographic declines have not yet occurred[29], consistent with model outcomes for the reported good body conditions that are maintained by extraordinary marine productivity[29]. The Barents Sea subpopulation currently seems stable but with low recruitment[32], consistent with the energetic requirements of bears that are shorter but also lighter than WH_{89-96} bears[23] (Fig. 3 and Extended Data Fig. 5), and no impacts have been observed in the Northern Beaufort Sea[30], as simulated (Fig. 3).

For estimates of future demographic impacts, we acknowledge but do not resolve uncertainties[3,15] regarding future subpopulation-specific $G_{(M_0,L_0)}$ distributions. Instead, we estimated fasting impact thresholds for the full range of biologically feasible $G_{(M_0,L_0)}$ (Extended Data Fig. 7), assuming that bears may begin fasting 20% lighter, the same, 20% heavier, or 40% heavier than WH_{89-96} bears (henceforth, the −20%, 0%, +20% and +40% thresholds; Table 1). Intersecting these thresholds with projected annual fasting periods under business-as-usual (Representative Concentration Pathway to 8.5 $W m^{-2}$ (RCP8.5)) or mitigated (RCP4.5) scenarios[33] yields timelines of risk for when recruitment and survival will likely begin declining (Fig. 4 and Extended Data Fig. 8): when fast duration remains below the −20% threshold in a subpopulation, we consider demographic impacts unlikely because short fasts are typically associated with good body conditions[7,9,13]; based on the observed impacts in the SIE and DIE (Fig. 3), we suggest that demographic impacts are likely to appear between exceedance of our −20% and +20% thresholds; and because high body conditions cannot be maintained with long fasts, effects become inevitable by the time the +40% threshold is crossed (Extended Data Fig. 8). Timeline uncertainties, arising from uncertainty in DEB parameters and uncertain ice availability–fasting relationships, were dealt with by evaluating how the timelines of risk would shift if our baseline assumptions were violated (Extended Data Figs. 6 and 9).

Estimated timelines of risk are shown in Fig. 4, illustrating how the physiological limits of fasting determine the polar bear's fate with unmitigated greenhouse gas emissions. Unlike previous projections that suggest ultimate large-scale declines but do not provide explicit timelines[1,2], our DEB approach provides previously unavailable mechanistic underpinnings that capture past demographic changes and quantify the timing, nature, order, and uncertainty surrounding future changes—even for data-scarce subpopulations. Despite timeline uncertainties, it is evident that demographic impacts will worsen in already affected subpopulations, and that similar impacts will occur over most of the species' range (Fig. 4). By 2100, following the RCP8.5 scenario, recruitment will be severely compromised or impossible everywhere except perhaps in the Queen Elizabeth Islands subpopulation. Most subpopulations will also experience dramatically increased adult mortality, making persistence unlikely throughout most of the polar bear range (Fig. 4). Ultimately, aggressive greenhouse gas emissions mitigation will be required to save polar bears from extinction, but moderating emissions to RCP4.5 would slow progressive extirpation, probably allowing some subpopulations to persist through this century—albeit with reduced recruitment (Fig. 4).

Potential errors and uncertainties remain with respect to the exact onset of demographic declines, both because of our reliance on a single Earth system model and because of uncertainties and variations in bear behaviour and energy usage among subpopulations. If many Earth system models were employed rather than just one, we would expect an increase in accuracy, but also an increase in uncertainty from accounting for structural uncertainty in Earth system model parameters and physics that we currently neglect. However, in the work presented here, the uncertainty in the onset of demographic declines is dominated by biological uncertainties, which is why we accept the underestimated uncertainty of fast durations that stems from using only one Earth system model at this time. More field data on polar bear characteristics could allow us to better constrain DEB model parameters, thereby increasing accuracy and reducing uncertainty in the demographic estimates, but filling these data gaps will probably not lead to more optimistic conclusions. Impacts could potentially occur decades sooner

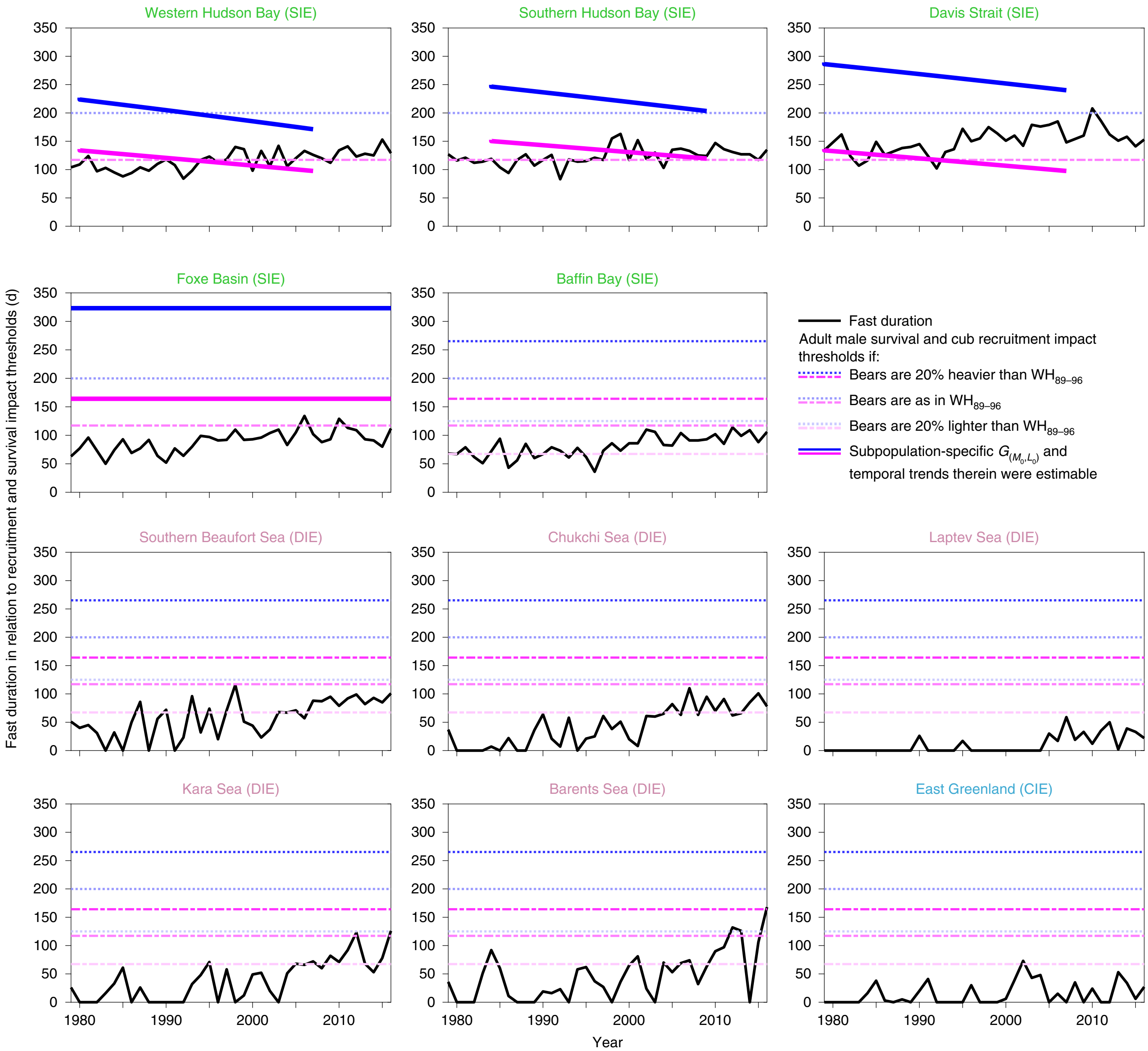

Fig. 3 | Estimated annual fasting period lengths of polar bears in the SIE, DIE and CIE from 1979–2016, in relation to estimated cub recruitment and adult male survival impact thresholds. For subpopulations where body lengths and fast-initiating body masses were estimable (Western Hudson Bay, Southern Hudson Bay, Davis Strait and Foxe Basin), we calculated subpopulation-specific impact thresholds by adjusting the $G_{(M_0,L_0)}(WH_{89-96})$ baseline (dot-dashed magenta line for recruitment; dotted blue line for adult male survival) for among-subpopulation differences and within-subpopulation trends in body mass[7,10,13,28] (thick solid magenta and blue lines). In the Western Hudson Bay subpopulation, for example, body masses declined by ~5.7% per decade during 1980–2007 (ref. [7]), leading to corresponding declines in the adult male survival (227 d in 1980; 171 d in 2007) and recruitment impact thresholds (136 d in 1980; 98 d in 2007). For subpopulations where fast-initiating masses and lengths were inestimable, we show a series of impact thresholds for cub recruitment (dot-dashed magenta) and adult male survival (dotted blue) for reference, assuming body masses that are 20% lower (light shade), the same (medium shade) or 20% higher (dark shade) than in WH_{89-96}. Fasting period lengths (solid black lines) were estimated as 24-d shorter than the summer period with ice extent <30%, and bears were assumed to be conserving energy while fasting, as observed in Western Hudson Bay. Recruitment and adult male survival declines are expected when the fasting period length exceeds the corresponding impact threshold. Impact thresholds for yearling recruitment and the survival of mother bears are not shown, but are similar to those for adult male survival (Table 1), and may thus also have been crossed occasionally in some SIE and DIE subpopulations in recent years. Only East Greenland is shown for the CIE, as the Northern Beaufort Sea and Queen Elizabeth Islands subpopulation regions have retained a perennial ice cover to date. Font colours of subpopulation names correspond to their ecoregion designation: green, SIE; red, DIE; blue, CIE.

than projected in Fig. 4 (Extended Data Figs. 6c and 9c), because all DEB model parameters and assumptions were chosen to yield optimistic threshold estimates in cases where data scarcity necessitated a choice. For example, we assumed that all bears follow an energy-conserving strategy of limited movement during fasting, as is observed in Western Hudson Bay, but higher movement costs combined with low hunting success may in some subpopulations drive bears into energy deficits well before they are forced to

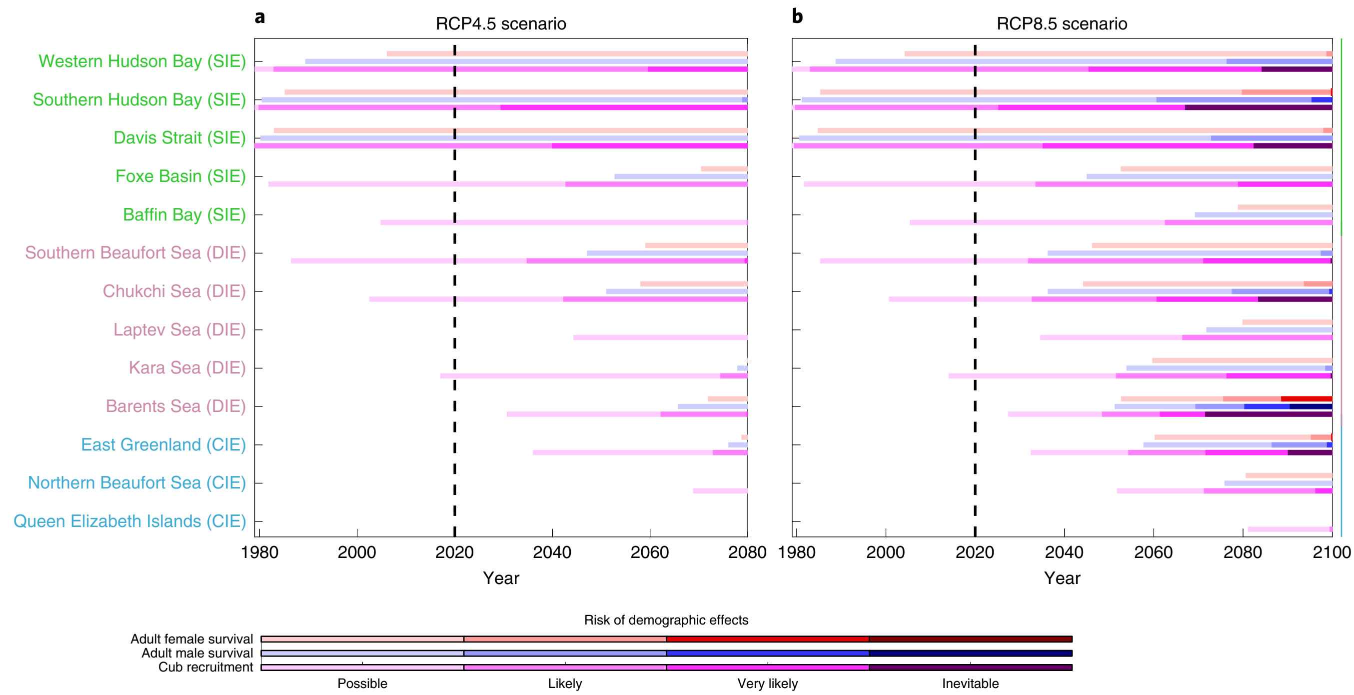

Fig. 4 | Modelled timelines of risk, as quantified by the years when projected annual fasting period lengths exceed cub recruitment and adult survival impact thresholds in different subpopulation regions. a,**b**, Years of first impact on cub recruitment (magenta), adult male survival (blue) and adult female survival (red) are shown for the RCP4.5 (**a**) and RCP8.5 scenarios (**b**), assuming fast-initiating masses that are 20% lighter (light shade), the same (medium-light shade), 20% heavier (medium-dark shade) or 40% heavier (dark shade) than in WH_{89-96}. The risk of demographic impacts increases with darker colours. Demographic impacts were considered possible when fast duration exceeds the −20% threshold, likely between exceedance of the 0% and +20% thresholds, and inevitable by the time the +40% threshold is crossed (see Fig. 3 and Extended Data Fig. 8). All thresholds were calculated conservatively by assuming metabolic rates and energy-conserving strategies while fasting as in the Western Hudson Bay subpopulation. Additionally, thresholds of adult female survival were calculated conservatively by using the upper bound estimates for the survival times of females with dependent cubs (Table 1). The year of first impact was defined conservatively as the first occasion when three of the next five years exceed a fasting impact threshold, thus avoiding triggering impact forecasts on a single low-ice year. Font colours of subpopulation names correspond to their ecoregion designation: green, SIE; red, DIE; blue, CIE.

abandon the sea ice completely[31]. Moreover, once thresholds are crossed, impact curves rise steeply (Fig. 2 and Table 1), meaning that a few extremely poor ice years could lead to non-recoverable population declines before such years are the rule. Demographic impacts we did not consider (for example, litter size declines[15], increased subadult mortality[8], and mate-finding difficulties[34] resulting from unequal impact timelines between sexes; Fig. 4) are likely to occur in concert with, and potentially earlier than[8], the outlined cub recruitment and adult survival declines. Land-based feeding is unlikely to occur at scales that shift the timelines for recruitment and survival declines by more than a few years, because foods that meet the energy demands of polar bears are largely unavailable on land[5]. Indeed, polar bears occurred as far south as the Baltic Sea at the close of the Pleistocene[35], but did not move onto land or adapt otherwise when ice-free periods grew during Holocene warming—they simply disappeared from the region. Avoiding continued sea-ice decline requires aggressively mitigating greenhouse gas rise[36], and our results explicitly describe the costs to polar bears of avoiding that mitigation.

Online content

Any methods, additional references, Nature Research reporting summaries, source data, extended data, supplementary information, acknowledgements, peer review information; details of author contributions and competing interests; and statements of data and code availability are available at https://doi.org/10.1038/s41558-020-0818-9.

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Exhibit C: Cecilia Blitz Calculations

The purpose of this section is to describe how we estimate that polar bears in Alaska face an additional ice-free day by 2100 due to emissions from the SAFE II Rule alone. This quantity is estimated from the observational records of ice-free days each year and emitted CO_2 by fossil fuel combustion and industrial processes. The emitted CO_2 dataset is published in a peer-reviewed journal article written by 87 authors (Friedlingstein et al., 2020). The ice-free season length is based on sea ice concentrations estimated from satellite passive microwave remote sensing (Cavalieri et al, 1996). The period of analysis for our calculation is limited by the start date of the satellite record, which is 1979, and the most recent year available for CO_2 emission estimates, which is 2019.

A thorough explanation of our methods and assumptions to quantify the ice-free season length, and its effects on polar bears, are given in Molnár et al. (2020) (attached as Exhibit B). Here, we briefly summarize the method. We begin by computing daily sea ice areal extent from gridded sea ice concentrations for subdomains of the Arctic associated with polar bear subpopulations (see Amstrup et al., 2010; Molnár et al., 2020). We define sea ice extent as the area of all grid cells in the subdomain where concentration exceeds a 30% threshold (below this concentration polar bear foraging efficiency is known to be poor). The subdomain was considered ice-free when the extent in a subpopulation region is below a critical value taken as 30% of the March mean extent for the period 1979-1988. The ice-free season length is the continuous period in summer that meets the ice-free definition.

Ice-free season lengths were computed for the oceanic region adjacent to the arctic coastline of Alaska that is occupied by two polar bear subpopulations identified by region, specifically the Southern Beaufort Sea and Chukchi Sea (see Amstrup et al., 2010; Molnár et al., 2020). The ice-free season lengths were initially computed separately for the two subpopulations. Next, regression coefficients were computed for the two subpopulations to give an estimate of ice-free season length per CO_2 emitted by fossil fuel combustion and industrial processes. The regression coefficients were then inverted to give an estimate of the amount of CO_2 that was emitted to cause an additional ice-free day during the ice-free season. Results for the two subpopulations are an additional ice-free day in the Chukchi Sea region per 8.7 billion metric tons of CO_2 emitted and an additional ice-free day in the Southern Beaufort Sea region per 14.2 billion metric tons of CO_2 emitted. Finally, the quantities for these two subpopulations were combined in a weighted arithmetic mean, where the weights are the relative areal proportion of the regions, giving a single estimate for the two subpopulations that occupy coastal Alaska. Because the Chukchi Sea region is over ten times larger than the Southern

Beaufort Sea, the estimate for the Chukchi Sea dominates the area weighted arithmetic mean, and the combined regional estimate is one additional ice-free day per 9.0 billion metric tons of CO_2 emitted.

As the EPA and NHTSA estimate that the SAFE II Rule will increase carbon dioxide (CO_2) emissions by 7.8 billion metric tons between 2021 and 2100, we estimate that the SAFE II Rule alone will cause almost one additional ice-free day for polar bear subpopulations in coastal Alaska by 2100.

Exhibit C: References List

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DECLARATION OF ILEENE ANDERSON

FOR THE CENTER FOR BIOLOGICAL DIVERSITY

I, Ileene Anderson, state and declare as follows:

1. The facts set forth in this declaration are based upon my personal knowledge. If called as a witness, I could and would testify to these facts. As to those matters which reflect an opinion, they reflect my personal opinion and judgment on the matter.

2. I am submitting this declaration on behalf of myself and the Center for Biological Diversity (the Center).

3. I have been a member of the Center since 1999. I was hired by the Center in October 2005 and I work at the Center as the Public Lands Desert Director and as a senior scientist. I rely upon the Center to represent my interests in protecting endangered species and their habitat.

4. I have a Master of Science in Biology from the California State University at Northridge. I have studied and surveyed for native species in California for over 30 years. I personally have researched, surveyed for, studied, observed, and sought protection for many imperiled species, both plant and animal. In addition, I have researched many rare and listed (threatened or endangered) California plants and animals, and their habitat needs, including the federally

threatened coastal California gnatcatcher, the federally endangered San Joaquin kit fox, the federally endangered blunt-nosed leopard lizard and the federally threatened Mojave desert tortoise, among other unique plants and animals.

5. Before my tenure at the Center for Biological Diversity, I was the Southern California Regional Botanist for the California Native Plant Society (CNPS) from 1997 to 2005. I continue to work with CNPS on conservation and litigation issues. I have been a member of CNPS since 1992. From 1995-2005, I also worked as an independent botanical consultant throughout the southwestern U.S.

6. I keep up to date on the latest information regarding the locations and status of the aforementioned species as part of my active participation in their conservation. For example, I regularly correspond with U.S. Fish and Wildlife Service personnel, California Department of Fish and Wildlife personnel and leading species experts on contemporary issues pertaining to these species. I have made this a habit since I started working on behalf of endangered species conservation.

7. I am aware that the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) promulgated a rule in 2020 that rolls back greenhouse gas emissions and mileage standards for vehicles (the Rollback Rule or Rule). The agencies have estimated that the Rule will result

in a cumulative increase in nitrogen pollution of 20,500 to 25,500 metric tons over the lifetime of vehicles through model year 2029, over and above the standards that were previously in place. I am also aware that the Rollback Rule will increase other air pollution as well, such as sulfur pollution, and will result in billions of tons of increased greenhouse gas pollution, worsening climate change.

8. I have an ongoing interest in protecting the imperiled species impacted by the Rollback Rule. The habitats of species such as the San Joaquin kit fox, blunt-nosed leopard lizard, the coastal California gnatcatcher, and the Mojave desert tortoise, which I care deeply about, are affected by the types of air pollution that vehicles emit. In 2012, I was delighted to read that the car and light truck fuel efficiency standards were to be ramped up to achieve greater efficiency, which would reduce air pollution and greenhouse gas emissions. One of the reasons I was so encouraged by this news was because of the air pollution reductions, which would decrease the amount of nitrogen deposition that is occurring in our natural landscapes. The Rollback Rule reverses that progress, adding thousands of tons of additional nitrogen pollution to the air and increasing the stress on these species.

9. The scientific literature has documented through numerous studies that nitrogen compounds from air pollution, known to be emitted from vehicles, are blown by prevailing winds. As the nitrogen compounds fall out of the air column, they are typically deposited on a pollution gradient that stretches for

hundreds of miles distant from the source of the emissions—in this case, tailpipes or refineries. For example, in southern California where I live and work, the nitrogen deposition gradient affecting plant communities stretches over 200 miles (Allen et al. 2009) (Please see Exhibit A for a full list of sources referenced in this declaration). This results in basin-wide air impacts from nitrogen pollution.

10. The deposition of nitrogen compounds onto natural landscapes and increases the amount of nitrogen available to plants but also kills beneficial soil organisms known as cryptobiotic soils (Egerton-Warburton and Allen 2000). Available nitrogen is usually a very limited nutrient for plants yet is essential for plant growth. Many native plants evolved with mutualistic soil bacteria and mycorrhizal fungi, known collectively as cryptobiotic soils, which break down the nitrogen (N_2) molecule, readily available in the air, into a useable form of nitrogen that the native plants can use. In return, the cryptobiotic soils receive carbohydrates produced by the native plants via photosynthesis. When excessive nitrogen is deposited on the cryptobiotic soils, they disappear. The altered nitrogen cycle results in better conditions for non-native invasive plant species to grow over natives, and non-natives are able to outcompete natives and become the dominant plants.

11. In the case of the San Joaquin kit fox, blunt-nosed leopard lizard, the coastal California gnatcatcher, and the Mojave desert tortoise, the non-native

invasive plant species of concern are primarily non-native grasses that originated in the Mediterranean area and were introduced to North America via European contact. Increasing nitrogen deposition has caused explosive growth of these grasses, which include cheat grass (*Bromus tectorum*), red brome (*Bromus madritensis* ssp. *rubens*), foxtail barley (*Hordeum murinum* ssp. *leporinum*) and split grass (*Schismus barbatus* and *S. arabicus*). These grasses impact the above-mentioned species in different ways, but primarily by impacting their ability to secure adequate food and/or habitat.

San Joaquin kit fox

12. I have researched, studied, observed, been trained to survey for, surveyed for, and sought protections for the highly imperiled San Joaquin kit fox. I have conducted various types of research on this declining species throughout its shrinking range. I was part of the Center for Biological Diversity and Los Padres Forest Watch team that petitioned the U.S. Fish and Wildlife Service to designate critical habitat for the imperiled San Joaquin kit fox. The kit fox's habitat has already been reduced by 90 percent due to conversion to agriculture and urbanization in the San Joaquin Valley (Diversity 2010). The species now occupies a much more limited and highly fragmented range (U.S. Fish and Wildlife Service 2010). Nitrogen deposition has further imperiled this species.

13. My most recent field work on the kit fox occurred just prior to COVID-19 restrictions being put into place, in February 2020. I looked for kit foxes and signs of kit fox at three locations in Kern County where new oil and gas development has been proposed. Prior to that, I had visited other sites in Kern County in December 2019. I intend to return to look for kit fox and its habitat in the spring of 2021 once restrictions from the pandemic have eased.

14. The house-cat-sized San Joaquin kit fox relies on sparse, very low-growing plants in order to be able to detect prey and predators. As discussed above, nitrogen deposition favors dense and tall growth of the non-native grasses, which effectively excludes the kit fox from effective use of its habitat, because the foxes have a hard time making their way through the dense growth and cannot detect prey as easily. Predators of the kit fox also take advantage of the tall grass growth to conceal themselves in order to more easily ambush the kit foxes.

Blunt-Nosed Leopard Lizard

15. I have also researched, studied, observed, and sought habitat protection for the blunt-nosed leopard lizard throughout its current range, which the U.S. Fish and Wildlife Services states is "greatly fragmented, and has been restricted to less than 15% of its historical range." (U.S. Fish and Wildlife Service 2020). My most recent field work on blunt-nosed leopard lizards occurred just

before COVID-19 restrictions were put into place, in February 2020. I looked for blunt-nosed leopard lizards and their habitat at two locations in Kern County where new oil and gas development has been proposed. In December 2019, I visited other sites in Kern County to look for blunt-nosed leopard lizards where they had been documented previously, and while I was unable to locate any blunt-nosed leopard lizards, I assessed the habitat in the area, which in my estimation appeared to be suitable for the species. I intend to return to look for blunt-nosed leopard lizards in these and other publicly accessible areas in the spring of 2021 to survey for adults and assess habitat. I plan to survey for the species in the late summer and fall of 2021 to look for juveniles.

16. I continue to keep up on research on the genetics of the blunt-nosed leopard lizard. I am worried about this species because there are no recent statewide on-the-ground surveys for blunt-nosed leopard lizards. However, the most recent "Special Status Assessment for the Blunt-nosed Leopard Lizard" (U.S. Fish and Wildlife Service 2020) determines that all three of the modeled future scenarios, using different combinations of climate change impacts and restoration efforts, predict ongoing declines in the condition of blunt-nosed lizard populations over the next 60 years. This modeling reinforces my ongoing concern about this unique lizard because in every place I used to see them, I am now unable to locate them. I am worried that their populations are declining and that the Rollback Rule

will place additional stress on the species because of increased nitrogen pollution.

17. The increase in dense grass growth that has drastically altered the blunt-nosed lizard's habitat occurs when non-native species outcompete natives and is a serious problem for the blunt-nosed leopard lizard. These lizards are found in habitat that has sparse, very low-growing plants including native wildflowers and other forbs with occasional widely spaced shrubs (typically saltbush). These lizards must be able to see and freely run after prey (typically insects). Dense growth of tall, non-native grasses makes predation less successful for the blunt-nosed leopard lizard. This can have acute effects on their ability to find enough food to survive, much less successfully reproduce. Years with greater precipitation, which result in greater growth of non-native grasses, have been correlated with declines in blunt-nosed leopard lizard populations (U.S. Fish and Wildlife Service 2020). In the northern part of the species' range, increased dense exotic vegetation has been found to correspond with a range contraction of occupied habitat (U.S. Fish and Wildlife Service 2020).

18. Blunt-nosed leopard lizards must also be able to effectively run away from predators to evade predation themselves. Non-native grasses can also inhibit escape and hide predators, even after the grasses have dried out (U.S. Fish and Wildlife Service 2020).

19. Based on the impacts to the blunt-nosed leopard lizard from non-

native exotic grasses and vegetation, which are promoted by increased nitrogen deposition from air pollution, I am deeply worried that the Rollback Rule will exacerbate the serious decline in habitat for the blunt-nosed leopard lizard and ultimately drive this species closer to extinction.

Mojave Desert Tortoise

20. I have researched, studied, observed, and participated in habitat restoration efforts for the federally threatened Mojave desert tortoise for several decades. I have biological, scientific, educational, and aesthetic interests in the Mojave desert tortoise and its habitat. As with the other species above, I continue to keep up on the most recent science and data on the Mojave desert tortoise, and I have given dozens of presentations at the premier scientific symposium on desert tortoises organized by the Desert Tortoise Council over the years. To me, the continuing decline of the desert tortoise reflects the ecological conditions of the southwest deserts and this saddens me because the invasions by non-native exotic grasses and forbs have drastically altered the habitat for the desert tortoise, including by helping to create adequate biomass to support large-scale fires in the deserts. Desert vegetation evolved in the absence of fire, and the increase in non-native exotic grasses, exacerbated by nitrogen deposition, has resulted in increasing fire frequency that ends up "type converting" desert landscapes into

non-native grasslands, to the detriment of desert tortoises and other wildlife (Boarman 2002).

21. I travel to the Mojave or Colorado deserts typically every month for a number of days in order to look for desert tortoises or their burrows, although COVID-19 precluded much of my field work in 2020. My most recent visit to desert tortoise habitat, when I looked for desert tortoises, was at the beginning of May 2020 in the Colorado desert in Imperial County, California. I intend to go to the Mojave desert in the spring and fall of 2021 to look for desert tortoise in the eastern Mojave in the Mojave National Preserve. Because desert tortoises mostly live underground, the best times to detect them above ground are the spring and fall when temperatures are more moderate and food (native wildflowers) are present.

22. The desert tortoise, which is an herbivore, relies on plants for nourishment and water in the arid desert regions it inhabits. Scientific reports have documented that the non-native grasses, exacerbated by nitrogen deposition, outcompete the native wildflowers and forbs that desert tortoises rely on for sustenance (Allen et al. 2009; Fenn et al. 2003; Boarman 2002). Research has documented that desert tortoises that rely on non-native grasses as their primary food sources have poorer health due to non-native grasses being a nutrient-poor food (Oftedal, Hillard, and Morafka 2002; Nagy, Henen, and Vyas 1998).

23. In addition, the seeds of the non-native brome grasses are commonly called “foxtails,” and any person who has walked through a field of dried brome grasses will recall numerous pointy and irritating foxtails that end up lodged in their socks. Foxtails are also the bane of dog owners because foxtails burrow into dogs’ feet, ears, and skin, causing abscesses. These same foxtails have been documented to invade desert tortoises’ mouths and nares, decreasing the ability for the tortoises to feed and causing injury to sensitive mouth and nasal tissues during the few brief months when tortoises are out of their burrows and feeding (Boarman 2002).

24. I have done revegetation work in the western Mojave desert, where I have planted native desert shrubs and seeds in order to improve habitat for the desert tortoise. The areas contained illegally created dirt roads caused by off-road vehicles. Roads in general are a known vector for the spread of non-native grasses in the desert. The revegetation team that I participated in planted dozens of different native desert shrubs, and implemented several different soil scarification techniques for seed introduction. Over time, this effort was successful in revegetating the illegally created roads while reducing the spread of non-native grasses into the landscape. While labor intensive, I felt a great sense of achievement in decreasing the fragmentation in the tortoise’s habitat, reducing the invasion of non-native grasses, and providing additional shelter and food for desert

tortoises through the revegetation of its habitat. I worry that increased nitrogen deposition will negatively affect these revegetation efforts by decreasing critical cryptobiotic soils and increasing non-native grasses.

California Gnatcatcher

25. I have also researched, studied, observed, and participated in habitat restoration efforts for the federally threatened coastal California gnatcatcher. I have biological, scientific, educational, and aesthetic interests in the gnatcatcher and its habitat. With its kitten-like "mew" of a call, the gnatcatcher is a prime indicator of ecosystem health for the unique coastal sage scrub community that the gnatcatcher calls home. In the coastal sage scrub that once stretched unbroken from Ventura County to northern Baja California, this tiny gray songbird's habitat has now become fragmented, scattered amid a patchwork of freeways, shopping malls, housing developments, and a smattering of farmlands. Ninety percent of southern California's coastal sage scrub has already been lost to development, and remnant patches have been hit hard by unnaturally frequent wildfires, exacerbated by climate change.

26. I first became interested in the gnatcatcher prior to working for the Center while employed as a botanist doing habitat restoration work in coastal sage scrub and other unique southern California plant communities. Due to unbridled

development, I worked on numerous projects that required revegetation or enhancement of coastal sage scrub in order to offset impacts from the destruction of gnatcatcher habitat elsewhere. I felt happy, proud, and relieved when gnatcatchers were successful in occupying areas in which I had designed and implemented revegetation and enhancement projects. However, I also came to understand that while recreating habitat is possible for the gnatcatcher, it is exceedingly expensive, and the revegetation sites are never as botanically diverse as undisturbed sites. This has led me to harbor ongoing concerns about the long-term viability of the sites. On the economics alone, it makes more sense to have undisturbed gnatcatcher habitat conserved rather than to try to revegetate or enhance sites.

27. I personally have visited gnatcatcher habitat for observation, research, aesthetic enjoyment, bird watching, botanizing, and other recreational, scientific, professional, and educational activities, and I intend to continue to do so in the near future. I spent years looking at undisturbed gnatcatcher habitat and implementing detailed analyses of it in order to be able to create successful revegetation projects. For example, I performed thousands of line-intercept transects to characterize the vegetation components of gnatcatcher habitat. I took hundreds of soil samples to understand the soil horizons and nutrient components. I worked with microbiologists to identify the mycorrhizal components of the upper

soil layers and developed site-specific mycorrhizal inoculums for the revegetation sites. All of this work was in support of enhancing gnatcatcher habitat.

28. During my studies of coastal sage scrub, I particularly noted when I was in a gnatcatcher territory. Because gnatcatchers are non-migratory, I greatly valued the locations where gnatcatchers were present because their presence identified what was "good" habitat. By hearing their distinctive "mewing" call, I could perceive and analyze their preferred habitat. I personally enjoyed watching the gnatcatchers busily flitting in and around shrubs in the coastal sage scrub.

29. During the breeding season, while I avoided gnatcatcher nests, I could tell when I was getting too close to a nest, because the gnatcatcher would become much bolder and fly near me to scold me away.

30. My most recent trip to view gnatcatchers was in early December of 2019, when I visited the Palos Verdes Peninsula. While there, I decided to wander down to the beach to see if I could spot a gnatcatcher—the Peninsula still retains some high-quality gnatcatcher habitat. After walking only a short way down the trail towards the beach, I heard the gnatcatcher's distinctive "mewing" call and I was overjoyed to see a California gnatcatcher flitting around in a California sagebrush.

31. Later in the day, when I returned to my car, another California gnatcatcher was "mewing" in some dense coastal sage scrub adjacent to the

parking lot. I could see it best with my binoculars. I was excited to see not one but two gnatcatchers that day.

32. I usually visit gnatcatcher habitat every two to three months and I plan on continuing to do so starting in February or March of 2021, depending on the COVID pandemic and whether it is safe to travel. Specifically, I am planning to go back to gnatcatcher habitat in the Palos Verdes Peninsula in Los Angeles County, to publicly accessible open space areas in Orange County, to the backcountry of State Park and Wilderness Parks, and to Temescal Valley in Riverside County.

33. The invasion of coastal California gnatcatcher habitat by non-native grasses is largely due to increased nitrogen availability through air pollution deposition. A recent study documents a strong gradient of nitrogen deposition in coastal sage scrub communities in the Santa Monica Mountains National Recreation Area, which is in close proximity to Los Angeles, California. The nitrogen deposition facilitates non-native plant invasions, altered ecosystem functions, and reduced plant richness that mirrors the nitrogen deposition (Valliere et al. 2020). Responding to the increased levels of nitrogen, the non-native grasses red brome and ripgut (*Bromus diandrus*) outcompete the native wildflowers and forbs and alter the nutrient functioning of the coastal sage scrub community. Gnatcatchers, as their very name implies, consume insects. The conversion of

habitat from wildflowers and forbs to non-native grasses reduces the diversity and quantity of insects, because non-native grasses rely on wind for pollination, while wildflowers and forbs typically require insects for pollination. Decreasing the presence of insect pollinators reduces the food source for gnatcatchers.

34. In all of these species' habitats, the increased prevalence of non-native grasses also alters the fire regime. Where fire was once a rare occurrence in the sparse and arid habitats of the San Joaquin kit fox, blunt-nosed leopard lizard, and Mojave desert tortoise, and even in the shrubbier coastal sage scrub habitat of the coastal California gnatcatcher, the increasingly heavy growth of non-native grasses provides enough seasonally dead plant material (often known as residual dry matter or RDM) to carry fire in these landscapes, impacting the existing shrubs and forbs. After fire, with even more nitrogen available from the burnt grasses and shrubs, the non-native grasses quickly recolonize and decrease germination of native plants resulting in what ecologists call a "type conversion" – where one type of vegetation wholly replaces another type. Here, where non-native grasses replace native wildflowers and shrubs, the fire frequency is vastly increased and the fire-return interval (the amount of time between fires) is greatly decreased, assuring that native plants will continue to decline until they no longer occur on the landscape at all, completing a "type conversion." Climate change also increases the frequency of fire on the landscape as well as the size of fires in habitat due to

increasing temperatures. The animals that rely on the natural habitat are consequently eliminated over time as well, because the resources that they rely on for sustenance and successful reproduction are no longer available.

35. My personal and professional interests regarding wildlife viewing, recreation, scientific research, wildlife habitat conservation, air pollution, and endangered species protection will be harmed by the Rollback Rule because the Rule allows for continuing nitrogen deposition onto our most vulnerable species' habitats. It also worsens climate change, which puts even more stress on these species and their habitats.

36. Based on my professional knowledge of ecosystems, I believe that the Rollback Rule will exacerbate the already critical problem of air pollution affecting our natural habitats by depositing even greater amounts of unnatural amounts of nitrogen on landscapes that are already struggling to survive from increased non-native grass invasions and increased fire frequency. For example, just this summer, two devastating fires occurred in prime Mojave desert tortoise habitat that is designated by the federal government as critical habitat for the species. In Washington County, Utah, over 12,0000 acres of high-density Mojave Desert tortoise habitat burned within the Red Cliffs Desert Preserve, a preserve established under Washington County's Habitat Conservation Plan, which is also part of the Red Cliffs National Conservation Area. Unfortunately, the Preserve has

been invaded by cheatgrass. Also this summer, in the Mojave National Preserve in California, over 43,000 acres of high quality Mojave desert tortoise habitat burned in the Dome fire, with non-native grass invasions helping to spread the fire.

37. It is my professional opinion that rolling back the fuel efficiency, greenhouse gas, and criteria pollutant standards will exacerbate degradation of endangered species' habitats that are sensitive to and affected by increasing nitrogen deposition and therefore harm the recovery of these species. I believe that if the Rollback standards were vacated, the reduction in fuel consumption and decrease in air pollution that would occur would decrease the amount of nitrogen deposition in the natural landscapes and decrease the growth and expansion of the invasive non-native grasses that are creating such a drastic "type conversion" of habitat for federally listed species as well as more common plants and animals.

38. I worry deeply about the future for the San Joaquin kit fox, the blunt-nosed leopard lizard, the Mojave desert tortoise, the California gnatcatcher, and other species and their habitats. EPA and NHTSA's failure to consult with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service about the impacts of the Rollback Rule hurts not only my interests but also the species that will be impacted by the Rollback Rule.

39. Damage to these species and habitats negatively affect my aesthetic, spiritual, recreational and moral interests. I take great pleasure in knowing that

these species are out there even when I can't always find them in their habitat. I fear that places where I used to see and enjoy watching these species will disappear, and that my life and those of others will be diminished. I am saddened because the pollution from the SAFE II rule will further imperil these species and their habitats.

40. Therefore, I firmly believe that the Rollback Rule should be vacated in order to protect the San Joaquin kit fox, the blunt-nosed leopard lizard, the Mojave desert tortoise, the California gnatcatcher, other species and their habitats, and human health.

Pursuant to 28 U.S.C. § 1746, I declare, under penalty of perjury, that the foregoing is true and correct.

Executed on January 5th, 2021, at Los Angeles, California.

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ILEENE ANDERSON

Exhibit A: Anderson Standing Decl. Rollback Rule References

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DECLARATION OF SYLVIA ARREDONDO

FOR THE CENTER FOR BIOLOGICAL DIVERSITY

I, Sylvia Arredondo, state and declare as follows:

1. I am over 18 years of age and competent to give this declaration. I have personal knowledge of the following facts, and if called as a witness could and would testify competently to them. As to those matters which reflect an opinion, they reflect my personal opinion and judgment on the matter.

2. I have been a member of the Center for Biological Diversity (the "Center") since 2015, and I rely upon the Center to represent my interests in protecting our air quality and our environment by gathering and disseminating information about air pollution, advocating for the remediation of that pollution, and enforcing our environmental laws in the courts.

3. I grew up in Wilmington, in the city of Los Angeles, and lived about a mile from a refinery and directly across the street from oil wells, drilling installations, and train switching stations. As a child, I was diagnosed with mild asthma and, on one occasion, I have developed bronchitis because of it. I lived in Wilmington until I moved away to the Bay Area for college. While living in the Bay Area, I began feeling much better and my health improved. In 2012, I returned to Wilmington. Three years later, I began living in an area close to the

Phillips 66 refinery, the Interstate 110 freeway, and the Port of Los Angeles.

4. In 2019, I moved from Wilmington to Long Beach, California. I now live close to the Interstate 710 freeway, which is heavily congested with passenger cars and light trucks. I also live within eight miles of the Valero Wilmington, Marathon Carson, and Marathon Los Angeles refineries. I am employed as a Civic Engagement Coordinator for Communities for a Better Environment ("CBE"), an environmental justice organization that seeks to prevent pollution and build healthy communities and environments. In non-COVID pandemic circumstances, I normally work out of CBE's Wilmington office, which is less than a quarter mile from the Phillips 66 oil refinery, 5.5 miles from the Port of Los Angeles, and less than three miles from the Interstate 110 freeway, which carries very heavy car and truck traffic to and from the Port and the refinery.

5. I am extremely concerned and care greatly about the bad air quality where I live and work, both for myself and those on whose behalf I advocate. There are approximately six refineries in and around Wilmington. These nearby refineries process enormous amounts of oil and emit large quantities of pollutants, including particulate matter ("PM2.5") and nitrogen oxides, which are precursors for ozone (also known as "smog"). Sometimes I can smell the pollution and toxic fumes from the refinery when I drive on nearby roads or take walks in the vicinity. I often see the black soot and grime that come from the refinery and vehicle traffic

near my home and place of work.

6. I often suffer from air pollution sickness due to the emissions from the refineries, heavy traffic on nearby freeways, and the Port of Los Angeles. When traffic and refinery pollution increases, my symptoms get worse. In 2018, I suffered from sinus infections that were worse than any I had experienced previously. In one instance, I was so sick I had to miss work for about a week. I might have lost my job if I did not work for an organization dedicated to caring for communities and people affected by air pollution.

7. When I get sinus infections, I become extremely sensitive to light and noise, and I feel painful pressure in my nasal cavities, above my eyelids, in my temples, and in my ears. When my nasal cavity is inflamed, it often feels as if I have a painful ear infection. My throat becomes sore, and the discomfort and pain keep me from being able to work. I was fully incapacitated in this way twice in 2017 and once the year before. When the temperature rises, as it has in recent years, my sinus infections are more frequent and intense, and my overall health worsens. I know that the greenhouse gases ("GHGs") produced by refineries and vehicles are responsible for the ever-rising temperatures that make air pollution and my symptoms worse.

8. I am on a medication regimen that calls for administering a nasal decongestant weekly or daily, depending on the temperature. Right now, I'm

afraid to go to my doctor and the drugstore because of COVID, but usually I take allergy tablets and prescribed eye drops to prevent my eyes from becoming dry and itchy. I try to use these medicines to preempt any air pollution sickness, but I still become incapacitated. I suffer all these effects even though I changed my diet to make it as healthy as possible and increased my fluid intake. I use an inhaler whenever I exercise, hike, or go for a bike ride. I know it is the emissions from the oil refineries and from vehicles that make me so sick.

9. Because of my job, I am aware of many people in Wilmington who live close to many refineries (including the Valero, Wilmington, Marathon Carson, and Marathon Los Angeles refineries), the Port of Los Angeles, and the 110 freeway who suffer from air pollution-related illnesses, such as asthma, sinus infections, other lung diseases, and even heart attacks. Particulate matter and ozone pollution are known causes for all of these conditions. Refineries like Phillips 66 in Wilmington emit benzene, which is a known carcinogen. The Wilmington area is notoriously described as a "cancer cluster," particularly for leukemia, a cancer directly associated with benzene emissions. I know many Wilmington community members suffering from leukemia, including children already diagnosed with the disease. In 2015, my friend died of leukemia. The harmful and often lethal consequences of refinery emissions make me anxious and fearful of my own risk of contracting cancer.

10. Poor air quality also impacts my family members, especially my younger nieces who are eight and six years old. They live in Wilmington about one mile from a refinery and across the street from oil wells, and they go to elementary school near the Port of Los Angeles, the 110 freeway, and several refineries. They both have to use inhalers and nebulizers to assist their breathing. I have watched how air pollution adversely impacts their health and prevents them from leading happy, healthy, and unencumbered lives. They must always remember to bring their inhalers to school and could be disciplined by the school if they use them without first going to the school nurse's office.

11. Because of my personal health issues from fossil-fuel-related pollution and my job duties, I am well informed of regulations, programs, and workshops designed to reduce the air pollution affecting my health and that of the communities I serve. For example, there are state programs that provide financial assistance to low-income communities for purchasing zero-emission vehicles ("ZEVs"). At CBE, we have been advocating for greater investments for an electric bus fleet in Wilmington. Unlike other California cities, Wilmington lags far behind when it comes to embracing clean transportation technology that could drastically improve the health and well-being of its residents. Until recently, city buses would spew exhaust as they traveled by our office and neighboring frontline communities. Now those buses are powered by "clean" natural gas; however, what

the community wants and needs most is a zero-emission fleet.

12. In 2012, the Environmental Protection Agency ("EPA") and the National Highway Traffic Safety Administration "(NHTSA") issued regulations that set increasingly stringent standards which reduced pollution, such as PM2.5, ozone precursors like nitrogen oxides, and greenhouse gases, from cars and light trucks built during the years 2017-2025 (the "2012 Vehicle Rule"). I learned, however, that in April 2018, EPA reversed course and withdrew its 2017 final determination, finding that the 2012 Vehicle Rule was no longer appropriate, too stringent, and would be rolled back. Now, NHTSA and EPA have issued the "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks" ("SAFE Vehicles Rule"). The first part of the SAFE Vehicles Rule states that federal law preempts—and on that basis revokes—California's ability to set stricter GHG standards and require auto manufacturers to produce and sell more ZEVs ("waiver"). The second part of the SAFE Vehicles Rule will be significantly weaker on GHG pollution reduction and fuel efficiency requirements than the 2012 Vehicle Rule. I am aware that both parts of the Rule have now been finalized.

13. I am deeply concerned by the rollback of federal vehicle standards and the federal government's attempt to revoke California's waiver. These decisions would make it exceedingly difficult for communities like mine to reduce

tailpipe emissions in our environment.

14. I fear that the federal government's lack of support for ZEV requirements and stricter fuel economy standards will undermine national and state-level efforts that encourage investments in and adoption of electric vehicles. I am also concerned that the confusion caused by the SAFE Vehicles Rule will cause uncertainty in the ZEV market, leading to fewer ZEVs being manufactured and made available, leading to more pollution from cars and refineries, and making it less likely that I could afford to purchase a ZEV in the future. I currently drive a fuel-dependent vehicle—a 2010 Kia Forte. Three years ago, I looked into purchasing a low-emission or zero-emission vehicle. At the time, I was not able to make the investment. Now that I have paid off my Kia Forte, I have recommitted to the idea of purchasing a used zero-emission vehicle like the Nissan Leaf. I would consider purchasing a new zero-emission vehicle if the cost of the car came down due to widespread penetration of electric vehicles in the state and the national market.

15. I am also concerned that the SAFE Vehicles Rule will increase PM2.5, ozone-forming nitrogen oxides, and greenhouse gas emissions from the Interstate 710 and 110 freeways and refineries near where I live and work, resulting in more polluted air. I am concerned these rules will increase pollution from cars on the freeway, and also from the refineries near me because people will

be driving less fuel-efficient cars and will need more gas to power them. I am very worried that, as a result, the SAFE Vehicles Rule will cause direct harm to my health. I will very likely miss more days of work due to more bouts of air pollution sickness. I am anxious about the prospect of more traumatic health experiences such as severe sinus infections, unnerving light and noise sensitivity, pressure in my head, pain in my ears, shortness of breath, and increased risk of developing cancer. I experience fear and anxiety about how much my health and that of my community will continue to deteriorate.

16. Furthermore, I know that increased GHG emissions worsen climate change, and that the SAFE Vehicles Rule will vastly increase GHG emissions. I am also concerned that by undermining ZEVs and encouraging cars with lower gas mileage, the SAFE Vehicles Rule will harm the climate. Urban areas like mine can suffer from "heat island" effects, which warm my area faster than others. Warmer temperatures increase air pollution, including ozone, and mean that I, and the communities I serve, will suffer more of the severe health consequences I have described. Wilmington is also low lying, and likely to suffer the consequences of storm surges and sea-level rise if climate change gets worse.

17. My job requires me to reach out to the community and provide information about: local air quality; air pollution emissions and their sources; impacts to public and environmental health; and how to resist these effects at a

grassroots level. The environmental review document that accompanies that second part of the SAFE Vehicles Rule fails to provide important information related to: the environmental and health impacts of the preemption rule and withdrawal of California's waiver; an evaluation of scenarios with stricter fuel economy standards; the rationale behind the inclusion or exclusion of certain scenarios or assumptions; the effects of this rule on air pollution control efforts; and the impacts to federally-listed or critically-imperiled species and habitats.

18. This lack of information deprives me of my procedural rights to be informed of the additional impacts and burdens placed on communities like mine that are already suffering disproportionately from the degradation of the air we must breathe. I need this information as part of my job to enable members to advocate more effectively on behalf of stronger pollution control measures. For the same reason, the Center, on which I also rely to advocate for air pollution reduction, is hampered in its ability to protect me and others by sharing that information.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on January 5, 2021 at Long Beach, California.

Sylvia Arredondo

DECLARATION OF WILLIAM C. BAKER

I, William C. Baker, declare as follows:

1. I am over 18 years of age, competent to testify, and based on personal knowledge, information, and belief, I have knowledge of the facts stated herein.

2. I am President of the Chesapeake Bay Foundation, Inc. ("CBF"), which is located at 6 Herndon Ave., Annapolis, Maryland 21403. I was Executive Director of CBF from 1982 until 1984, when my title changed to President. I have held that position since 1984. Because of my position and responsibilities, I am familiar with CBF's mission, organization, and activities, and with the environmental interests and concerns of CBF's members and board of trustees. I am also familiar with the demographics of CBF's membership and board of trustees.

3. CBF is a regional, nonprofit, nonpartisan, public-interest advocacy organization with members throughout the Chesapeake Bay region. As of July 2019, CBF has over 300,000 members and electronic subscribers nationwide, including 109,137 members in Maryland; 6,368 members and electronic subscribers in Delaware; 6,094 members and electronic subscribers in the District of Columbia; 91,425 members and electronic subscribers in Virginia; 47,070 members and electronic subscribers in Pennsylvania; 18,102 members and electronic subscribers in New York; and 1,604 members and electronic subscribers in West Virginia.

4. CBF maintains offices in Annapolis and Easton, MD; Richmond and Virginia Beach, VA; Harrisburg, PA; and Washington, DC. CBF operates several environmental education centers on the Chesapeake Bay and maintains oyster restoration operations in Shady Side, MD and Gloucester Point, VA.

5. CBF's mission is to "Save the Bay" and keep it saved, as defined by reaching a 70

on CBF's Health Index. *See* CBF, 2018 State of the Bay Report, https://www.cbf.org/about-the-bay/state-of-the-bay-report/. For over 50 years, CBF has worked to restore and protect the Chesapeake Bay through education, advocacy, restoration, and litigation. CBF uses its various resources to achieve its mission. However, climate change has adversely affected CBF's ability to do so and is worsened by continued increases in air pollution.

6. The Chesapeake Bay faces persistent water quality challenges due to nitrogen, phosphorus, and sediment pollution. Excessive nitrogen and phosphorus lead to an overabundance of algae which blocks sunlight from reaching underwater grasses that serve as food and habitat. As the algae decay, they rob the Bay of oxygen, leading to hypoxic or anoxic dead zones—water with little to no oxygen where it is impossible for oxygen-dependent creatures to survive.

7. Climate change, fueled by greenhouse gas emissions, exacerbates the Bay's water quality problems by increasing water temperatures, which decreases dissolved oxygen levels; increasing the frequency and strength of precipitation events and associated runoff pollution; changing salinity regimes; and causing the loss of wetlands and marshes, which provide valuable habitat and water-filtering services throughout the watershed, due to sea level rise. *See* CBF, "Climate Change", https://www.cbf.org/issues/climate-change/.

8. CBF is the largest independent organization dedicated solely to restoring and protecting the Chesapeake Bay and its tributary rivers. Our goal is to improve water quality through the implementation of the Chesapeake Bay Clean Water Blueprint. The "Blueprint" refers to the Chesapeake Bay Total Maximum Daily Load (TMDL), issued by the United States Environmental Protection Agency (EPA) in December 2010, and state-developed Watershed Implementation Plans (WIPs) which outline Bay jurisdictions' strategies to meet the pollution

reduction targets of the Bay TMDL. The Bay jurisdictions are Maryland, Pennsylvania, Virginia, Delaware, West Virginia, New York, and the District of Columbia.

9. The Bay Blueprint set the pollution reduction targets for the Bay's three primary pollutants (nitrogen, phosphorus, and sediment) at levels necessary to meet water quality standards for dissolved oxygen and water clarity in the Bay. U.S. EPA, Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus, and Sediment (Dec. 2010), https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-document. The Bay TMDL is designed to ensure that "by 2025 all practices necessary to fully restore the Bay and its tidal waters are in place." *Id*. at ES-6.

10. CBF and a coalition of groups and individuals sued EPA to ensure development and implementation of the Bay TMDL. *Fowler v. EPA*, No. 1:09-C-00005-CKK, 2009 U.S. Dist. LEXIS 132084 (D.D.C. 2009). This matter resulted in a settlement agreement requiring EPA to, among other things, issue the Chesapeake Bay TMDL by December 31, 2010.

11. I am aware that EPA and the National Highway Traffic Safety Administration (NHTSA) recently finalized rules that weaken efforts to reduce air pollution from cars and trucks. In the first action, EPA withdrew California's authority to establish greenhouse gas and zero-emission vehicle (ZEV) standards for passenger cars and trucks and removed other states' ability to adopt those standards. Five of the seven watershed jurisdictions have adopted elements of the California standards in their efforts to fight climate change, reduce air pollution, and clean up the Bay.[1] In the second action, EPA and NHTSA weakened the federal greenhouse gas emissions and fuel economy standards, respectively, for passenger cars and trucks.

[1] *See* Maryland Department of the Environment, "States Adopting California's Clean Cars Standards", https://mde.maryland.gov/programs/air/mobilesources/pages/states.aspx (including Maryland, Delaware, New York, Pennsylvania, and Washington, D.C.).

12. I understand that, collectively, the rules will lead to an increase in greenhouse gas emissions from vehicles, further exacerbating the impacts of climate change, as well as an increase in nitrogen oxides and other harmful air pollutants from increased fuel consumption. This increased air pollution will negatively impact the health of the Chesapeake Bay and CBF's members.

Air Pollution and Chesapeake Bay Health

13. CBF's interest in improving the water quality of the Chesapeake Bay is intertwined with regional air quality issues. The Chesapeake Bay airshed—the area from which airborne nitrogen pollution can reach the Bay watershed—is 570,000 square miles, stretching from Canada in the north, to South Carolina in the south, and to Indiana and Kentucky in the west. The airshed is more than nine times the area of the Bay's watershed. *See* Chesapeake Bay TMDL, Appendix L: Setting the Chesapeake Bay Atmospheric Nitrogen Deposition Allocations, at L-4 (Dec. 29, 2010), https://www.epa.gov/sites/production/files/2015-02/documents/appendix_l_atmos_n_deposition_allocations_final.pdf.

14. When the Bay TMDL was established in 2010, EPA identified the atmospheric deposition of nitrogen as contributing approximately one-third of the entire nitrogen input to the Bay watershed via deposition onto tidal surface waters and the surrounding Bay watershed. *See id*. at L-2. Atmospheric loads of nitrogen come from the emission of nitrogen oxides and ammonia (NH3). Primary sources of nitrogen oxides are industrial-sized boilers and internal combustion engines in cars, trucks, and other vehicles. *Id*. at L-1.

15. As EPA updated the modeling associated with the TMDL, the Agency relied in part on the implementation of federal and state vehicle emissions programs to achieve necessary reductions in atmospheric nitrogen in order to meet the requirements of the Chesapeake Bay

TMDL. *See* U.S. EPA, Midpoint Assessment of the Chesapeake Bay Total Maximum Daily Load at 4, https://www.epa.gov/sites/production/files/2018-07/documents/factsheet-epa-midpoint-assessment-chesapeake-bay-tmdl.pdf ("EPA and the jurisdictions will need to continue implementing Clean Air Act regulations for both stationary and mobile source pollution to ensure that the air deposition reduction goals will be achieved.").

16. Climate change poses a significant threat to water quality and to achieving the goals of the Chesapeake Bay Blueprint. *See* U.S. EPA Chesapeake Bay Program, "Climate Change", https://www.chesapeakebay.net/issues/climate_change. Among other impacts, warmer water holds less oxygen, meaning that as temperatures continue to rise, dissolved oxygen in the Bay will decrease, worsening dead zones; stronger storms with more rainfall will lead to more polluted runoff entering the tributaries of the Bay; and climate change-induced sea level rise destroys marshes and wetlands necessary for filtering polluted runoff and for providing critical habitat to watershed species. Climate change and its impacts are fueled by increases in greenhouse gas emissions.

17. CBF has expended significant resources and time investigating regional air pollution to better understand and communicate how air pollution, especially greenhouse gases and nitrogen oxides, affects the Chesapeake Bay. These activities require a substantial amount of policy, advocacy, and scientific staff time. CBF recognizes the importance of participating in public comment and hearing processes related to federal and state air pollution regulation and regularly contributes its unique expertise and regional interests to such proceedings. CBF also devotes resources to educating the public, including members, about the impact of air pollution and climate change on water quality in the Bay watershed.

Impact to CBF Members

18. CBF members engage in a wide array of activities around the Bay watershed including fishing, crabbing, boating, swimming, hiking, bird watching, and oyster-gardening (growing oysters in baskets attached to a dock: https://www.cbf.org/how-we-save-the-bay/programs-initiatives/frequently-asked-questions-about-oyster-gardening.html). In this way, CBF members rely on a healthy Bay watershed for economic, recreational, and aesthetic interests.

19. Many CBF members live, work, recreate, and/or own property in areas throughout the watershed that are impacted by sea level rise, including sunny day flooding and increased storm events.

20. Numerous CBF members live near high traffic areas, interstate highway corridors traversing the Bay region, and in cities and areas that suffer from increasing days of extreme heat.[2] Many CBF members also live in Bay watershed areas impacted by harmful ground-level ozone pollution, including all or part of three areas currently not attaining federal air quality standards for ozone: Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE (Marginal Nonattainment); Washington, DC-MD-VA (Marginal Nonattainment); Baltimore, MD (Marginal Nonattainment). EPA, Greenbook: "8-Hour Ozone (2015) Designated Area/State Information" (current as of November 30, 2020), https://www3.epa.gov/airquality/greenbook/jbtc.html. I understand that climate change contributes to an increase in heat-related formation of ground-level ozone pollution.

21. I understand that there are several petroleum refineries located in or near the

[2] *See* U.S. Global Change Research Program, Fourth National Climate Assessment, Chapter 18: Northeast, Key Message 4: "Threats to Human Health" (2018), *available at* https://nca2018.globalchange.gov/chapter/18/.

Chesapeake Bay airshed and that an increase in production at these facilities will increase the amount of harmful air pollution emitted to the region.

22. Increases in greenhouse gases, nitrogen oxides, and other pollutants contribute to air and water pollution and climate change impacts suffered by communities in the Bay region, especially vulnerable communities who are already disproportionately impacted by pollution. These impacts harm CBF members' health, livelihoods, and interests in the Bay watershed.

Impact to CBF Restoration Work

23. CBF operates a watershed-wide restoration department. CBF's restoration programs within the Chesapeake Bay watershed are designed to improve water quality, in many cases by taking up nitrogen in the air and water. Those restoration efforts include planting vegetative buffers along rivers and streams, planting trees, and growing and planting oysters and underwater grasses. During fiscal year 2019, CBF spent over $3.1 million on restoration programs in the Chesapeake Bay region.

24. CBF's restoration department engages in numerous oyster restoration projects designed to revive the Chesapeake Bay's native oyster population after decades of decline due to pollution, overharvesting, and disease. Current estimates place the Bay's native oyster population at a fraction of historic levels. By restoring the Bay's oyster population, CBF aims to harness oysters' filtering ability to improve both water quality and clarity in the Bay. But climate change poses a serious threat to oyster populations in the Bay, including both restoration efforts and commercial fishing and aquaculture operations.

25. CBF's oyster restoration projects include oyster plantings, population and habitat monitoring, project maintenance, and public education (including the oyster gardening program). The primary restoration activity is planting juvenile oysters (or "spat") to build and enhance

oyster reefs throughout the Bay. In 2019, CBF planted 6 million oysters in the Little Choptank River, 2 million at Fort Carroll on the Patapsco River, and 250 spat-covered reef balls in the South River. Additionally, CBF launched its Making History Campaign in 2018. As a part of the Campaign, CBF set a goal to achieve 10 billion more oysters in the Chesapeake Bay by 2025; and to restore and protect oyster populations in ten Chesapeake Bay watershed tributaries in accordance with the goals of the Chesapeake Bay Watershed Agreement. *See* U.S. EPA Chesapeake Bay Program, "Chesapeake Bay Watershed Agreement", https://www.chesapeakebay.net/what/what_guides_us/watershed_agreement.

26. Funding for these projects comes from a variety of sources including, but not limited to: National Oceanic and Atmospheric Administration (NOAA) grants; Abell Foundation grants; financial support from outside organizations such as Arundel Rivers Federation; and CBF's Making History Campaign. Climate change is damaging CBF's ability to meet grant deliverables.

27. Sea level rise and intense precipitation events are threatening the success and straining the resources of CBF's oyster restoration program. In 2019, high precipitation caused large segments of the Bay to become less saline, which negatively affected oyster habitat, led to oyster deaths, and slowed oyster restoration projects.[3] CBF's program suffered severe setbacks in larval oyster availability and survival. These setbacks caused CBF to default on grant program project deliverables and prevented CBF from assisting smaller Bay watershed groups with their own oyster restoration projects.

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[3] U.S. Geological Survey, "Record Freshwater Flow in Water Year 2019 Affects Conditions in the Chesapeake Bay" (last visited Dec. 29, 2020), https://www.usgs.gov/centers/cba/science/record-freshwater-flow-water-year-2019-affects-conditions-chesapeake-bay?qt-science_center_objects=0#qt-science_center_objects.

28. Sea level rise poses a serious threat to CBF's Maryland Oyster Restoration Center in Shadyside, Maryland. Due to rapid sea level rise, CBF is searching for an alternative site to move its terrestrial oyster growing operations sometime in the next three years. Replacement sites suitable for such work are costly—one prospective property would cost CBF at least two million dollars to purchase and renovate. Additional greenhouse gases will contribute to continued sea level rise and intense precipitation events, which will continue to threaten the viability of CBF's oyster restoration programs and its ability to support the programmatic goals of the Chesapeake Bay Watershed Agreement and the Bay Blueprint.

29. In addition to oyster restoration projects, CBF conducts agricultural restoration projects throughout the watershed to protect and restore water quality. A key component of CBF's agricultural restoration projects is planting streamside buffers and stream restoration. The goal of these projects is to reduce the nutrient and sediment load entering Chesapeake Bay tributaries. Planting native grasses, shrubs, and trees along streams stabilizes the stream banks, filters pollutants from agricultural runoff, provides wildlife habitat for aquatic and terrestrial wildlife, sequesters carbon dioxide, and provides cooling shade for the water.

30. In Pennsylvania, tree plantings serve CBF's agricultural restoration goals and the Keystone 10 Million Trees Partnership, which is a CBF-led campaign to plant ten million trees in Pennsylvania—many in the Bay watershed—by 2025. Unfortunately, extreme weather events and unpredictable precipitation patterns threaten to derail these efforts. During 2018, the Bay watershed experienced a heavy rainfall season, with numerous storms producing multiple inches of precipitation at a time. These events led to flooding, which washed out numerous tree-planting projects and sent trees and planting materials downstream. In some cases, entire projects were decimated. Even for those projects that were not completely destroyed, they were ultimately

ineffective because these projects require a threshold number of planted trees in order for the project to provide its intended ecological services. As a result, CBF had to replant numerous riparian buffers, which costs roughly $8 per tree for hundreds of trees per acre on often multi-acre projects.

31. Conversely, due to a dry summer in 2019, CBF's inventory of unplanted tree seedlings dried out faster than they could be watered, and as a result, could not be successfully planted. This weather also dries out potential planting ground, making it difficult for staff and volunteers to dig holes appropriate for planting. Without viable seedlings and arable land, seedlings cannot be planted in a timely fashion and will ultimately be unlikely to survive the winter. Frequent and intense weather events, be they droughts or severe rainstorms, harm CBF's ability to meet its goals in an effective and economically sustainable manner. Increased greenhouse gas emissions will contribute to these chaotic weather patterns, threatening the viability of CBF's agricultural restoration programs and its ability to support the programmatic goals of the Chesapeake Bay Watershed Agreement and the Bay Blueprint.

Impact to CBF Education Programs

32. The CBF Education Department operates three main programs: Student Field Programs, Teacher Professional Learning, and Student Leadership Programs.[4]

33. The Field Programs represent the lion's share of the department's work. CBF currently operates fifteen different programs throughout the watershed. *See* CBF, "Field Programs", https://www.cbf.org/join-us/education-program/field-programs/. CBF operates five Boat Investigation Programs—Baltimore Harbor (Baltimore and Havre de Grace, MD);

[4] The COVID-19 pandemic has affected CBF's in-person education programs, requiring many to be conducted virtually. However, CBF intends to resume these programs in-full as soon as it is safely possible.

Hampton Roads (Hampton Roads, VA); James River (Hopewell, VA); Potomac River (Washington, DC); and Arthur Sherwood (Annapolis, MD)—utilizing scientific data collection and traditional watermen's fishing techniques to allow students to discover the health of their local rivers. CBF operates two Green Building Investigation Programs out of the Brock Environmental Center in Virginia Beach and the Phillip Merrill Environmental Center in Annapolis. CBF runs three canoe programs: the Susquehanna Watershed Environmental Education Program in Pennsylvania; the Elizabeth Reed Carter Environmental Education Program in tidal rivers of Virginia; and the Virginia Watershed Environmental Education Center in non-tidal rivers of Virginia. CBF operates a program of one-day field experiences throughout the Susquehanna River watershed via the Pennsylvania Student Action and Restoration Program. Lastly, CBF operates four multi-day education programs out of the Karen Noonan Center (Dorchester County, MD); Smith Island (Tylerton, MD); and Port Isobel (Tangier, VA) (Port Isobel EAST and Port Isobel WEST).

34. The CBF Education Department educates over 34,000 students and teachers per year, measured in participant days. CBF's Education Department subsidizes much of the cost of these programs for schools and students.

35. Heavy rainfall and increased water pollution negatively impact field programs and the experiences available to students. After significant rainfall, CBF educators will avoid water contact on programs run in areas that are prone to contamination as a result of surface runoff that carries human and animal fecal waste, pesticides, fertilizers, oil, and various other contaminants. As a result, students would either have to wear gloves and goggles to do water sampling and bottom dredging, or these activities would be skipped due to concerns over water quality and student safety.

36. CBF's canoe programs are impeded during heavy rain events and seasons, as well as periods of long drought and low water levels. These scenarios make navigation both difficult and dangerous. Heavy rains cause high waters and large amounts of debris in the water. Droughts lower water levels so boats cannot travel on certain waters. Erratic precipitation patterns often prevent CBF's canoe programs from operating for weeks at a time.

37. CBF's outdoor education programs are also impacted by extreme heat events such as those experienced in July 2019. The heat alone is dangerous to participants, but it also exacerbates air quality issues, which further endanger student and adult participants in CBF's Teacher Professional Learning and Student Leadership Courses.

38. In recent years, CBF education courses and programming have been cancelled due to extreme weather; cancellations lead to loss of revenue from programming. Increases in severe weather—such as hurricanes and high winds, extreme summer heat, and heavy rainstorms and high waters—will increase the risk of program cancellations, create more safety risks, and threaten CBF's capital investments in education centers and boats.

39. Increased greenhouse gas emissions will contribute to climate change and exacerbate the weather patterns that disrupt numerous aspects of CBF's education programming and resources.

Impact to CBF Property

40. Climate change and its accordant sea level rise threatens to inundate significant portions of the 11,000-mile Chesapeake Bay shoreline—including Chesapeake Bay Foundation property. While the threat of sea level rise is imminent worldwide, the Chesapeake Bay faces additional, unique challenges due to regional land subsidence—exacerbating the deleterious effect of sea level rise. *See* Chesapeake Bay Foundation Report: *Climate Change and the*

Chesapeake Bay: Challenges, Impacts, and the Multiple Benefits of Agricultural Conservation Work, at 2 (2007), https://www.cbf.org/document-library/cbf-reports/Climate-Change37bf.pdf. Thousands of acres of environmentally critical wetlands have been and continue to be at risk. This combination of processes has resulted in approximately one foot of net sea level rise in the Chesapeake Bay over the past 100 years—a rate nearly twice that of the global historic average. According to some scientists, the region might see as much as a three-to-four-foot sea level rise this century.[5]

41. Additionally, in low-lying areas, storm surges combined with higher sea levels and increasingly erratic storm activity may create a "perfect storm" that would flood thousands of acres. Many of those areas are economically disadvantaged, and the combination of flooding and limited access to emergency facilities—facilities that might themselves be flooded—could be disastrous.

42. CBF owns property throughout the Chesapeake Bay Watershed. CBF operates two environmental centers: the Phillip Merrill Environmental Center in Annapolis, MD and the Brock Environmental Center in Virginia Beach, VA. Both waterfront properties are raised to account for flooding from storms, but both centers are still threatened by sea level rise projected for this region. Additionally, CBF owns farmland in Maryland, including Holly Beach Farm, Harry Green Wildlife Preserve, and Clagett Farm. CBF owns other small islands and marshland in Accomack County, VA and Broad Creek, MD.

43. CBF holds nineteen conservation easements across the watershed in Maryland and Virginia, ranging from small one-acre easements to expansive 120-acre easements. Most of

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[5] *See, e.g.*, Zhang, Fan & Li, Ming. (2019). Impacts of Ocean Warming, Sea Level Rise and Coastline Management on Storm Surge in a Semi-enclosed Bay. *Journal of Geophysical Research: Oceans*. 10.1029/2019JC015445.

these properties are tidal marsh and are receding due to the erosive effects of sea level rise.

44. CBF's Clagett Farm is in Upper Marlboro, MD and uses sustainable farming methods to grow vegetables and raise beef cattle and sheep, as well as growing trees and shrubs for restoration projects. Through its Community Supported Agriculture (CSA) program, Clagett Farm sells a variety of organic vegetables to subscribers who invest in a "share" of the Farm's crop yield at the beginning of the planting season. These subscriptions financially support Clagett Farm. The Farm also grows organic produce that is donated to provide free and reduced-price fruits and vegetables to people living in poverty and near-poverty in Prince George's County, Maryland. Clagett Farm also operates a native tree nursey, which provides CBF with trees to be potted, transported, and planted throughout the watershed as part of CBF's restoration programs.

45. Clagett Farm operates best, and produces its highest yields, with moderate, predictable weather. In 2018, the Farm experienced its wettest year on record. The water-logged soils inhibited plant growth and, in some fields, completely killed crops. This resulted in Clagett Farm's lowest yield in its 20-plus-year history. In 2019, Clagett Farm saw a drought where there were more than three months without soaking rain, along with extremely high temperatures. This led to a steep decline in late summer fruiting crops, such as tomatoes, eggplants, peppers, and beans. And hay fields and pasture grasses stopped growing. A side-effect of these conditions is desperate animal behavior as animals face food and habitat constraints, leading to destruction of crops and fencing.

46. Without predictable weather patterns, Clagett Farm's staff must plant for all possible weather scenarios—planting warm spring crops and cool spring crops simultaneously to ensure there will be some crops to harvest. Likewise, farm staff must plant both water-friendly

crops as well as drought-tolerant crops. Under these conditions, staff now expect that in any given year, half of the planted crops will not produce a sustainable yield. Making matters worse, Clagett Farm must shift financial resources to invest in additional fencing, animal control, irrigation systems, and well-digging to protect the crops that are thriving. Ultimately, all of this threatens the financial stability of Clagett Farm. Because Clagett Farm is a CSA and has subscribers who invest in the harvest upfront, multiple seasons of reduced harvest could lead to lower subscriber retention rates, which could result in the Farm selling fewer shares and increasing prices to cover the cost of supplies and labor. If greenhouse gas emissions are not reduced and climate change continues unabated, CBF's Clagett Farm can expect these sporadic weather patterns to continue and/or worsen. As a result, Clagett Farm's financial stability will continue to be threatened.

47. CBF's education facilities are on the front lines of climate change impacts and CBF has invested significant resources to protect these facilities, especially from sea level rise. CBF operates the Karen Noonan Education Center on the shores of the Bay in Dorchester County, MD. CBF also operates three Island Education Programs on the Eastern Shore of Maryland and Virginia; the Smith Island Environmental Education Center and the Port Isobel Island Education Center's EAST and WEST programs. The Centers are located in the island communities of Smith Island and Tangier Island, respectively, where the economic livelihood of the community is tied directly to the Chesapeake Bay. Due to the many impacts of climate change articulated herein, the commercial watermen's communities of Tangier and Smith Islands will be hard hit, not only by sea level rise but by the loss of fish, oyster, and crab stocks that are integral to their economic livelihoods and well-being. As a landowner in both communities, any impact to the economies of Smith and Tangier will affect CBF's property values, as well as those

of our friends and neighbors.

48. CBF's Smith Island Education Center is located in Tylerton, MD on Smith Island. Somerset County, MD, in partnership with the U.S. Army Corps of Engineers and the State of Maryland, built a sea wall to protect Smith Island. But the seawall has become ineffective at preventing "tide overs", whereby the tide is so high it breaches the seawall. This leads to significant nuisance flooding on a near-daily basis. This flooding regularly inundates roads around the Education Center, making access to Smith Island and its buildings increasingly difficult.

49. CBF's Fox Island Environmental Education Center is in Accomack County, VA. The Fox Island Center was built in 1929 as a hunting lodge, which CBF later converted to an education center. When CBF obtained Fox Island, the deed stated the acreage of the property was 426 acres. The property was appraised in April of 2019, and the estimate of remaining acreage is 34.5 acres. The Fox Island Center was closed after the Fall 2019 education season because of safety concerns due to sea level rise. The surrounding islands that protected the Fox Island Center from high winds have eroded due to sea level rise, leaving the Center unprotected and exposed to high winds that pose a safety issue for students. The emotional loss of this center, which has been in operation for forty years, was felt by CBF staff as well as the innumerable students who first experienced the Chesapeake Bay at Fox Island. Moreover, the unique teaching experience Fox Island provided has now been lost.

50. CBF has invested significant financial resources into protecting the Port Isobel Island Education Center near Tangier Island, VA. CBF has invested more than $500,000 dollars into shoreline protection projects, including installing rock revetments to protect the dunes that shelter the Center's harbor, and underwater and beach grass plantings to control erosion.

Continued sea level rise and extreme weather will require continued improvements to protect Port Isobel.

51. CBF has invested significant resources into protecting the Karen Noonan Center and the roads leading to the Center from increased flooding. CBF installed a breakwater to protect tidal shoreline from erosion and create a safe harbor for boats to access the Center. CBF has spent thousands of dollars to protect and maintain the driveway around the Center, and has also devoted significant staff time to advocating for county and federal partners to repair and maintain the road that leads to the Karen Noonan Center. The road is frequently awash during above-average high tides, which are increasing in height and frequency. The frequency of nuisance flooding is also increasing and often affects other roads leading to this area. This flooding prevents school buses from traveling on paved county roads as they try to reach the Center. CBF soon anticipates not being able to drive to the Center and transitioning the program to a boat-only program as the road becomes permanently inundated with water. Such a transition will make the program vulnerable to weather conditions on the water and may limit how often visits can occur.

Impact to CBF

52. I understand that climate change and its impacts, including sea level rise, are directly tied to greenhouse gas emissions, including those from vehicle tailpipe pollution. Increased greenhouse gas emissions contribute to climate change and sea level rise in the Chesapeake Bay region and further threaten CBF members, programs, and property, and require CBF to expend financial and other resources to protect its assets. I understand that these threats are expected to worsen without meaningful action to reduce greenhouse gas emissions.

53. I understand that EPA and NHTSA issued final rules that collectively allow an

increase in greenhouse gases, nitrogen oxides, and other harmful air pollution. I understand that the rules will negatively impact the Chesapeake Bay watershed and may interfere with the goals of the Chesapeake Bay Blueprint and the Chesapeake Bay Watershed Agreement.

54. I also understand that EPA's action will impede states' abilities to implement zero-emission vehicle standards in order to increase the number of ZEVs on their roadways and reduce vehicle-related air pollution. In this way, the rules harm CBF's interest in ensuring the reduction of nitrogen oxides and other air pollution sufficient to meet the goals of the Bay Blueprint and protect the health of its members throughout the watershed.

55. Decisions from the Court finding the rules invalid would allow for more stringent standards to achieve much-needed reductions in air pollutants. This outcome would advance the interests of CBF's members who rely on and value clean air and clean water throughout the watershed; would protect CBF's properties and programs from worsening climate change impacts; and would contribute to CBF's organizational mission of improving water quality and achieving the goals of the Bay Blueprint.

I declare under penalty of perjury and based on personal knowledge that the foregoing is true and correct to the best of my knowledge and belief.

Executed on this 4th day of January 2021.

William C. Baker

DECLARATION OF JAMES W. BERRY
FOR CONSERVATION LAW FOUNDATION

I, James W. Berry, hereby declare and state:

1. This declaration is based on my personal knowledge, information, and belief. I am 77 years old and I am competent to testify to all facts contained in this declaration.

2. I am a permanent resident at 142 County Road, Ipswich, Massachusetts 01938. I have lived in Ipswich since 1972.

3. I am a current member of Conservation Law Foundation (CLF). I joined in 2017. I was attracted to CLF because it is a New England-based group that works on issues that are important to me and to the region, such as the preservation of the piping plover. This work makes the group more valuable to me than similar national or international organizations that do not focus on New England.

4. I have an avid interest in birds, bird watching, bird research, and bird writing, which began when I took an ornithology course at Miami University (Ohio) my senior year (1965). I have been watching and studying birds ever since.

5. In pursuit of my interests in birds and bird watching, I am a member of the Cornell Laboratory of Ornithology, the American Birding Association, the American Bird Conservancy, The Nature Conservancy, Massachusetts Audubon, New Hampshire Audubon, and several local land trusts and watershed associations. I am also a past president of the Essex County Ornithological Club. I am a former member of the Association of Field Ornithologists, the Ipswich Conservation Commission, and the Ipswich Open Space Committee.

6. I have contributed to the development of a number of breeding bird atlases. During the 1970s, I helped Massachusetts create its first Breeding Bird Atlas. For six years, I routinely surveyed six blocks to confirm the breeding of as many species as possible in each

block by locating nests or seeing an adult bird carrying food or nest material. From 2007-2011, I coordinated surveys for the Essex County portion of the second Massachusetts Breeding Bird Atlas, leading an army of volunteers and conducting many of the surveys myself. I have also contributed to breeding bird atlases in seven other states.

7. I have also written extensively on birds. I just finished writing a book, tentatively titled *Birds of Essex County*, which includes a "species account" of each species, including piping plovers. I have also written many articles for Bird Observer, a New England birding journal, on topics such as the nesting of rare or uncommon New England species and the history of published bird records in New England; I also edited a regular series on where to go birding for 25 years. I intend to continue writing about birds, including piping plovers.

8. I have a strong personal interest in piping plovers. Crane Beach in Ipswich, Massachusetts(a property of The Trustees of Reservations, or TTOR, a statewide land trust) has more pairs of piping plovers than even the Parker River National Wildlife Refuge. It is one of the most successful colonies in Massachusetts. I feel personally attached to these birds because I live here and see them often, which makes me feel a sense of guardianship over them.

9. I really enjoy watching piping plovers—in particular how they interact with one another, the way they run around on the beach, and the way they take care of their chicks. I take great pleasure in watching plovers show affection for their chicks and protect them from threats. Though they do not always stick right with their young as the chicks learn to be independent, the parents are never far away, and may even try to drive off a predator or shield the young. When there is danger, the chicks will sometimes run to the parent and try to hide underneath, leading to memorable images of adult piping plovers with many sets of legs sticking out below.

10. I also enjoy listening for the call of the piping plover, a piping sound that is easy to recognize. Sometimes piping plovers communicate with their young this way, or warn one another of potential risks.

11. I go to Crane Beach once a month or so to view piping plovers during the breeding season when they are in Massachusetts. The plovers stay at Crane Beach from late March to October. I always try to find plovers at the beginning of the season, usually around the third week in March. As I have in prior years, I intend to go look for them again upon their expected return in March 2021. I also lead field trips at the beach, including an annual trip every June at the peak of nesting season that I have led for almost all of the last 30-35 years. That trip focuses on viewing nesting piping plovers and least terns, which are the two primary nesting birds at the beach. I keep statistics on piping plovers and their nesting successes and I always count the plovers when I see them. I keep records in a field notebook and when I get home I enter my data in eBird, an online scientific and educational database that allows birders to document their observations for posterity.

12. I intend to continue observing piping plovers at Crane Beach and other locations for as long as I am able. I also intend to continue leading the annual bird walk, a tradition I do not want to stop doing because it teaches people about plovers and other species of birds.

13. I also have a strong conservation interest in the piping plover. Their habitat is very specific: the upper beaches and sparse grass above the high tide line. I have a strong interest in preserving their habitat. I want there to be as much habitat for piping plovers as can be preserved around the state.

14. I have read and been informed that the federal government has finalized a rulemaking that lessened restrictions on vehicle fuel efficiency as well as emissions standards. I understand that these rule changes will result in substantially greater emissions of climate-damaging greenhouse gases, which will worsen climate change.

15. I understand that climate change is causing average temperatures and sea levels to rise, and this is likely to have an impact on piping plovers. For instance, piping plover nests can get wiped out during storms. Because the plover nesting habitat is so specific, higher sea levels may result in the piping plovers building their nests dangerously close to the high tide line. This leaves their nests at greater risk of being washed away by ocean waves. A changing climate can also cause more frequent and intense storms and hurricanes, which negatively affect the piping plover by decimating nests.

16. My various interests in piping plovers outlined above would be harmed if there were fewer piping plovers to observe and enjoy. I believe that if the Court grants CLF the relief it is seeking in this case, it would reduce climate change-causing emissions, which would lessen the harm to piping plovers that results from climate change.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 7th day of January, 2021 in Ipswich, Massachusetts.

James W. Berry

James W. Berry

DECLARATION OF DYLAN BROCK

I, Dylan Brock, declare as follows:

1. I am a member of Environmental Defense Fund (EDF). I reside in Denver, Colorado. I have lived in Denver since 2015.

2. I am a pediatric neurologist at Children's Hospital Colorado. As a pediatric physician, I understand that children are particularly vulnerable to air pollution because they typically spend more time outdoors than adults, and because their lungs are still developing.

3. I have a 16-month-old daughter who loves to be outside, and spends time playing in our backyard every day.

4. I am aware that Denver County, where my family and I reside, is in nonattainment with EPA's health-based ozone standard. I understand that this means Denver County has unhealthy levels of ground-level ozone, or smog.

5. I am familiar with the Suncor refinery off Brighton Boulevard in Denver. The facility sits between three major highways—I-25, I-70, and I-270. I understand that it produces about a third of the gasoline consumed in Colorado.[1]

[1] Moe Clark, Suncor oil refinery agrees to $9 million settlement with Colorado for air quality violations in Commerce City (March 6, 2020), https://coloradosun.com/2020/03/06/suncore-commerce-city-colorado-settlement-air-quality/.

According to Google Maps, I-270 runs within 2,000 feet from the refinery. I-25 and I-70 run within two miles from the refinery.

6. The Suncor refinery is notorious for permit exceedances, evidenced by periodic local news reports of air and water pollution events caused by malfunctions at the complex.[2]

7. I live approximately six miles from the refinery and pass it frequently when I drive with my daughter in the car on I-25, I-70, and I-270. I use these highways on at least a weekly basis. I use stretches of I-25 and I-70 that pass the refinery to get from my home to other parts of Denver, and to get to the recreation areas west of the city. I use the stretch of I-270 that directly passes the refinery to get to Boulder and recreation areas northwest of Denver. When we near the refinery from I-270 the fumes pervade our car.

8. I am aware that the Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) have recently issued a rule that dramatically weakens the federal greenhouse gas and fuel economy standards for passenger vehicles. I understand that this rule will increase fuel consumption—and demand for gasoline—compared to the prior standards.

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[2] *See, e.g., id.* (reporting that the refinery "emitted volatile organic compounds in excess of its permit, including sulfur dioxide, hydrogen sulfide, hydrogen cyanide, nitrogen oxides, carbon monoxide, and particulate matter.").

9. In the course of my daily life I will continue to drive in close proximity to the Suncor refinery with my daughter in tow. I am deeply concerned that this rule will result in an increase in emissions of dangerous pollution from the refinery—directly impacting my health and the health of my daughter—both because we will have to continue driving in close proximity to the refinery, and because the refinery will contribute more ozone-forming pollution to the already unhealthy ozone levels in Denver county.

I declare under penalty of perjury that the foregoing is true and correct.

MD MA

Dylan Brock

Executed on May 29, 2020

Declaration of Ann K. Brown

for the Center for Biological Diversity

I, Ann K. Brown, declare as follows:

1. I have personal knowledge of the matters asserted in this declaration, and if called upon to testify would state the same.

2. I have been a member of the Center for Biological Diversity ("the Center") since 2017. I currently live in Portland, Oregon.

3. I earned a J.D. from Suffolk University Law School. I currently serve as the Open Government Coordinator for the Center for Biological Diversity. In my position, I submit and facilitate open records requests under the Freedom of Information Act ("FOIA") and similar statutes to government agencies on behalf of the Center's staff.

4. On March 30, 2020, Environmental Protection Agency ("EPA") Administrator Andrew R. Wheeler and National Highway Traffic Safety Administration ("NHTSA") Acting Administrator James C. Owens signed the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks (NHTSA-2018-0067, EPA-HQ-OAR-208-0283; FRL 10000-45-OAR) ("SAFE Rule").

5. On April 15, 2020, I submitted two FOIA requests on behalf of the Center: one to the U.S. Fish and Wildlife Service ("FWS"), and one to National Oceanic and Atmospheric Administration's ("NOAA") National Marine Fisheries Service ("NMFS"). True and correct copies of these requests are attached as Exhibit A.

6. Both of the letters contained the same request:

> From the date of publication in the federal register of the Notice of Proposed Rulemaking for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks ("SAFE Rule")[1] to the date FWS conducts this search: the biological assessment(s), request(s) for information, or correspondence with the Environmental Protection Agency ("EPA") or the National Highway Traffic Safety Administration ("NHTSA"), pursuant to the Endangered Species Act, 16 U.S.C. §§ 1531-1544 ("ESA") Section 7(c) in connection with the SAFE Rule.

7. On April 22, 2020, Samuel D. Rauch III, Deputy Assistant Administrator for Regulatory Programs at NOAA responded to the Center's April 15, 2020 FOIA request, stating the following: "After searching our files we were unable to locate any records that are responsive to your request." A true and correct copy of the April 22, 2020, response from NOAA is attached as Exhibit B.

8. On April 24, 2020, Cathy Willis, FWS FOIA Officer responded to the Center's April 15, 2020, FOIA request, stating the following: "After a thorough search of our files, it has been determined that the FWS has no records responsive

[1] 83 Fed Reg 42986 (Aug. 24, 2018).

to your request." A true and correct copy of the April 24, 2020, response from FWS is attached as Exhibit C.

9. EPA and NHTSA published the SAFE Rule in the Federal Register on April 30, 2020, 85 Fed. Reg. 24,174.

I declare under penalty of perjury that the foregoing is true and correct.

Signed on January 7, 2021 at Portland, Oregon.

Ann K. Brown

EXHIBIT A

CENTER for BIOLOGICAL DIVERSITY Because life is good.

April 15, 2020

VIA FOIAONLINE.REGULATIONS.GOV
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

Re: Freedom of Information Act Request: Safe Rule & ESA Compliance

Dear FOIA Officer:

This is a request under the Freedom of Information Act, 5 U.S.C. § 552, *as amended* ("FOIA"), from the Center for Biological Diversity ("Center"), a non-profit organization that works to secure a future for all species hovering on the brink of extinction through science, law, and creative media, and to fulfill the continuing educational goals of its membership and the general public in the process.

REQUESTED RECORDS

The Center requests from the National Oceanic and Atmospheric Administration ("NOAA") National Marine Fisheries Service ("NMFS"):

> From the date of publication in the federal register of the Notice of Proposed Rulemaking for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks ("SAFE Rule")[1] to the date NMFS conducts this search: the biological assessment(s), request(s) for information, or correspondence with the U.S. Environmental Protection Agency ("EPA") or the National Highway Traffic Safety Administration ("NHTSA"), pursuant to the Endangered Species Act, 16 U.S.C. §§ 1531-1544 ("ESA") Section 7(c) in connection with the SAFE Rule.

For this request, the term "records" refers to, but is not limited to, documents, correspondence (including, but not limited to, inter and/or intra-agency correspondence as well as correspondence with entities or individuals outside the federal government), emails, letters, notes, recordings, telephone records, voicemails, telephone notes, telephone logs, text messages, chat messages, minutes, memoranda, comments, files, presentations, consultations, biological opinions, assessments, evaluations, schedules, papers published and/or unpublished, reports, studies, photographs and other images, data (including raw data, GPS or GIS data, UTM, LiDAR, etc.), maps, and/or all other responsive records, in draft or final form.

This request is not meant to exclude any other records that, although not specially requested, are reasonably related to the subject matter of this request. If you or your office have destroyed or

[1] 83 Fed. Reg. 42986 (Aug. 24, 2018).

determine to withhold any records that could be reasonably construed to be responsive to this request, I ask that you indicate this fact and the reasons therefore in your response.

Under the FOIA Improvement Act of 2016, agencies are prohibited from denying requests for information under FOIA unless the agency reasonably believes release of the information will harm an interest that is protected by the exemption. FOIA Improvement Act of 2016 (Public Law No. 114-185), codified at 5 U.S.C. § 552(a)(8)(A).

Should you decide to invoke a FOIA exemption, please include sufficient information for us to assess the basis for the exemption, including any interest(s) that would be harmed by release. Please include a detailed ledger which includes:

1. Basic factual material about each withheld record, including the originator, date, length, general subject matter, and location of each item; and

2. Complete explanations and justifications for the withholding, including the specific exemption(s) under which the record (or portion thereof) was withheld and a full explanation of how each exemption applies to the withheld material. Such statements will be helpful in deciding whether to appeal an adverse determination. Your written justification may help to avoid litigation.

If you determine that portions of the records requested are exempt from disclosure, we request that you segregate the exempt portions and mail the non-exempt portions of such records to my attention at the address below within the statutory time limit. 5 U.S.C. § 552(b).

The Center is willing to receive records on a rolling basis.

FOIA's "frequently requested record" provision was enacted as part of the 1996 Electronic Freedom of Information Act Amendments, and requires all federal agencies to give "reading room" treatment to any FOIA-processed records that, "because of the nature of their subject matter, the agency determines have become the subject of subsequent requests for substantially the same records." *Id*. § 552(a)(2)(D)(ii)(I). Also, enacted as part of the 2016 FOIA Improvement Act, FOIA's Rule of 3 requires all federal agencies to proactively "make available for public inspection in an electronic format" "copies of records, regardless of form or format … that have been released to any person … and … that have been requested 3 or more times." *Id*. § 552(a)(2)(D)(ii)(II). Therefore, we respectfully request that you make available online any records that the agency determines will become the subject of subsequent requests for substantially the same records, and records that have been requested three or more times.

Finally, agencies must preserve all the records requested herein while this FOIA is pending or under appeal. The agency shall not destroy any records while they are the subject of a pending request, appeal, or lawsuit under the FOIA. 40 C.F.R. § 2.106; *see Chambers v. U.S. Dept. of Interior*, 568 F.3d 998, 1004 (D.C. Cir. 2009) ("[A]n agency is not shielded from liability if it intentionally transfers or destroys a document after it has been requested under FOIA or the Privacy Act"). If any of the requested records are destroyed, the agency and responsible officials are subject to attorney fee awards and sanctions, including fines and disciplinary action. A court held an agency in contempt for "contumacious conduct" and ordered the agency to pay plaintiff's costs and fees for destroying "potentially responsive material contained on hard drives and email backup tapes." *Landmark Legal Found. v. NMFS*, 272 F. Supp.2d 59, 62 (D.D.C. 2003); *see also Judicial Watch, Inc. v. Dept. of Commerce*, 384 F. Supp. 2d 163, 169 (D.D.C. 2005) (awarding attorneys' fees and costs because, among other factors, agency's "initial search was unlawful and egregiously mishandled and …likely responsive documents were destroyed and removed"), *aff'd in relevant part*, 470 F.3d 363, 375 (D.C. Cir. 2006) (remanding in part to recalculate attorney fees assessed). In another case, in addition to imposing a $10,000 fine and awarding attorneys' fees and costs, the court found that an Assistant United States Attorney prematurely "destroyed records responsive to [the] FOIA request while [the FOIA] litigation was pending" and referred him to the Department of Justice's Office of Professional Responsibility. *Jefferson v. Reno*, 123 F. Supp. 2d 1, 6 (D.D.C. 2000).

FORMAT OF REQUESTED RECORDS

Under FOIA, you are obligated to provide records in a readily accessible electronic format and in the format requested. 5 U.S.C. § 552(a)(3)(B) ("In making any record available to a person under this paragraph, an agency shall provide the record in any form or format requested by the person if the record is readily reproducible by the agency in that form or format."). "Readily accessible" means text-searchable and OCR-formatted. *See id*. Pursuant to this requirement, we hereby request that you produce all records in an electronic format and in their native file formats. Additionally, please provide the records in a load-ready format with a CSV file index or Excel spreadsheet. If you produce files in .PDF format, then please omit any "portfolios" or "embedded files." Portfolios and embedded files within files are not readily accessible. **Please do not provide the records in a single, or "batched," .PDF file**. We appreciate the inclusion of an index.

If you should seek to withhold or redact any responsive records, we request that you: (1) identify each such record with specificity (including date, author, recipient, and parties copied); (2) explain in full the basis for withholding responsive material; and (3) provide all segregable portions of the records for which you claim a specific exemption. *Id*. § 552(b). Please correlate any redactions with specific exemptions under FOIA.

RECORD DELIVERY

We appreciate your help in expeditiously obtaining a determination on the requested records. As mandated in FOIA, we anticipate a reply within 20 working days. *Id*. § 552(a)(6)(A)(i); 21 C.F.R. § 20.41(b). Failure to comply within the statutory timeframe may result in the Center taking additional steps to ensure timely receipt of the requested materials. Please provide a complete reply as expeditiously as possible. We prefer email, but you may mail copies of records to:

Ann K. Brown
Center for Biological Diversity
P.O. Box 11374
Portland, OR 97211

foia@biologicaldiversity.org

If you find that this request is unclear, or if the responsive records are voluminous, please email me to discuss the scope of this request.

REQUEST FOR FEE WAIVER

FOIA was designed to provide citizens a broad right to access government records. FOIA's basic purpose is to "open agency action to the light of public scrutiny," with a focus on the public's "right to be informed about what their government is up to." *NARA v. Favish*, 541 U.S. 157, 171 (2004) quoting *U.S. Dep't of Justice v. Reporters Comm. for Freedom of Press*, 489 U.S. 749, 773-74 (1989) (internal quotation and citations omitted). In order to provide public access to this information, FOIA's fee waiver provision requires that "[d]ocuments shall be furnished without any charge or at a [reduced] charge," if the request satisfies the standard. 5 U.S.C. § 552(a)(4)(A)(iii). FOIA's fee waiver requirement is "liberally construed." *Judicial Watch, Inc. v. Rossotti*, 326 F.3d 1309, 1310 (D.C. Cir. 2003); *Forest Guardians v. U.S. Dept. of Interior*, 416 F.3d 1173, 1178 (10th Cir. 2005).

The 1986 fee waiver amendments were designed specifically to provide non-profit organizations such as the Center access to government records without the payment of fees. Indeed, FOIA's fee waiver provision was intended "to prevent government agencies from using high fees to discourage certain types of requesters and requests," which are "consistently associated with requests from journalists, scholars, and *non-profit public interest groups*." *Ettlinger v. FBI*, 596 F. Supp. 867, 872 (D. Mass. 1984) (emphasis added). As one Senator stated, "[a]gencies should not be allowed to use fees as an offensive weapon against requesters seeking access to Government information ... ." 132 Cong. Rec. S. 14298 (statement of Senator Leahy).

I. The Center Qualifies for a Fee Waiver.

Under FOIA, a party is entitled to a fee waiver when "disclosure of the information is in the public interest because it is likely to contribute significantly to public understanding of the operations or activities of the [Federal] government and is not primarily in the commercial interest of the requester." 5 U.S.C. § 552(a)(4)(A)(iii). The U.S. Department of Commerce FOIA regulations that govern NMFS at 15 C.F.R. § 4.11(l) establish the same standard.

Thus, NMFS must consider four factors to determine whether a request is in the public interest: (1) whether the subject of the requested records concerns "the operations or activities of the Federal government," (2) whether the disclosure is "likely to contribute" to an understanding of government operations or activities, (3) whether the disclosure "will contribute to public understanding" of a reasonably broad audience of persons interested in the subject, and (4) whether the disclosure is likely to contribute "significantly" to public understanding of government operations or activities. *Id.* § 4.11(l)(2)(i) – (iv). As shown below, the Center meets each of these factors.

A. The Subject of This Request Concerns "The Operations and Activities of the Government."

The subject matter of this request concerns the operations and activities of the NMFS. This request asks for from the date of publication in the federal register of the Notice of Proposed Rulemaking for the SAFE Rule[2] to the date NMFS conducts this search: the biological assessment(s), request(s) for information, or correspondence with EPA or NHTSA, pursuant to the ESA Section 7(c) in connection with the SAFE Rule.

This FOIA will provide the Center and the public with crucial insight into the proposal to rollback fuel economy standards. It is clear that a federal agency's decision to modify or withdraw United States' fuel economy standards is a specific and identifiable activity of the government, in this case it is the executive branch agency of NMFS. *Judicial Watch,* 326 F.3d at 1313 ("[R]easonable specificity is all that FOIA requires with regard to this factor") (internal quotations omitted). Thus, the Center meets this factor.

B. Disclosure is "Likely to Contribute" to an Understanding of Government Operations or Activities.

The requested records are meaningfully informative about government operations or activities and will contribute to an increased understanding of those operations and activities by the public.

Disclosure of the requested records will allow the Center to convey to the public information about the extent to which the Trump administration considered the needs of climate-threatened endangered wildlife and plants when it developed its proposal to rollback fuel economy standards. Once the information is made available, the Center will analyze it and present it to its over 1.7 million members and online activists and the general public in a manner that will meaningfully enhance the public's understanding of this topic.

Thus, the requested records are likely to contribute to an understanding of NMFS's operations and activities.

A. Disclosure of the Requested Records Will Contribute to a Reasonably Broad Audience of Interested Persons' Understanding of the Café Standards and ESA Compliance.

The requested records will contribute to public understanding of whether NMFS's actions are consistent with the ESA. As explained above, the records will contribute to public understanding of this topic.

Activities of NMFS generally and specifically how its actions impact wildlife and plants, are areas of interest to a reasonably broad segment of the public. The Center will use the information it obtains from the disclosed records to educate the public at large about this subject matter. *See W. Watersheds Proj. v. Brown*, 318 F.Supp.2d 1036, 1040 (D. Idaho 2004) ("... find[ing] that WWP adequately specified the public interest to be served, that is, educating the

[2] *Id.*

public about the ecological conditions of the land managed by the BLM and also how … management strategies employed by the BLM may adversely affect the environment.").

Through the Center's synthesis and dissemination (by means discussed in Section II, below), disclosure of information contained in and gleaned from the requested records will contribute to a broad audience of persons who are interested in the subject matter. *Ettlinger v. FBI*, 596 F. Supp. at 876 (benefit to a population group of some size distinct from the requester alone is sufficient); *Carney v. Dept. of Justice*, 19 F.3d 807, 815 (2d Cir. 1994), *cert. denied*, 513 U.S. 823 (1994) (applying "public" to require a sufficient "breadth of benefit" beyond the requester's own interests); *Cmty. Legal Servs. v. Dep't of Hous. & Urban Dev.*, 405 F. Supp.2d 553, 557 (E.D. Pa. 2005) (in granting fee waiver to community legal group, court noted that while the requester's "work by its nature is unlikely to reach a very general audience," "there is a segment of the public that is interested in its work").

Indeed, the public does not currently have an ability to easily evaluate the requested records, which are not currently in the public domain. *See Cmty. Legal Servs.*, 405 F. Supp.2d at 560 (because requested records "clarify important facts" about agency policy, "the CLS request would likely shed light on information that is new to the interested public."). As the Ninth Circuit observed in *McClellan Ecological Seepage Situation v. Carlucci*, 835 F.2d 1282, 1286 (9th Cir. 1987), "[FOIA] legislative history suggests that information [has more potential to contribute to public understanding] to the degree that the information is new and supports public oversight of agency operations… ."[3]

Disclosure of these records is not only "likely to contribute," but is certain to contribute, to public understanding of the Trump administration's proposal to rollback fuel economy standards. The public is always well served when it knows how the government conducts its activities, particularly matters touching on legal questions. Hence, there can be no dispute that disclosure of the requested records to the public will educate the public about this topic.

C. <u>Disclosure is Likely to Contribute Significantly to Public Understanding of Government Operations or Activities.</u>

The Center is not requesting these records merely for their intrinsic informational value. Disclosure of the requested records will significantly enhance the public's understanding of the impacts NMFS's actions may have on climate-threatened endangered wildlife and plants, as compared to the level of public understanding that exists prior to the disclosure. Indeed, public understanding will be *significantly* increased as a result of disclosure because the requested records will help reveal more about the imperiled wildlife that will be affected by the rollback of fuel economy standards.

The records are also certain to shed light on NMFS's compliance with the ESA. Such public oversight of agency action is vital to our democratic system and clearly envisioned by the drafters of the FOIA. Thus, the Center meets this factor as well.

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[3] In this connection, it is immaterial whether any portion of the Center's request may currently be in the public domain because the Center requests considerably more than any piece of information that may currently be available to other individuals. *See Judicial Watch*, 326 F.3d at 1315.

D. Obtaining the Requested Records is of No Commercial Interest to the Center.

Access to government records, disclosure forms, and similar materials through FOIA requests is essential to the Center's role of educating the general public. Founded in 1994, the Center is a 501(c)(3) nonprofit conservation organization (EIN: 27-3943866) with more than over 1.7 million members and online activists dedicated to the protection of endangered and threatened species and wild places. The Center has no commercial interest and will realize no commercial benefit from the release of the requested records.

II. The Center's Primary Interest in Disclosure is the Public Interest.

As stated above, the Center has no commercial interest that would be furthered by disclosure. Although even if it did have an interest, the public interest would far outweigh any pecuniary interest.

The Center is a non-profit organization that informs, educates, and counsels the public regarding environmental issues, policies, and laws relating to environmental issues. The Center has been substantially involved in the activities of numerous government agencies for over 30 years, and has consistently displayed its ability to disseminate information granted to it through FOIA.

In consistently granting the Center's fee waivers, agencies have recognized: (1) that the information requested by the Center contributes significantly to the public's understanding of the government's operations or activities; (2) that the information enhances the public's understanding to a greater degree than currently exists; (3) that the Center possesses the expertise to explain the requested information to the public; (4) that the Center possesses the ability to disseminate the requested information to the general public; (5) and that the news media recognizes the Center as an established expert in the field of imperiled species, biodiversity, and impacts on protected species. The Center's track record of active participation in oversight of governmental activities and decision making, and its consistent contribution to the public's understanding of those activities as compared to the level of public understanding prior to disclosure are well established.

The Center intends to use the records requested here similarly. The Center's work appears in over 5,000 news stories online and in print, radio and TV per month, including regular reporting in such important outlets as *The New York Times*, *Washington Post*, *The Guardian*, and *Los Angeles Times*. Many media outlets have reported on the plight of endangered species under this administration utilizing information obtained by the Center from federal agencies. In 2019, more than 2.9 million people visited the Center's extensive website, and viewed pages a total of 5.3 million times. The Center sends out more than 297 email newsletters and action alerts per year to more than over 1.7 million members and supporters. Three times a year, the Center sends printed newsletters to more than 74,500 members. More than 561,000 people follow the Center on Facebook, and there are regular postings regarding the protection of endangered and threatened species The Center also regularly tweets to more than 85,000 followers on Twitter. The Center intends to use any or all of these far-reaching media outlets to share with the public information obtained as a result of this request.

Public oversight and enhanced understanding of the NMFS's duties is absolutely necessary. In determining whether disclosure of requested information will contribute significantly to public understanding, a guiding test is whether the requester will disseminate the information to a reasonably broad audience of persons interested in the subject. *Carney*, 19 F.3d 807. The Center need not show how it intends to distribute the information, because "[n]othing in FOIA, the [agency] regulation, or our case law require[s] such pointless specificity." *Judicial Watch*, 326 F.3d at 1314. It is sufficient for the Center to show how it distributes information to the public generally. *Id.*

III. Conclusion

For all of the foregoing reasons, the Center qualifies for a full fee waiver. We hope that NMFS will immediately grant this fee waiver request and begin to search and disclose the requested records without any unnecessary delays.

If you have any questions, please contact me at foia@biologicaldiversity.org. All records and any related correspondence should be sent to my attention at the address below.

Sincerely,

Ann K. Brown
Open Government Coordinator
CENTER FOR BIOLOGICAL DIVERSITY
P.O. Box 11374
Portland, OR 97211-0374
foia@biologicaldiversity.org

CENTER for BIOLOGICAL DIVERSITY Because life is good.

April 15, 2020

VIA ONLINE PORTAL
U.S. Fish and Wildlife Service
https://www.foia.gov/

Re: Freedom of Information Act Request: Safe Rule & ESA Compliance

Dear FOIA Officer:

This is a request under the Freedom of Information Act, 5 U.S.C. § 552, *as amended* ("FOIA"), from the Center for Biological Diversity ("Center"), a non-profit organization that works to secure a future for all species hovering on the brink of extinction through science, law, and creative media, and to fulfill the continuing educational goals of its membership and the general public in the process.

REQUESTED RECORDS

The Center requests from the U.S. Fish and Wildlife Service ("FWS"):

> From the date of publication in the federal register of the Notice of Proposed Rulemaking for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks ("SAFE Rule")[1] to the date FWS conducts this search: the biological assessment(s), request(s) for information, or correspondence with the Environmental Protection Agency ("EPA") or the National Highway Traffic Safety Administration ("NHTSA"), pursuant to the Endangered Species Act, 16 U.S.C. §§ 1531-1544 ("ESA") Section 7(c) in connection with the SAFE Rule.

For this request, the term "records" refers to, but is not limited to, documents, correspondence (including, but not limited to, inter and/or intra-agency correspondence as well as correspondence with entities or individuals outside the federal government), emails, letters, notes, recordings, telephone records, voicemails, telephone notes, telephone logs, text messages, chat messages, minutes, memoranda, comments, files, presentations, consultations, biological opinions, assessments, evaluations, schedules, papers published and/or unpublished, reports, studies, photographs and other images, data (including raw data, GPS or GIS data, UTM, LiDAR, etc.), maps, and/or all other responsive records, in draft or final form.

This request is not meant to exclude any other records that, although not specially requested, are reasonably related to the subject matter of this request. If you or your office have destroyed or

[1] 83 Fed. Reg. 42986 (Aug. 24, 2018).

determine to withhold any records that could be reasonably construed to be responsive to this request, I ask that you indicate this fact and the reasons therefore in your response.

Under the FOIA Improvement Act of 2016, agencies are prohibited from denying requests for information under FOIA unless the agency reasonably believes release of the information will harm an interest that is protected by the exemption. FOIA Improvement Act of 2016 (Public Law No. 114-185), codified at 5 U.S.C. § 552(a)(8)(A).

Should you decide to invoke a FOIA exemption, please include sufficient information for us to assess the basis for the exemption, including any interest(s) that would be harmed by release. Please include a detailed ledger which includes:

1. Basic factual material about each withheld record, including the originator, date, length, general subject matter, and location of each item; and

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If you determine that portions of the records requested are exempt from disclosure, we request that you segregate the exempt portions and mail the non-exempt portions of such records to my attention at the address below within the statutory time limit. 5 U.S.C. § 552(b).

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Finally, agencies must preserve all the records requested herein while this FOIA is pending or under appeal. The agency shall not destroy any records while they are the subject of a pending request, appeal, or lawsuit under the FOIA. 40 C.F.R. § 2.106; *see Chambers v. U.S. Dept. of Interior*, 568 F.3d 998, 1004 (D.C. Cir. 2009) ("[A]n agency is not shielded from liability if it intentionally transfers or destroys a document after it has been requested under FOIA or the Privacy Act"). If any of the requested records are destroyed, the agency and responsible officials are subject to attorney fee awards and sanctions, including fines and disciplinary action. A court held an agency in contempt for "contumacious conduct" and ordered the agency to pay plaintiff's costs and fees for destroying "potentially responsive material contained on hard drives and email backup tapes." *Landmark Legal Found. v. FWS*, 272 F. Supp.2d 59, 62 (D.D.C. 2003); *see also Judicial Watch, Inc. v. Dept. of Commerce*, 384 F. Supp. 2d 163, 169 (D.D.C. 2005) (awarding attorneys' fees and costs because, among other factors, agency's "initial search was unlawful and egregiously mishandled and …likely responsive documents were destroyed and removed"), *aff'd in relevant part*, 470 F.3d 363, 375 (D.C. Cir. 2006) (remanding in part to recalculate attorney fees assessed). In another case, in addition to imposing a $10,000 fine and awarding attorneys' fees and costs, the court found that an Assistant United States Attorney prematurely "destroyed records responsive to [the] FOIA request while [the FOIA] litigation was pending" and referred him to the Department of Justice's Office of Professional Responsibility. *Jefferson v. Reno*, 123 F. Supp. 2d 1, 6 (D.D.C. 2000).

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RECORD DELIVERY

We appreciate your help in expeditiously obtaining a determination on the requested records. As mandated in FOIA, we anticipate a reply within 20 working days. *Id*. § 552(a)(6)(A)(i); 21 C.F.R. § 20.41(b). Failure to comply within the statutory timeframe may result in the Center taking additional steps to ensure timely receipt of the requested materials. Please provide a complete reply as expeditiously as possible. We prefer email, but you may mail copies of records to:

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REQUEST FOR FEE WAIVER

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I. The Center Qualifies for a Fee Waiver.

Under FOIA, a party is entitled to a fee waiver when "disclosure of the information is in the public interest because it is likely to contribute significantly to public understanding of the operations or activities of the [Federal] government and is not primarily in the commercial interest of the requester." 5 U.S.C. § 552(a)(4)(A)(iii). The U.S Department of Interior's ("Interior") FOIA regulations that govern FWS at 43 C.F.R. § 2.45(a) – (b) establish the same standard.

Thus, when determining whether a request is in the public interest, FWS must consider: (1) how the subject of the requested records concerns "the operations or activities of the Federal government;" and (2) how disclosure is "likely to contribute" significantly to an understanding of those government operations or activities, including (i) how the contents of the records are meaningfully informative; (ii) what the logical connection is between the content of the records and the operations or activities of the federal government; (iii) how disclosure will contribute to an understanding of a reasonably broad audience of persons interested in the subject; (iv) the Center's expertise in the subject area, as well as its identity, vocation, qualifications, and plan to disclose the information in a manner that will be informative to the understanding of a reasonably broad audience of persons interested in the subject; (v) the requester's ability and intent to disseminate the information to a reasonably broad audience of persons interested in the subject; (vi) whether the records would confirm or clarify data that has been previously released; and (vii) how the public's understanding of the subject in question will be enhanced to a significant extent by the disclosure. *Id.* § 2.48(a)(1) – (2).

A. <u>The Subject of This Request Concerns "The Operations and Activities of the Government."</u>

The subject matter of this request concerns the operations and activities of FWS, a government agency. This FOIA will provide the Center and the public with crucial insight into the proposal to rollback fuel economy standards.

The requested records are likely to contribute to an understanding of government operations and activities, and therefore the Center meets this factor.

B. <u>Disclosure is "Likely to Contribute" to an Understanding of Government Operations or Activities.</u>

The requested records are meaningfully informative about government operations or activities, and will contribute to an increased understanding of those operations and activities by the public. As described further below, the requested records meet the requirements to be considered in the public interest.

(i) <u>The Contents of the Records Are Meaningfully Informative.</u>

The records requested through this FOIA request are meaningfully informative. Disclosure of the requested records will allow the Center to convey to the public information about the extent to which the Trump administration considered the needs of climate-threatened endangered wildlife and plants when it developed its proposal to rollback fuel economy standards.

Thus, the Center meets this factor.

(ii) <u>There Is a Logical Connection Between the Content of the Records and the Operations or Activities of the Federal Government.</u>

There is a logical connection between the responsive records' content and the operations or activities of the federal government.

It is clear that a federal agency's decision to modify or withdraw United States' fuel economy standards is a specific and identifiable activity of the government, in this case it is the executive branch agency of FWS. *Judicial Watch*, 326 F.3d at 1313 ("[R]easonable specificity is all that FOIA requires with regard to this factor") (internal quotations omitted). Thus, the Center meets this factor. The requested records will also contribute to public understanding of whether FWS's actions are consistent with the ESA. The requested records will contribute to public understanding of this topic.

Thus, the Center meets this factor.

(iii) Disclosure Will Contribute to the Understanding of a Reasonably Broad Audience of Persons Interested in the Subject.

Activities of FWS generally and specifically how its actions impact wildlife and plants, are areas of interest to a reasonably broad segment of the public. The Center will use the information it obtains from the disclosed records to educate the public at large about this subject matter. *See W. Watersheds Proj. v. Brown*, 318 F.Supp.2d 1036, 1040 (D. Idaho 2004) ("... find[ing] that WWP adequately specified the public interest to be served, that is, educating the public about the ecological conditions of the land managed by the BLM and also how … management strategies employed by the BLM may adversely affect the environment.").

Through the Center's synthesis and dissemination (by means discussed in Section II, below), disclosure of information contained in and gleaned from the requested records will contribute to a broad audience of persons who are interested in the subject matter. *Ettlinger*, 596 F. Supp. at 876 (benefit to a population group of some size distinct from the requester alone is sufficient); *Carney v. Dep't of Justice*, 19 F.3d 807, 815 (2d Cir. 1994), *cert. denied*, 513 U.S. 823 (1994) (applying "public" to require a sufficient "breadth of benefit" beyond the requester's own interests); *Cmty. Legal Servs. v. Dept. of Hous. & Urban Dev.*, 405 F. Supp. 2d 553, 557 (E.D. Pa. 2005) (in granting fee waiver to community legal group, court noted that while the requester's "work by its nature is unlikely to reach a very general audience," "there is a segment of the public that is interested in its work").

Disclosure of these records is not only "likely to contribute," but is certain to contribute, to public understanding of the Trump administration's proposal to rollback fuel economy standards. The public is always well served when it knows how the government conducts its activities, particularly matters touching on legal questions. Hence, there can be no dispute that disclosure of the requested records to the public will educate the public about this topic.

(iv) The Center Has Expertise in this Subject Area, and Has Plan to Disclose the Information in a Manner that Will Be Informative to the Understanding of a Reasonably Broad Audience of Persons Interested in the Subject.

The Center is a non-profit organization that informs, educates, and counsels the public regarding environmental issues, policies, and laws relating to environmental issues. The Center has been substantially involved in the activities of numerous government agencies for over 30 years, and has consistently displayed its ability to disseminate information granted to it through FOIA.

In consistently granting the Center's fee waivers, agencies have recognized: (1) that the information requested by the Center contributes significantly to the public's understanding of the government's operations or activities; (2) that the information enhances the public's understanding to a greater degree than currently exists; (3) that the Center possesses the expertise to explain the requested information to the public; (4) that the Center possesses the ability to disseminate the requested information to the general public; (5) and that the news media recognizes the Center as an established expert in the field of imperiled species, biodiversity, and impacts on protected species. The Center's track record of active participation in oversight of governmental activities and decision making, and its consistent contribution to the public's understanding of those activities as compared to the level of public understanding prior to disclosure are well established.

Once the information is made available, the Center will analyze it and present it to its 1.7 million members and online activists and the general public in a manner that will meaningfully enhance the public's understanding of this topic.

(v) The Center Has the Ability and Intent to Disseminate the Information to a Reasonably Broad Audience of Persons Interested in the Subject.

The Center has a proven track records of successfully disseminating information to a reasonably broad audience of people interested in this subject matter.

The Center intends to use the records requested here similarly. The Center's work appears in over 5,000 news stories online and in print, radio and TV per month, including regular reporting in such important outlets as *The New York Times*, *Washington Post*, *The Guardian*, and *Los Angeles Times*. Many media outlets have reported on the plight of endangered species under this administration utilizing information obtained by the Center from federal agencies. In 2019, more than 2.9 million people visited the Center's extensive website, and viewed pages a total of 5.3 million times. The Center sends out more than 297 email newsletters and action alerts per year to more than over 1.7 million members and supporters. Three times a year, the Center sends printed newsletters to more than 74,500 members. More than 561,000 people follow the Center on Facebook, and there are regular postings regarding the protection of endangered and threatened species The Center also regularly tweets to more than 85,000 followers on Twitter. The Center intends to use any or all of these far-reaching media outlets to share with the public information obtained as a result of this request.

Furthermore, public oversight and enhanced understanding of FWS's duties is absolutely necessary. In determining whether disclosure of requested information will contribute significantly to public understanding, a guiding test is whether the requester will disseminate the information to a reasonably-broad audience of persons interested in the subject. *Carney*, 19 F.3d 807. The Center need not show how it intends to distribute the information, because "[n]othing in FOIA, the [agency] regulation, or our case law require[s] such pointless specificity." *Judicial Watch*, 326 F.3d at 1314. It is sufficient for the Center to show how it distributes information to the public generally. *Id.*

The Center intends to its these far-reaching media outlets to share with the public information obtained as a result of this FOIA request.

(vi) The Records Were Not Previously Released, So They Would Neither Confirm or Clarify Data That Had Been Previously Released.

The government has not previously released the requested records, as the Center has specifically requested record that have not been released previously.

Indeed, the public does not currently have the ability to easily evaluate the requested records, which are not currently in the public domain.[2] *See Cmty. Legal Servs.*, 405 F. Supp. 2d at 560 (because requested records "clarify important facts" about agency policy, "the CLS request would likely shed light on information that is new to the interested public."). As the Ninth Circuit observed in *McClellan Ecological Seepage Situation v. Carlucci*, 835 F.2d 1282, 1286 (9th Cir. 1987), "[FOIA] legislative history suggests that information [has more potential to contribute to public understanding] to the degree that the information is new and supports public oversight of agency operations… ."

Thus, the requested records will neither confirm nor clarify data that was previously released.

(vii) The Public's Understanding of the Subject in Question Will Be Enhanced to a Significant Extent by the Disclosure.

The Center is not requesting these records merely for their intrinsic informational value. Disclosure of the requested records will significantly enhance the public's understanding of the impacts FWS's actions may have on climate-threatened endangered wildlife and plants, as compared to the level of public understanding that exists prior to the disclosure. Indeed, public understanding will be *significantly* increased as a result of disclosure because the requested records will help reveal more about the imperiled wildlife that will be affected by the rollback of fuel economy standards.

The records are also certain to shed light on FWS's compliance with the ESA. Such public oversight of agency action is vital to our democratic system and clearly envisioned by the drafters of the FOIA. Thus, the Center meets this factor as well.

C. Obtaining the Requested Records is of No Commercial Interest to the Center.

In deciding whether the fee waiver request meets the requirements in § 2.45(a)(2)(b), Interior must consider that the Center has no commercial interest that would be furthered by the requested disclosure.
Access to government records, disclosure forms, and similar materials through FOIA requests is essential to the Center's role of educating the general public. Founded in 1994, the Center is a 501(c)(3) nonprofit conservation organization (EIN: 27-3943866) with more than 1.7 million members and online activists dedicated to the protection of endangered and threatened species and wild places. Even if the Center did have a primary interest furthered by the request, the public interest in disclosure of the records would far outweigh any commercial interest recognized by the Center.

Thus, the Center has no commercial interest and will realize no commercial benefit from the release of the requested records.

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[2] It is immaterial whether any portion of the Center's request may currently be in the public domain because the Center requests considerably more than any piece of information that may currently be available to other individuals. *See Judicial Watch*, 326 F.3d at 1315.

II. Conclusion

For all of the foregoing reasons, the Center qualifies for a full fee waiver. We hope that FWS will immediately grant this fee waiver request and begin to search and disclose the requested records without any unnecessary delays.

If you have any questions, please contact me at foia@biologicaldiversity.org. All records and any related correspondence should be sent to my attention at the address below.

Sincerely,

Ann K. Brown
Open Government Coordinator
CENTER FOR BIOLOGICAL DIVERSITY
P.O. Box 11374
Portland, OR 97211-0374
foia@biologicaldiversity.org

EXHIBIT B

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

April 22, 2020

Via FOIAOnline

Re: FOIA Request DOC-NOAA-2020-001088

Ann Brown
Center for Biological Diversity
foia@biologicaldiversity.org

Dear Ms. Brown:

This letter is in response to your Freedom of Information Act (FOIA) request which was received by our office on April 20, 2020, in which you requested:

> "From the date of publication in the federal register of the Notice of Proposed Rulemaking for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks ("SAFE Rule") to the date NMFS conducts this search (April 20, 2020): the biological assessment(s), request(s) for information, or correspondence with the U.S. Environmental Protection Agency ("EPA") or the National Highway Traffic Safety Administration ("NHTSA"), pursuant to the Endangered Species Act, 16 U.S.C. §§ 1531-1544 ("ESA") Section 7(c) in connection with the SAFE Rule."

After searching our files we were unable to locate any records that are responsive to your request. We regret that we are unable to assist you further in your request.

Although no records were located during our search, you have the right to appeal a "no document found" response. All appeals should include a statement of the reasons why you believe the FOIA response was not satisfactory. An appeal based on documents in this release must be received within 90 calendar days of the date of this response letter at the following address:

> Assistant General Counsel for Employment, Litigation, and Information
> U.S. Department of Commerce
> Office of General Counsel
> Room 5896
> 14th and Constitution Avenue, N.W.
> Washington, D.C. 20230

An appeal may also be sent by e-mail to FOIAAppeals@doc.gov, or by FOIAonline at https://foiaonline.regulations.gov/foia/action/public/home#.

For your appeal to be complete, it must include the following items:

- a copy of the original request,
- our response to your request,
- a statement explaining why the withheld records should be made available, and why the denial of the records was in error.
- "Freedom of Information Act Appeal" must appear on your appeal letter. It should also be written on your envelope, or e-mail subject line.

FOIA appeals posted to the e-mail box, FOIAonline, or Office after normal business hours will be deemed received on the next business day. If the 90th calendar day for submitting an appeal falls on a Saturday, Sunday or legal public holiday, an appeal received by 5:00 p.m., Eastern Time, the next business day will be deemed timely.

FOIA grants requesters the right to challenge an agency's final action in federal court. Before doing so, an adjudication of an administrative appeal is ordinarily required.
The Office of Government Information Services (OGIS), an office created within the National Archives and Records Administration, offers free mediation services to FOIA requesters. They may be contacted in any of the following ways:

Office of Government Information Services
National Archives and Records Administration
Room 2510
8601 Adelphi Road
College Park, MD 20740-6001
Email: ogis@nara.gov

Phone: 301-837-1996
Fax: 301-837-0348
Toll-free: 1-877-684-6448

If you have questions regarding this correspondence, please contact Ms. Ellen Sebastian at ellen.sebastian@noaa.gov or the NOAA FOIA Public Liaison Ed Kearns at (301) 628-5658.

Sincerely,

Samuel Rauch

Samuel D. Rauch III,
Deputy Assistant Administrator
for Regulatory Programs

EXHIBIT C

United States Department of the Interior

FISH AND WILDLIFE SERVICE

5275 Leesburg Pike, MS: IRTM
Falls Church, VA 22041

In Reply Refer To:
FWS-2020-00616

April 24, 2020

Ann K. Brown
Open Government Coordinator
Center for Biological Diversity
P.O. Box 11374
Portland, Oregon 97211-0374
Email: foia@biologicaldiversity.org

Ms. Brown:

The United States Fish and Wildlife Service (FWS) received your Freedom of Information Act (FOIA) request, dated April 15, 2020, and assigned it control number FWS-2020-00616. Please cite this number in any future communications with our office regarding your request. You requested the following:

> *"From the date of publication in the federal register of the Notice of Proposed Rulemaking for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021- 2026 Passenger Cars and Light Trucks ("SAFE Rule")*[1] *to the date FWS conducts this search: the biological assessment(s), request(s) for information, or correspondence with the Environmental Protection Agency ("EPA") or the National Highway Traffic Safety Administration ("NHTSA"), pursuant to the Endangered Species Act, 16 U.S.C. §§ 1531-1544 ("ESA") Section 7(c) in connection with the SAFE Rule."*

RESPONSE

We are writing to both acknowledge and complete our response to your request. Your fee waiver is approved.

After a thorough search of our files, it has been determined that the FWS has no records responsive to your request. The undersigned is responsible for this denial.

MEDIATION SERVICES

The 2007 FOIA amendments created the Office of Government Information Services (OGIS) to offer mediation services to resolve disputes between FOIA requesters and Federal agencies as a non-exclusive alternative to litigation. Using OGIS services does not affect your right to pursue litigation. You may contact OGIS in any of the following ways:

Office of Government Information Services
National Archives and Records Administration
8601 Adelphi Road – OGIS

College Park, MD 20740-6001
E-mail: ogis@nara.gov
Web: https://ogis.archives.gov/ogis
Telephone: 202-741-5770
Fax: 202-741-5769
Toll-free: 1-877-684-6448

Please note that using OGIS services does not affect the timing of filing an appeal with the Department's FOIA & Privacy Act Appeals Officer. Contact information for the Department's FOIA Public Liaison, who you may also seek dispute resolution services from, is available at *https://www.doi.gov/foia/foiacenters.*

APPEAL RIGHTS

You may appeal this response to the Department's FOIA/Privacy Act Appeals Officer. If you choose to appeal, the FOIA/Privacy Act Appeals Officer must receive your FOIA appeal **no later than 90 workdays** from the date of this letter. Appeals arriving or delivered after 5 p.m. Eastern Time, Monday through Friday, will be deemed received on the next workday.

Your appeal must be made in writing. You may submit your appeal and accompanying materials to the FOIA/Privacy Act Appeals Officer by mail, courier service, fax, or email. All communications concerning your appeal should be clearly marked with the words: "FREEDOM OF INFORMATION APPEAL." You must include an explanation of why you believe the Service's response is in error. You must also include with your appeal copies of all correspondence between you and the Service concerning your FOIA request, including your original FOIA request and the Service's response. Failure to include with your appeal all correspondence between you and the Service will result in the Department's rejection of your appeal, unless the FOIA/Privacy Act Appeals Officer determines (in the FOIA/Privacy Act Appeals Officer's sole discretion) that good cause exists to accept the defective appeal.

Please include your name and daytime telephone number (or the name and telephone number of an appropriate contact), email address and fax number (if available) in case the FOIA/Privacy Act Appeals Officer needs additional information or clarification of your appeal.

DOI FOIA/Privacy Act Appeals Office Contact Information

Department of the Interior
Office of the Solicitor
1849 C Street, N.W.

Brown
FWS-2020-00616

MS-6556 MIB
Washington, DC 20240

Attn: FOIA/Privacy Act Appeals Office

Telephone: (202) 208-5339
Fax: (202) 208-6677
Email: FOIA.Appeals@sol.doi.gov

CONCLUSION

For your information, Congress excluded three discrete categories of law enforcement and national security records from the requirements of FOIA. *See* 5 U.S.C. 552(c). This response is limited to those records that are subject to the requirements of FOIA. This is a standard notification that is given to all our requesters and should not be taken as an indication that excluded records do, or do not, exist.

If you have any questions about our response to your request, you may contact Eileen Harke by phone at 703-358-2096 or by email at eileen_harke@fws.gov.

Sincerely,

Cathy Willis

Cathy Willis
FWS FOIA Officer

Declaration of John Cassani

I, John Cassani, state and declare as follows:

1. I am a resident of Alva, Florida. The following facts are personally known to me and if called as a witness I could and would truthfully testify to these facts.

2. I am a member of the Center for Biological Diversity and have been a member since 2010. As a member of the Center for Biological Diversity, I participate in action alerts, read newsletters, follow updates on social media, attend events, collaborate with staff organizing educational events, and share current research findings on topics like biodiversity, climate change and sea-level rise. I rely in part on the Center for Biological Diversity to represent my professional and personal interests in conserving endangered species and their habitats.

3. I have a Bachelor of Science degree in fisheries and wildlife and a Master of Science degree in biology with a concentration in aquatic ecology.

4. Prior to my current occupation, I spent 36 years as resource manager, research supervisor, and finally as deputy director for the Lee County Hyacinth Control District managing water resources in Lee County and the Caloosahatchee River in Florida.

5. I have been employed as the Calusa Waterkeeper since December 2016, when Calusa Waterkeeper, Inc., achieved member status in the Waterkeeper Alliance. Prior to December 2016, I was involved with Calusa Waterkeeper's predecessor, the Caloosahatchee River Citizens Association (Riverwatch), since its founding in 1995, as a director, member, and volunteer.

6. Calusa Waterkeeper is dedicated to the protection of the Caloosahatchee River & Estuary, Lake Okeechobee, Nicodemus Slough, Charlotte Harbor, Estero Bay, the near-shore waters of Lee County, and their watersheds, through education, science, and promotion of responsible use and enjoyment by all people.

7. Calusa Waterkeeper has 410 members. These members have educational, scientific, moral, spiritual, and aesthetic interests in the health of the natural environment and in preventing the extinction of species like the smalltooth sawfish, manatee, and sea turtle.

8. At Calusa Waterkeeper, we strive to: improve the waters of our jurisdiction, including impacts on riparian and estuarine systems, wildlife habitat, and marine life; promote public education concerning the historical significance, present condition, and future of our water bodies and watersheds; increase public awareness of the importance of our waters to our quality of life; become

informed as to the effect of sea-level rise on wildlife and wildlife habitat; study the effect of domestic, commercial, and agricultural uses of our water resources; monitor and work to improve water quality, quantity, and flow characteristics; and observe and participate in the activities of public bodies responsible for the management of our waters and our watersheds.

9. As the Calusa Waterkeeper, I oversee a volunteer water ranger program, teaching courses in water monitoring and data collection and designing water quality studies. I actively participate in agency events and meetings on issues that relate to water resource policy implementation, such as the Florida Department of Environmental Protection Caloosahatchee Basin Management Action Plan and the Caloosahatchee River Watershed Protection Plan. I also review applications for development that impact water resources of the region. I use the data collected by Florida government agencies, Calusa Waterkeeper volunteer rangers and other sources to advocate on behalf of our community and to inform the public and government officials on the effects of water quality, wildlife, and habitat issues, including climate change and sea level rise.

10. A significant part of my job involves conserving endangered species and their habitats.

11. I live in Lee County, Florida and have lived in Lee County since 1978. I have owned and resided on property within two miles of the Caloosahatchee River since 2004.

12. I am concerned about the effects of climate change and sea-level rise on critical habitat of the smalltooth sawfish in the Caloosahatchee Estuary in Florida as it relates to the survival of the species.

13. Smalltooth sawfish are rays, and get their name from their long, flat snout edged with teeth, which looks like a saw. They live in tropical seas and estuaries of the Atlantic Ocean and Gulf of Mexico. In the U.S., they were once found from coastal Texas to North Carolina, but are now restricted to the coast of Florida. The numbers of smalltooth sawfish have declined steeply because of habitat loss. The species was the first marine fish to be listed as an endangered species under the Endangered Species Act in 2003.

14. Sea-level rise caused by climate change will detrimentally alter the reproduction of smalltooth sawfish, which already has a low rate of growth and low fecundity, and it will limit the available habitat for juveniles.

15. The rate of sea-level rise will likely outpace the adaptive response of the shallow red mangrove community that is designated critical habitat for juvenile smalltooth sawfish because the built environment will block inland

migration of the red mangrove habitat as the seas rise. There will simply be nowhere left for the smalltooth sawfish to go, and accelerating sea level rise will put more and more pressure on this species.

16. I typically boat recreationally or professionally in the Caloosahatchee River or near-shore waters of the Gulf of Mexico at least once per month, and at times observe smalltooth sawfish.

17. I train Calusa Waterkeeper volunteers to be cognizant of smalltooth sawfish observations and where to report such sightings. A Calusa Waterkeeper volunteer, trained by me, recently rescued a smalltooth sawfish entangled in fishing line.

18. The official logo of Calusa Waterkeeper features a sawfish.

19. I have also organized an educational meeting at Florida Gulf Coast University about smalltooth sawfish research on behalf of the Southwest Florida Watershed Council.

20. During 2017, I helped organize a conference at Florida Gulf Coast University on conserving biodiversity, also sponsored by the Center for Biological Diversity, with an emphasis on how habitat changes impact endangered species.

21. I have reviewed an application to the Army Corps of Engineers as part of my professional responsibilities that would have impacts on smalltooth sawfish and their habitat and have requested a public hearing on the application.

22. I authored or co-authored peer-reviewed research on changes to biodiversity and habitat in 2006, 2013, 2015, and 2019.

23. I founded the Southwest Florida Amphibian Monitoring Network, a wildlife monitoring program, now in its 21st year, for determining how species respond to a changing environment.

24. I seek spiritual fulfillment from observing wildlife, including endangered species and their habitat.

25. I believe I have a moral obligation to do what I can to conserve endangered species and their habitats.

26. I believe biodiversity has inherent value and take pleasure knowing that species exist even if I do not always get to observe them.

27. I plan to continue to go out on my boat in the Caloosahatchee River and Estuary and nearshore waters of the Gulf of Mexico in the future, weekly if not daily, in both a professional and recreational capacity, and will be interested in observing smalltooth sawfish and changes to their critical habitat.

28. I am concerned that the smalltooth sawfish will go extinct if its critical habitat is diminished by sea-level rise.

29. I understand that the Environmental Protection Agency ("EPA") and the National Highway Traffic Safety Administration ("NHTSA") have rolled back the federal greenhouse gas emissions standards and fuel economy standards, and that doing so will increase greenhouse gas pollution from passenger vehicles. I am aware that the agencies have said these emissions will contribute to climate change, including sea-level rise. I believe that by adopting this rollback without consulting with the federal wildlife agencies, EPA and NHTSA have adopted a rule that will harm and could destroy the critical habitat of the smalltooth sawfish. And I am afraid that this will further jeopardize the already endangered and imperiled smalltooth sawfish.

I declare under penalty of perjury that the foregoing is true and correct. Executed on December 7, 2020 in Fort Myers, Florida.

John R. Cassani

John R. Cassani, Jr.

DECLARATION OF GINA COPLON-NEWFIELD

I, Gina Coplon-Newfield, declare as follows:

1. I am the Director of the Clean Transportation for All Campaign at Sierra Club, a position I've held for about three years. I was formerly the Director of the Electric Vehicle Initiative at the Sierra Club; a position that I held for more than six years.

2. In my current role, I manage and coordinate Sierra Club's policies and efforts on behalf of its members to advocate for greenhouse gas reductions and greater fuel efficiency from our nation's vehicle fleet and broader transportation system. While at Sierra Club, I have worked on numerous matters involving greenhouse gas regulations and fuel economy standards for light-duty and heavy-duty vehicles. My position requires me to be familiar with Sierra Club's purpose and mission, its activities relating to motor vehicles and to air quality (among other things), and the nature and scope of its membership.

3. Sierra Club is a national non-profit membership organization incorporated under the laws of the State of California, with its principal place of business in Oakland. Sierra Club's mission is to explore, enjoy and protect the wild places of the Earth; to practice and promote the responsible use of the Earth's resources and ecosystems; to educate and enlist humanity to protect and restore the

quality of the natural and human environment; and to use all lawful means to carry out these objectives.

4. Sierra Club has 786,109 active members nationwide, according to data last updated in April 2020. These include members that live in close proximity to high volume roadways and refineries that process the oil products powering the vehicles traveling those busy roadways, and some of whom experience adverse health effects from the resulting pollution. They include members in states and counties that have been designated non-attainment for ozone and particulate matter, pollution that is caused by vehicles, among other sources. They also include members whose use and enjoyment of the natural environment is threatened and harmed by a changing climate. These members have a strong interest in protecting human health and the environment from the air pollution emitted by the transportation sector. Sierra Club works on behalf of its members, who rely upon the organization to advocate for their interests in front of state, local and federal entities, including EPA, NHTSA and the courts.

5. As part of carrying out this mission, for decades the Sierra Club has used the traditional tools of advocacy--organizing, lobbying, litigation, and public outreach—to push for policies that decrease air and climate pollution by reducing our nation's dependence on fossil fuels.

6. Sierra Club has a long history of involvement in vehicle regulations aimed at tackling pollution and lessening our dependence on oil as a transportation

fuel. Together with other organizations, Sierra Club has in the past challenged NHTSA's CAFE standards for light-duty vehicles for failure to comply with the relevant requirements under the Energy Policy and Conservation Act. *Center for Biological Diversity v. National Highway Traffic Safety Administration*, 538 F.3d 1172 (9th Cir. 2008).

7. Sierra Club has long advocated for climate regulations for vehicles. In 2002, Sierra Club and other organizations filed a lawsuit against the Environmental Protection Agency (EPA) asking the agency to regulate greenhouse gases from motor vehicles. EPA settled that lawsuit and denied the petition in 2003, on the grounds that the agency lacked authority to do so. Sierra Club and numerous states and environmental organizations challenged that denial, ultimately leading to the Supreme Court's decision in *Massachusetts v. EPA*, which held that greenhouse gases are air pollutants subject to regulation under the Clean Air Act. 549 U.S. 497 (2007).

8. The Supreme Court's ruling resulted in EPA's issuing a finding that six greenhouse gases emitted by vehicles endanger the public health and welfare of current and future generations, which forms the basis of the agency's greenhouse gas regulations for light-duty and heavy-duty vehicles. *Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act*, 74 Fed. Reg. 66,496 (Dec. 15, 2009). Sierra Club has consistently worked to strengthen and defend those federal standards.

9. In 2010, NHTSA and EPA jointly issued CAFE and greenhouse gas emission standards for light-duty vehicles. *Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule*, 75 Fed. Reg. 25,324 (May 7, 2010). Sierra Club and others commented on the proposed rule and intervened in the industry's lawsuit challenging the standards. *Coalition for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102 (D.C. Cir. 2012), *rev'd on other grounds sub nom. Utility Air Regulatory Group v. EPA*, 134 S. Ct. 2427 (2014).

10. NHTSA and EPA updated these standards in 2012 by issuing fuel efficiency and greenhouse gas standards for light-duty vehicles built from model years 2017 through 2025. Because the law allows NHTSA to issue CAFE standards only in five year increments, NHTSA's CAFE standards for model years 2022 through 2025 were "augural." In the regulation, EPA bound itself to review the appropriateness of the greenhouse gas standards by April 2018. *2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards*, 77 Fed. Reg. 62,624 (Oct. 15, 2012). During 2016, Sierra Club and others commented on EPA's Draft Technical Assessment Report and its proposed determination as part of this mid-term evaluation and, in January 2017, EPA found that the standards remained appropriate at even lower cost than originally estimated. In April 2018, however, EPA reversed its position, determining that the current standards are not appropriate and might be too stringent. Sierra Club and its allies challenged EPA's revised determination. *California v. EPA*, 940 F.3d 1342 (D.C. Cir. 2019). Sierra Club

and others also commented on NHTSA's and EPA's proposed rule to revise the standards for light-duty vehicles for model year 2021 and to issue new standards for model years 2022 through 2026, frozen at the stringency set for model year 2020.

11. In 2011, NHTSA and EPA adopted fuel economy and greenhouse gas standards for heavy-duty trucks, updating these standards in 2016. *Greenhouse Gas Emission Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Final Rule*, 76 Fed. Reg. 57,106 (Sep. 15, 2011); *Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles-Phase 2*, 81 Fed. Reg. 73,478 (Oct. 25, 2016). Sierra Club and others intervened to defend those rules against industry challenges. *Truck Trailer Manufacturers Association v. EPA*, Nos. 16-1430, 16-1447 (D.C. Cir. 2017). Recently, Sierra Club and its allies also challenged EPA's final decision not to enforce its regulations of glider vehicles nationwide. *Environmental Defense Fund v. EPA*, No. 18-1190 (D.C. Cir. 2018).

12. On September 27, 2019, EPA and NHTSA issued a rulemaking in which NHTSA declared that the Energy Policy and Conservation Act preempts California's ability to set its own greenhouse gas and zero emission vehicle (ZEV) standards for passenger cars and light duty vehicles, and in which EPA revoked the waiver it had issued California under the Clean Air Act allowing the state to do so. *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program,* 84 Fed. Reg. 51,310 (Sept. 27, 2019) ("SAFE One"). This rule also declared that other states may no longer adopt California's greenhouse gas and ZEV standards for vehicles. On

April 30, 2020, the agencies issued a second rule which considerably weakened the greenhouse gas and fuel efficiency rules applicable to the nation's passenger cars and light duty trucks. *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks,* 85 Fed. Reg. 24,174 (Apr. 30, 2020) ("SAFE TWO"). The result of SAFE Two will be the consumption of massive amounts of additional gasoline and diesel and the emissions of vast amounts of greenhouse gases and other harmful pollution.

13. Strong regulations that increase vehicles' fuel efficiency, reduce their emissions of greenhouse gases and other harmful air pollutants, and allow California and states adopting California's standards to set Zero Emission Vehicle (ZEV) standards are a critical part of Sierra Club's work to reduce pollution in the transportation sector. Rules that increase fuel consumption and air pollution and prohibit the adoption of ZEV standards by California and other states are directly contrary to Sierra Club's mission and work, and harm our members in numerous ways. Our members rely on Sierra Club to represent their interests in reducing harmful pollution by means of strong efficiency and emission standards and mandates for the sale of ZEV vehicles. SAFE One and SAFE Two directly affect our members' health, their ability to enjoy the environment and protect numerous species, and to purchase fuel efficient and ZEV vehicles that meet their needs. If Sierra Club's challenge to these regulations is successful, the much more stringent former national fuel efficiency and greenhouse gas regulations will be reinstated; California will regain

its right to set its own greenhouse gas standards and ZEV standards; and other states will again be able to adopt California's standards. Sierra Club members will directly benefit from the resulting reductions in climate and conventional air pollution and its many and grave harms to them and the environment.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief. Executed on May 20, 2020.

Gina Coplon-Newfield

DECLARATION OF PHILIP B. COUPE
FOR CONSERVATION LAW FOUNDATION

I, Philip B. Coupe, hereby declare and state:

1. This declaration is based on my personal knowledge, information, and belief. I am over the age of eighteen years and suffer from no legal incapacity.

2. I have been a resident of Maine for 40 years. I live at 345 Mitchell Road in Cape Elizabeth, which is located in Cumberland County.

3. I am currently a member of CLF's Maine State Board. I have served on CLF's Maine State Board for more than two years and have been a CLF member for ten years. I am a member of CLF because they are one of the most effective non-governmental organizations in New England when it comes to protecting citizens' rights to clean air, clean water and a healthy, sustainable environment.

4. Among the most important current and future threats to Maine's natural and built environment is the ongoing damage due to anthropogenic climate change. I am aware of the science documenting the existence of climate change, its causes, and its potential adverse impacts on public health and welfare and the environment. I understand that human activities—including transportation—have resulted in elevated levels of carbon dioxide pollution in earth's atmosphere. Carbon dioxide and other greenhouse gases trap heat in the Earth's atmosphere and are now causing a variety of climatic and environmental changes, including, but not limited to, increased local and global temperatures, sea level rise, and increases in the frequency and intensity of extreme weather events, including increased precipitation and heavy downpours in the northern United States.

5. I understand that 2019 was the second hottest year on record for the United States and that this is part of a pattern of increased warming globally and in my region. Between 1895

and 2011, average annual temperatures in Maine, indeed in the entire Northeast U.S., increased by almost two degrees Fahrenheit, and precipitation increased by more than ten percent. I am also aware that 2019 was the second wettest year to date on record for the contiguous U.S. Additionally, I understand that sea level rise is already documented in Maine and that global sea levels are projected to rise up to 6.5 feet by 2100, substantially increasing coastal flooding risks in my region.

6. I am familiar with the final rule published by the Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) as *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks*, 85 Fed. Reg. 24,174 (Apr. 30, 2020) (Final Rule). I understand that this rule weakens federal greenhouse-gas emission and fuel-economy standards pertaining to cars and light trucks. I also understand that CLF is among a group of public interest organizations that have challenged the Final Rule in court.

7. The Final Rule harms me and my family. My family enjoys spending time outdoors and participating in outdoor activities including camping, swimming, canoeing, fishing, biking, hiking, and running, as well as outdoor sports like soccer, ultimate frisbee, and lacrosse. Both of my sons (age 15), my daughter (age 17), and I suffer from episodic asthma, which can cause shortness of breath, wheezing, and coughing. Our symptoms are aggravated by ground-level ozone and ozone smog. We are, therefore, directly impacted by climate change because increased temperatures lead to more frequent bad ozone days, exacerbating our symptoms. This will make it harder for us to breathe when we attempt to exercise and recreate outdoors and will force us to curtail these activities. If climate-related temperature rises remain unchecked, these bad ozone days will only continue to increase, and the associated adverse health impacts will be

compounded. Greenhouse gas emissions will increase as a result of the Final Rule, thereby contributing to climate change and increasing the number of days our asthma symptoms are exacerbated.

8. My three children are an important reason why I am so concerned about the issue of climate change. I worry about how the changing climate will impact their health and their futures. I believe we must do everything we can to protect them from the adverse effects of climate change.

9. I am also the Co-founder and Managing Partner of a solar energy company called ReVision Energy. Our company mission is to transition northern New England from a fossil fuel-based economy to a sustainable, renewable energy-based economy. As a 100% employee-owned company and certified B Corp, we are committed to creating the better future we know is possible for ourselves and future generations by drastically reducing fossil fuel consumption and the associated emissions. We are particularly focused on helping consumers acquire solar electric systems and electric vehicle charging stations so they can meet their transportation needs with zero emissions.

10. Recognizing that more than 50% of northern New England's carbon pollution comes from vehicle tailpipe emissions, ReVision Energy has created an Electric Vehicle Charging division as part of its overall business strategy to reduce fossil fuel consumption and associated emissions. Zero-emission electric vehicles and low-emission plug-in hybrid vehicles are critically important to the regional effort to reduce carbon pollution and ReVision Energy is actively participating in the market-based business solution of installing "EVSE" (electric vehicle supply equipment) to encourage adoption of electric vehicles and plug-in hybrid electric vehicles. ReVision Energy has become a market leader in the installation of electric vehicle

charging stations in Maine, New Hampshire and Massachusetts for homeowners, commercial businesses, nonprofits, schools and municipalities.

11. The Final Rule harms ReVision Energy's business interests. If vehicular emissions and fuel economy rules are loosened, there will be fewer sales of electric vehicles, and there will be less consumer demand for ReVision Energy's EVSE installation services. This will materially harm ReVision's business interests by reducing revenues and profits. As the managing partner of ReVision Energy, I and other ReVision Energy employee-owners stand to lose business and money due to the Final Rule.

12. It is my opinion that the Final Rule is an illegal assault on citizens' rights to enjoy clean, healthy air and water. It is worth noting that electric vehicles are roughly 50% less expensive to operate than internal combustion engine vehicles because electric vehicles are vastly more efficient and because they require virtually zero maintenance (no oil changes, no engine work, etc). For these economic reasons, and because electric vehicles drastically reduce carbon pollution, electric cars are superior to the more expensive and polluting internal combustion engine vehicles. ReVision Energy is building the EVSE infrastructure that enables this beneficial transition.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 4th day of January, 2021.

Phil Coupe

Philip B. Coupe

DECLARATION OF DEBORAH CRAMER
FOR CONSERVATION LAW FOUNDATION

I, Deborah Cramer, hereby declare and state:

1. This declaration is based on my personal knowledge, information, and belief. I am 69 years old and am competent to testify to all facts contained in this declaration.

2. I am a permanent resident at 318 Concord St., Gloucester, MA, 01930, where I have lived for 36 years.

3. I am a current member of the Conservation Law Foundation (CLF) and support its track record protecting threatened, endangered, and overexploited species. CLF works, among other strategies, through litigation. For example, one ongoing CLF case seeks to protect endangered right whales and a previous CLF case sought to protect depleted cod on Georges Bank in the Gulf of Maine.

4. I am a science writer. I have written three books about the sea and the coast – *Great Waters: An Atlantic Passage* (W.W. Norton, 2001), *Smithsonian Ocean: Our Water Our World* (HarperCollins, 2008), and *The Narrow Edge: A Tiny Bird, An Ancient Crab, and An Epic Journey* (Yale University Press, 2014). *The Narrow Edge* received the Best Book Award from the U.S. National Academies of Science, Medicine, and Engineering; the Rachel Carson Book Award from the Society of Environmental Journalists, the Reed Award from the Southern Environmental Law Center, and a "Must Read" from the Massachusetts Book Awards. It has been translated into Spanish and Chinese. And National Public Radio affiliates in Massachusetts, New York, and Texas, as well as the Canadian Broadcasting Company, have broadcast interviews with me about the shorebirds of *The Narrow Edge*.

5. In addition to these books, I have written shorter articles about endangered shorebirds, including: "A Bird Whose Life Depends on a Crab," *New York Times* Op-Ed (Nov.

27, 2013); "Silent Seashores," *New York Times* Op-Ed (May 1, 2015); "Bay of Plenty," *BBC Wildlife* (May 2016); "Red Knots Are Battling Climate Change at Both Ends of the Earth," *Audubon* (May – June 2016); "Inside the Biomedical Revolution To Save Horseshoe Crabs and the Shorebirds That Need Them," *Audubon* (Summer 2018); "How Plover Chicks Born in a Parking Lot Spurred a City To Make Its Beach Safer," *Audubon* (Spring 2018); and "The Flight of the Red Knot," *Orion* (Spring 2020). I am a Visiting Scholar at the Environmental Solutions Initiative at MIT, where I am working with scientists at the Horseshoe Crab Recovery Coalition and lawyers at the National Resources Defense Council, the Defenders of Wildlife, the Center for Biological Diversity, and CLF developing projects for MIT graduate and undergraduate students to assist the work of these organizations stanching the dissolution of the nation's laws and regulations protecting endangered species, including shorebirds.

6. I belong to a number of other organizations that work either to protect shorebirds, or work to protect their coastal homes and migratory stopovers, including the Cornell Lab of Ornithology, the Massachusetts Audubon Society, the Natural Resources Defense Council, the Center for Biological Diversity, the Southern Environmental Law Center, and the Trustees of Reservations. I am also an advisor to the Horseshoe Crab Recovery Coalition, a partnership of national and coastal ornithological organizations and others seeking to restore horseshoe crabs and thereby to restore the many species of shorebirds that depend on horseshoe crab eggs. You cannot protect birds without protecting the places where they live and stop to refuel for their long migrations. The journeys of shorebirds, including piping plovers, are like climbing the rungs of a ladder. Today, this ladder has many broken rungs – global warming and rising seas; coastal development; disturbance of the birds' seaside homes from the increasing presence on beaches of humans, and their dogs; global warming and ocean acidification, which will reduce the shellfish

on which many shorebirds depend; and global warming and increasing ocean temperature, which is altering the food supply for shorebirds. With so many broken rungs, their journey, and their survival, is jeopardized.

7. I have strong professional and scientific interests in piping plovers. In my professional capacity as a science writer focusing on nature and the environment, and informing and educating the public about the human effects on the future of endangered shorebirds, I wrote this article specifically about piping plovers: "How Plover Chicks Born in a Parking Lot Spurred a City To Make Its Beach Safer," *Audubon* (Spring 2018). On this congested urban beach – Good Harbor Beach, which is an example of the kind of urban beach essential to the recovery of piping plovers – the human-induced stresses on shorebirds come into full view. While researching the fate of piping plovers for the article, and every year since its publication in 2018, I have gone to Good Harbor Beach, stationed near the areas where piping plovers courted, sought areas to nest, laid their eggs, and raised their chicks, answering the public's questions about the plovers, their behavior, their migration, and their needs on the beach. I last did this in 2020 and hope to continue in the years to come, beginning with the anticipated return of the piping plovers at the end of March 2021. I advised the City of Gloucester's Animal Advisory Committee about the need for a tougher dog ordinance to protect the plovers, providing them with studies documenting the deleterious effects of human disturbance and running dogs on piping plovers, and testifying at the hearings held by the City Council, which ultimately passed the stronger ordinance. I also provided information to one city councilor about how ceasing to rake the beach and fencing the areas used by the plovers would both benefit the plovers and decrease erosion on the beach.

8. I also have strong personal interests in piping plovers. My interest in shorebirds, including piping plovers, began when I moved to Gloucester, MA, 36 years ago and began walking nearby barrier beaches where piping plovers nest or have nested in the past. When I began researching the book that would become *The Narrow Edge*, I walked these beaches regularly, at least once a week, and more often in the spring and summer, looking for nesting least and common terns; migrating shorebirds, including ruddy turnstones, sanderling, semipalmated sandpiper, semipalmated plover, piping plover, dunlin, and red knot. Beginning in 2017, and continuing through the 2020 season, I spent one to four hours a day, sometimes more, three, four, and five days a week looking for the arrival of piping plovers at the end of March or the beginning of April, watching the birds courting — the males digging scrapes (potential nests for the females to inspect) in the sand — and strutting in the sand to attract females, or charging across the beach to chase off other males. When there were nests, I checked every few days to see whether or when the female began laying eggs and how many, and I kept watch for coyotes, foxes, people crowding onto the beach, dogs running free on the sand, or unusually high tides or storms – any of which could interrupt the nesting or cause the birds to give up. I looked, and continue to look for piping plovers on Wingaersheek Beach in Gloucester, where piping plovers used to nest but where dogs and people prevent their nesting now; on Coffin's Beach in Gloucester, where there are usually one or two attempted nests each season; on Good Harbor Beach in Gloucester; on Crane Beach in Ipswich, where there are dozens of nests; and at the Parker River National Wildlife Refuge in Newburyport. The last time I went looking was throughout the nesting season of 2020, and I hope to begin looking again for piping plovers when I anticipate they will return to these beaches at the end of March 2021.

9. On Good Harbor Beach in Gloucester, I have witnessed throngs of people and dogs shunt the plovers into the parking lot, forcing them to lay their eggs on the asphalt. I have witnessed increasingly high tides threaten to swamp the beach, which became increasingly narrow at high tide. When the chicks hatch, I have watched their parents try to protect them from people crowding the narrow strip of sand at the high tide line, and from the many sea gulls attracted to the beach by people's garbage. I have watched the chicks' chased by dogs, barely avoid being hit by balls or scalded by hibachis. Of all the chicks I have watched on Good Harbor Beach since 2017, only two survived long enough to learn to fly. The stresses on this beach were the subject of my article in *Audubon*.

10. On Coffin's Beach in the summer of 2020, I followed the birds as they laid their eggs; as the eggs hatched; as one parent and one chick were killed; and then as the remaining parent kept the chicks safe throughout the summer, leading them back and forth to the tidal flats to feed, teaching them how to hide from seagulls in the dune grass, and "piping" warning calls of danger to them. I stayed with this family until late in the summer when the birds departed for their winter home, possibly in Bermuda. I continue to walk the beaches monitoring shorebirds and will continue to do so throughout the year and into next spring and summer and fall and winter for as long as I am able. I last walked Coffin's Beach on December 28, 2020, and hope to go again in the next week or two. Walking the wrack line or kayaking along the marshes and sandy shoals amidst the migrating birds, small and large fish, and the (very) occasional whale, both along the coast near my home, and along the U.S. eastern seaboard is how I spend much of my recreational time. The beaches and marshes, and the migrating birds that inhabit them, are places of great beauty.

11. I also have strong moral and spiritual interests in piping plovers. In the words of E.O. Wilson, we are "hemorrhaging" species. Before humans began redesigning the Earth, a bird extinction was thought to occur once every 1000 years. Already in my lifetime, 19 birds have become extinct. Millions of shorebirds are disappearing as their populations plummet. These dramatic losses signify our moral and ethical failure. We did not create the world into which we were born, but we are responsible for it while we are here. In the Judeo-Christian tradition, that responsibility was given in Genesis, when God bestowed humans with dominion over the fish of the sea and the fowls of the air. For me, the beaches, bays, and the salt marshes that constitute the liminal, fertile place between land and sea, and belonging to both, whose waters are nursey to so many of our richest fisheries, whose grasses are more fertile than agricultural fields, whose tiny, invisible (to us) phytoplankton provide half the air we breathe are an immediate, palpable manifestation of how the earth nourishes and sustains us. It is an abuse of our power to decimate so many species and their homes, to pollute the sea and the sea edge that brought us here and that make our lives possible. Looking at ourselves across the great span of time, if the history of life on earth were collapsed into one day, we humans would appear just before midnight on the last day of the year. Who are we, such late arrivals, whose very existence has been made possible by the life that preceded us, to now determine who shall live and who shall die? The piping plover, even though it can't speak and can't vote, has as much a right to be here as we do.

12. I believe in conserving, protecting and restoring endangered species not only on moral, ethical, and spiritual grounds, but on practical, scientific grounds as well. Birds are the canaries in the coal mine. As long as they are healthy, E.O. Wilson wrote, the rest of earth's flora and fauna are healthy. In *The Narrow Edge*, I examine the connections between birds and human well-being, including: how migrating shorebirds, eating insects that would devastate farmers'

crops, were of great economic value until they were extirpated by hunters; how migrating birds carried in seeds that reforested Mt. St. Helens after the volcanic eruption burned the landscape; how migrating birds seeded salt marshes after the glaciers receded; and today transport seeds along entire edges of continents; how the passenger pigeon, before it became extinct, tamped down the now burgeoning populations of disease-bearing ticks; and how the destruction of native trees to build commercial coconut palms expelled nesting seabirds that fertilized the soil and nearby waters, supporting a productive subsistence fishery that disappeared once the birds and the fertile water were gone. Closer to home, a healthy salt marsh, home to the highly endangered salt marsh sparrow, provides millions of dollars of free protection from storm surges. Similarly, the beaches that are home to piping plovers also provide millions of dollars of protection from hurricanes and storm surges. If the beaches where the birds nest disappear, we will suffer as well. In Newburyport, not far from where I live, houses routinely collapse into the ocean as increasingly fierce and frequent storms erode the beach.

13. I understand that in 2020 the U.S. Environmental Protection Agency ("EPA") and the National Highway Traffic Safety Administration ("NHTSA") jointly issued amended rules known as the SAFE Part Two Rule that weaken federal light-duty vehicle greenhouse gas emissions and corporate average fuel economy standards. I have learned that before the amendment, the rules in place would have required that vehicles of model years 2021-2026 increased in stringency by 4.7 percent annually, but under the SAFE Part Two Rule, they will only increase in stringency by 1.5 percent each year. I have been informed that this will allow new vehicles to emit 15 percent more greenhouse gases than under the prior standards. Further, I understand that this is projected to have an impact of increasing nationwide greenhouse gas emissions by more than 850 million metric tons.

14. I understand that higher emissions of greenhouse gases contribute to global warming, and I have learned about the impacts of global warming on shorebirds, including piping plovers. Scientists analyzing the effects of global warming on shorebirds have found that global warming exacerbates the risk of extinction for 90% of shorebird taxa migrating through North America, (Galbraith). According to this comprehensive analysis, the human-induced consequences of global warming on the breeding grounds and winter homes of shorebirds dramatically raise the extinction risk of piping plovers, already highly imperiled, to critically endangered. These risks are particularly pronounced in the piping plover breeding grounds where I live and are manifested by a warming atmosphere, rising water, and strong northeast storms and hurricanes. Piping plovers breed on sandy beaches, in sparse vegetation at the foot of sand dunes. Global warming induced sea level rise is already taking place in New England, with at least a seven-foot rise predicted by 2100. (Trustees of Reservations, State of the Coast). While the barrier beaches where piping plovers nest experience cyclical patterns of expanding and contracting, the overall trajectory as the earth warms is one of loss.

15. To give a specific example of global warming's impacts from one of the beaches I walk and which is frequented by shorebirds including piping plovers, Crane Beach, which backs onto the bay where I live, is growing more and more narrow, losing five feet of girth per year since the 1950s. (Trustees, Ibid.). The dunes fronting the beach are disappearing before my eyes. High dunes which my children used to roll down when they were little are gone. Copses of trees that grew between the dunes, now regularly flooded with water, are dying from the inundation of salt. Their blackened trunks lie uprooted in the sand. The end of the beach is also eroding, losing an astonishing 2000 feet in length since 1995. (Trustees, Ibid.). We used to stand at the end of the beach, looking directly across the bay to a friend's house. Today, the place where we stood is

submerged, along with nesting sites for piping plovers and terns. By 2050, 27% of estuarine beach and tidal flats in the bay where I live will be lost to open water. (Trustees, Ibid.). Lastly, the summer of 2020 was the warmest on record in Massachusetts. I understand that on Crane Beach, more than twice as many chicks died as the average rate each year for the last ten years, presumably, given where they died, from the excessive heat and accompanying drought.

16. These losses affect not only the breeding habitat of piping plovers, but also the migratory stopovers for other shorebirds. In *The Narrow Edge*, I wrote about the challenges facing the red knots – birds that fly 19,000 miles every year from Tierra del Fuego up to their Arctic nesting grounds and back – and other long-distance migrating shorebirds. Over three years I traveled from the southern tip of Chile up along the coast of America and up into the Arctic to explore these challenges. I wrote about the extra burdens of global warming in "Red Knots Are Battling Climate Change at Both Ends of the Earth," *Audubon* (2016). These global warming induced stresses include rapidly increasing ocean acidification – the ocean is growing increasingly corrosive at a rate higher than any time in the last 55 million years – decreasing the availability of the tiny clams and mussels that are the birds' primary sources of food along their southbound migration from James Bay, Canada, and in their winter home in Tierra del Fuego. Other global warming induced stressors include warming water, compromising the birds' sources of food in the Virginia tidelands, and increasing storms and storm surges threatening to obliterate their critical migration stopover in Delaware Bay. Hurricane Sandy destroyed 70% of the New Jersey beaches where shorebirds refuel on horseshoe crab eggs – the energy-rich food they need to make it up to their Arctic nesting grounds. Hurricane Sandy storm surges, a once every 100-year event in 1950, and occurring every couple of decades by 2012, are expected to occur every few years as the earth continues to warm. As temperatures rise, the tree line is moving north into

the Arctic, bringing in new predators and taking over the birds' nesting grounds on the icy tundra. The U.S. Fish and Wildlife Service has found that global warming threatens red knots with extinction in the next several decades. The same factors also threaten other long-distance migrating shorebirds, such as ruddy turnstones and semipalmated sandpipers, whose populations are also dramatically falling. While I was researching *The Narrow Edge*, on autumn days, I'd kayak into the bay behind my home, pull up on a marshy shoal, and wait as the tide came in for migrating shorebirds to come in to feed in the muddy flats. I'd see white-rumped sandpipers, semipalmated sandpipers, a few godwit, sometimes a whimbrel, black-bellied plover, and a few juvenile red knot flying down from the Arctic, their fresh plumage shining in the afternoon sun. I don't see them there now. Rising water and sand pouring in from the outer bay and the eroding beach has drowned their roost. Perhaps they will find another; perhaps not.

17. I live along a tidal creek that empties into the bay. The effects of global warming are manifested here as well. The tides at a bridge near my house are higher now. The road floods more frequently during storm surges and during the full and new moon "king" tides, and the bridge is washing out, the blocks of granite supporting the bridge falling into the creek. At the mouth of the creek where I often launch my kayak, storm surges have destroyed a sea wall built to protect one of the adjacent houses. When I return from paddling on a weekend when the tide is high, I've seen the owners and their guests out on their deck, sitting in their chairs eating lunch, their feet and ankles covered with flooding water. Many of the properties out here are at an extreme risk of flooding.

18. The piping plover is only one shorebird species whose future is imperiled by global warming. Numerous other shorebirds are imperiled as well. For those birds already listed as threatened or endangered under the U.S. Endangered Species Act, the dollars and untold

volunteer hours invested by the federal government as well as municipal and state governments, and conservation organizations, bringing these birds back from the edge of extinction, or in the case of those birds not yet listed, slowing the population declines, will be undermined by ratcheting down previous vehicle emission and mileage standards, which had offered a tangible, realizable, substantive means of reducing our carbon emissions, offering us a pathway to avoiding climate catastrophe. To consciously and brazenly steal and destroy a livable Earth for our children is unconscionable. The Court granting CLF the relief it is seeking in this case would reduce the harm to piping plovers and other shorebirds, thereby lessening the harm to my interests in this species, and putting us back on a path toward saving our Earth.

I declare under penalty of perjury that the foregoing is true and correct.

Signed on the 5th day of January 2021.

Deborah Cramer

Galbraith H, DesRochers DW, Brown S, Reed JM (2014) "Predicting Vulnerabilities of North American Shorebirds to Climate Change." PLoS ONE 9(9): e108899. doi:10.1371/journal.pone.0108899

Trustees of Reservations "State of the Coast." 2020 https://www.onthecoast.thetrustees.org/about

Massachusetts 2020 hottest summer on record https://www.ncdc.noaa.gov/cag/statewide/time-series/19/tavg/3/8/1895-2020?base_prd=true&firstbaseyear=1901&lastbaseyear=2000

Flood risk first foundation https://floodfactor.com/property/111-conomo-point-rd-essex-county-massachusetts/251169560_fsid

– 37% this year, 99% in the next 30 years

DECLARATION OF SARA CROSBY

I, Sara Crosby, state and declare as follows:

1. I am over 18 years of age and competent to give this declaration. I have personal knowledge of the following facts and, if called as a witness, I would testify competently to them. As to those matters that reflect an opinion, they reflect my personal opinion and judgment on the matter.

2. Currently, I live in Columbus, Ohio, but I grew up in Grand Isle, Louisiana. Grand Isle is a narrow barrier island in the Gulf of Mexico. I lived in Grand Isle and in Cut Off, a small town a few miles up the bayou from the island, from the time that I was born until I went away for college when I was 17 years old. My parents still own and live in the house that I grew up in. That property has been in my family for about 200 years. My parents also own two rental properties in Grand Isle. My sister and I will inherit the properties from my parents after they pass away. I would like to move back to Grand Isle and live in the house that was my childhood home and has been in my family for generations.

3. During the past several years, Grand Isle has experienced intensified storms and flooding. The storms and flooding have negatively impacted, and continue to negatively impact, the existence and value of the property that my family owns in Grand Isle.

4. For example, when Hurricane Katrina hit in 2005, my parents were forced to evacuate. It was a couple of months before anyone was allowed back on the island. The storm surge generated by Hurricane Katrina caused my parents' house to flood with about six feet of water. Both rental properties also flooded. My parents lost almost everything that they owned, including some items that could not be replaced. For example, my great-grandmother was a photographer and many of her old photographs were destroyed. The salt water caused significant

damage to property. The house where my parents live is made out of cypress, which is able to maintain itself pretty well, but the entire house had to be gutted. Insurance helped cover some of the repair costs, but my family was still required to incur significant out-of-pocket costs to repair the damage.

5. Now, even a relatively small amount of rain causes flooding in areas of the island that previously didn't flood, for example, areas in the middle of the island that are not right next to the water. My parents have also noticed flooding on their property that previously would not have occurred with a similar amount of rain. There is also increased flooding on Louisiana Highway 1 (LA 1), which is the only land access to or from Grand Isle.

6. Many properties are for sale in Grand Isle, but hardly anyone is buying them. My family feels like it doesn't have any good options when it comes to the properties. We don't want to sell them, but we feel like we should. However, even if we decided to sell the properties, we'd have to sell at a very low price because so many properties are for sale and no one is buying because they know that the island is threatened.

7. The price of flood insurance has also significantly increased in the past several years. My understanding is that my parents are currently paying about $5,000 per year for flood insurance.

8. I have been a member of Environment America since about 2016. I became a member of Environment America because I have a young daughter, and I am very frightened and concerned about the world that I'm leaving for her. I am also concerned that global warming and the rising sea level threatens the value and existence of my family's property in Grand Isle, and I might not be able to pass that property on to my daughter as I would like.

9. I know that strong standards for greenhouse gas emissions and fuel economy for cars were put in place during the Obama administration and that the Trump administration wants to reverse course and roll back these strong standards. I know that California and other states want to be able to keep stronger emissions standards. I support Environment America's efforts to oppose the Trump administration's plans and keep the stronger standards in place.

I declare under penalty of perjury that the foregoing is true and correct.

Sara Crosby
Columbus, Ohio

5/28/20
Date

DECLARATION OF TRISHA DELLO IACONO

I, Trisha Dello Iacono, declare as follows:

1. I am currently a member of the Environmental Defense Fund ("EDF") and have been since 2012. I also work as the National Field Manager with Moms Clean Air Force, a special project of EDF where I manage the field staff and volunteers from across the country to develop and deploy strategic plans to increase grassroots advocacy on key public health and environmental issues at the local, state, and federal level. I have worked with Moms Clean Air Force since 2013.

2. I support EDF's mission and Moms Clean Air Force's mission to protect the health and future of our children from climate change and dangerous air pollution because as a parent to four young children, I want them to have a safe and healthy world to grow up in.

3. I currently live in Mullica Hill in Gloucester County, New Jersey with my three young sons, ages fourteen, ten, and three, and newborn baby girl. We have lived at our current location for about a year, and lived in Haddon Heights in Camden County, New Jersey for two years prior to that.

4. From my work with Moms Clean Air Force I understand that in 2012, EPA established gradually strengthening national greenhouse gas emission standards for

passenger cars and trucks for Model Years 2017-2025 and the National Highway Traffic Safety Administration established gradually strengthening fuel efficiency standards for Model Years 2017-2021. I understand that New Jersey has adopted the Advanced Clean Cars program, as have 13 other states, which includes protective greenhouse gas emission standards and "Zero Emission Vehicle" or "ZEV" standards.

5. I am also aware that the current administration recently finalized rules that dramatically weaken the federal clean car standards for upcoming years and declare state greenhouse gas and ZEV standards unlawful, seeking to end states' authority to enforce more protective ZEV and greenhouse gas emission standards.

6. I am aware that Gloucester County, New Jersey, where my family resides, is in nonattainment with the 2015 national health-based standard for ground-level ozone.

7. I understand that there is well-established scientific research linking ozone pollution with serious health problems such as respiratory disease, asthma attacks, and impaired lung function. I know that being outside during high ozone days can be dangerous for children and adults. But, in particular, I'm aware that ozone pollution poses more serious danger to children because their lungs are still developing and they spend more time outdoors than adults.

8. My children enjoy riding their bikes, playing soccer, and being outside or in our backyard with their friends. However, on days when ozone pollution is unsafe to breathe, I limit my children's outdoor activities, so they are not exposed to this harmful pollution.

9. I am also aware that carbon dioxide and other greenhouse gas pollutants are rapidly changing our climate.

10. I grew up in Southern New Jersey, where my parents farm over 5,000 acres of land. My children and I live about a five-minute drive away and will visit this farm several times each month. I have personally watched the impacts of climate change affect my parents' vegetable farming business. Increased heavy downpours lead to smaller crop yields and cause greater fungal growth, necessitating increased fungicide use. Higher temperatures entail increased water use and result in a reduced crop yield when daytime temperatures exceed 90 degrees for even short periods of time. Warmer temperatures and higher carbon dioxide concentration also contribute to an increase in crop disease, necessitating higher concentrations and more frequent spraying of toxic chemical pesticides. Not only does this increased pesticide use raise operating costs for the farm, it also creates greater health risks for my parents and the farmworkers who apply the pesticides, and for my children who want to enjoy eating the produce directly from the fields, as I once did as a

child. Now they have to check with my dad first to find out when he last sprayed, and cannot eat the produce if he sprayed too recently.

11. I hope that my children will be able to continue enjoying and, in the future, help operate our family farm. I am concerned that the impacts of climate change will negatively affect our family business and decrease the chances that my family and children can continue operating our farm in the future.

12. I am also aware from my work that climate change contributes to higher levels of ground-level ozone. I am concerned that the impacts of climate change will worsen Gloucester County's ozone levels and increase the frequency and severity of high ozone days when I must either keep my children indoors or expose their developing lungs to harmfully high ozone levels.

13. I am concerned that the administration's action weakening federal clean car standards and efforts to eliminate state authority for protective greenhouse gas and ZEV standards will lead to increased GHG and criteria pollution that will adversely impact my health and the health of my family. I am further concerned that my children and I will be less able to engage in the recreational activities that we enjoy because I must keep them inside more frequently to avoid harmfully high ozone levels exacerbated by the additional climate pollution and criteria pollution caused

by this rule. I am also concerned that the action will contribute to climate change that harms the operations and long-term future of my family's farm.

14. In addition, I am concerned that the administration's new rules will undermine my ability to buy the kind of car I want and need for my growing family.

15. Having experienced the way in which environmental pollution can fundamentally diminish the health and well-being of a family, it is deeply important to me that my family minimize its own contribution to dangerous air and climate pollution, for the sake of my own family and others.

16. This desire is particularly acute with respect to pollution from cars and trucks.

17. My family uses our two cars a lot. Because part of our family lives in New Hampshire, my husband and our children drive every other week from New Jersey to New Hampshire. We also use our cars regularly for day-to-day errands, work, and school events.

18. In December 2018, my husband and I determined that we needed to replace one of our two vehicles with a minivan to accommodate our growing family. We initially preferred the Toyota Sienna, but specifically decided to buy a Chrysler Pacifica because the Pacifica is the only minivan with an electric or plug-in hybrid model available. I want to own a zero-emission vehicle—*i.e.*, electric or plug-in

hybrid—both to reduce my contribution to air and climate pollution, and to save money on gas expenses. Consequently, my husband and I drove to New Hampshire from our New Jersey home to purchase a Chrysler Pacifica electric minivan after learning that a New Hampshire car dealership had one for sale.

19. The dealership informed us upon our arrival that the electric minivan was out of stock and repeatedly redirected our requests for an electric model, refusing to help us find one and instead pointing us towards the standard combustion Pacifica.

20. Needing a minivan as soon as possible, we ultimately were convinced by the dealership to purchase a standard combustion Pacifica. We are already dissatisfied with this car, largely because of its pollution impact, and have voiced this dissatisfaction to the dealership. We would like to replace this vehicle with a zero-emission car that fits our whole family at some point in the future, when it is financially viable given our outstanding loan on the car.

21. We also own a second family vehicle that does not fit our entire family. Because it cannot fit all of us at once, we anticipate needing to replace this vehicle in the next five years or even sooner. Ideally, we would also like to replace this car with a zero-emission minivan.

22. I understand that the recently finalized rule that declares state greenhouse gas and ZEV standards unlawful claims to block New Jersey's ability to implement and

enforce its ZEV standards, which would otherwise provide gradually strengthening incentives for the sale of zero-emission vehicles in-state. I am concerned that this rule, as well as the weakening of the federal standards, will reduce incentives for automakers and dealers to provide and sell low-emission vehicles, and specifically that fewer zero-emission vehicles—and fewer models of zero-emission vehicles—will be available for my family to purchase in the future. I am concerned that these rules will reduce dealerships' interest in helping my family buy a zero-emission vehicle.

I declare the foregoing is true and correct.

Trisha Dello Iacono

Dated: May 28, 2020

DECLARATION OF JANET DIETZKAMEI

FOR THE CENTER FOR BIOLOGICAL DIVERSITY

I, Janet DietzKamei, state and declare as follows:

1. I am over 18 years of age and competent to give this declaration. I have personal knowledge of the following facts, and if called as a witness could and would testify competently to them. As to those matters which reflect an opinion, they reflect my personal opinion and judgment on the matter.

2. I live in Fresno, California, and have lived there since 2003. I am retired from a 25-year career as a federal employee. I worked for the Air Force, the U.S. Department of the Treasury, the Veterans' Administration, and the United States Department of Agriculture Forest Service.

3. I am deeply concerned and care greatly about the air quality in Fresno. Poor air quality in my hometown and California's air-polluted Central Valley make me severely ill. I am keenly interested in doing all I can to improve the air I must breathe.

4. I have been a member of the Center for Biological Diversity (the Center) since 2017, and I rely on the Center to represent my interests in protecting our air quality and environment by: gathering and disseminating information about air pollution, advocating for the remediation of pollution, and enforcing our

environmental laws.

5. I have also been a member of the Fresno Environmental Reporting Network (FERN) and Central Valley Air Quality Coalition (CVAQ) since December 2015 and June 2016, respectively. CVAQ and FERN are organizations that monitor and report on local air pollution (FERN also addresses other forms of pollutants), and they advocate on behalf of myself and other citizens to reduce that pollution.

6. I am aware that in 2012, the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) issued fuel efficiency and greenhouse gas standards for all cars and light trucks manufactured during Model Years 2017 through 2025 (the 2012 Vehicle Rule) and that those standards increased these vehicles' fuel efficiency and greenhouse gas reductions every year through 2025, on a rising curve that contained steeper increases in the later years. I know that in April 2018, EPA reversed course and withdrew the final determination of the 2012 Vehicle Rule, finding that it was "not appropriate," too stringent, and needed to be revised.

7. I'm also aware that in August 2018, NHTSA and EPA jointly released a notice of proposed rulemaking for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021 through 2026 for Passenger Cars and Light Trucks (SAFE Vehicles Rule), which proposed to drastically reduce fuel

economy from the 2012 Vehicles Rule. In the first part of the SAFE Vehicles Rule, NHTSA issued a preemption rule, which states that federal law preempts California's ability under the Clean Air Act to set stricter greenhouse gas tailpipe standards or to require auto manufacturers to produce and sell an increasing number of zero-emission vehicles (ZEVs), and EPA revoked California's Clean Air Act waiver. The second part of the SAFE Vehicles Rule will result in a drastic reduction in fuel efficiency standards and means that Model Years 2021 through 2026 vehicles will combust more gasoline per mile traveled, thereby drastically increasing the amount of dangerous pollutants they emit, including ozone-forming nitrogen oxides, particulate matter (PM 2.5), and greenhouse gases.

8. I am extremely concerned and personally injured by all parts of the SAFE Vehicles Rule, because it makes fuel efficiency standards and ZEV requirements less stringent than they were. I fear that the increased pollution from the vehicle fleet will restrict my daily life activities even more since I cannot help but breathe the pollution.

9. The SAFE Vehicles Rule directly harms my health and has concrete, direct, and frightening daily effects on my personal quality of life. I had allergies before moving to Fresno in 2003 but had never had asthma. Around 2009, I was diagnosed with asthma after having a severe reaction to an unknown trigger pollutant when I was in Virginia on vacation. Within five days of the onset of this

reaction, I was in the emergency room (ER) with severe bronchitis. The consulting doctor was leaning toward admitting me to hospital. I was prescribed inhalers and other asthma relieving medications with the understanding that if I did not improve, I would return to the ER. Until the ER visit in Virginia, I had not known that I had asthma. After I was diagnosed, I realized that I had been suffering from asthma-related sicknesses since at least 2006, three years after I moved to Fresno.

10. Air quality in Fresno and the Central Valley is among the worst in the nation. I understand that the significant number of vehicles travelling on the road contributes enormously to the pollution. My house is located about 1,400 feet from the busy Interstate 180 highway. The highway has seen a spike in traffic due to a partially complete extension. There is already much more congestion due to the 12.9 miles of highway that have been completed as part of this extension. Since I purchased my home, a business park was constructed approximately 1,400 feet away, and adjacent to that is a new housing development. These sites are major contributors to increased tailpipe pollution near my home.

11. When the air quality for ozone or PM 2.5 turns from “good” to “moderate,” I am immediately affected. When ozone is less than “good,” I cannot leave my house because I find it exceedingly difficult to get enough air into my lungs. When particulate matter is less than “good,” I cannot leave the house without wearing a mask. When I do leave my house, and the air quality is worse

than “moderate,” my husband must drop me off right in front of the building I am entering. Even with these precautionary measures, I still run the risk of suffering an asthma attack or becoming sick with bronchitis or pneumonia.

12. When I begin having an attack, I feel heaviness in my chest and cannot get air. Often, I also start coughing. I feel like a fish out of water, gasping. If I am outside and begin to feel this chest pressure, shortness of breath, and/or coughing, I go into a building, a house, a car, or anywhere else that is enclosed so that I am better sheltered from the polluted air. Other effects of particulate matter and ozone air pollution on my health sometimes include sneezing and sniffling, feeling tired, achy, suffering from headaches, and feeling as if I am about to come down with a cold or flu. I also have a chronic cough when the particulate matter count increases.

13. I also cannot leave my house any time there is smoke in the air. During the months of November through February, my asthma symptoms are exacerbated by smoky air. To prevent pollutants from entering our home, my husband and I take off our outside clothing and put on clean clothing that is only worn inside the house. I have towels on my sofa and chairs that are washed after visitors sit on our furniture. No one can wear shoes inside our home. We have a nine-pound indoor dog. When he returns from a walk or goes out for potty breaks, we wash his feet and wipe him with a damp towel.

14. Asthma has made me exceedingly sick. When I suffer an attack, it is very difficult to breathe. A particularly severe attack occurred in the summer of 2012 when I went outside to take my dog for a walk. Even though I wore a mask, PM 2.5 particulates and ozone were in the "moderate" level. I began having trouble breathing and getting enough oxygen into my lungs. Feeling faint and lightheaded, I panicked and turned around to go back home. I nearly lost consciousness right there on the road. I believe that only the adrenaline produced by my panic allowed me to make it back home, where I administered asthma medication and then passed out. I learned a lesson that day—the mask only protected me from the PM 2.5 particulates, not ozone. The entire experience was horrific.

15. Because I never want to experience such an attack again, I use multiple sources and devices to monitor air pollution in Fresno and the Central Valley. I must monitor both the PM 2.5 and the ozone in my area on a daily, and sometimes hourly, basis because I have become increasingly sensitive to both pollutants over time. I use the San Joaquin Valley Air Pollution Control District's Real-Time Air Advisory Network (RAAN) to monitor for ozone. I access the RAAN database through my computer or on the phone. I also receive alerts on my phone when air quality has degraded to a level where I will not be able to breathe. Even after leaving my house, I again check the RAAN database to make sure the

air quality has not changed.

16. I have a PurpleAir Air Quality Sensor device in my yard to track PM 2.5. I hang it outside at the same level where I am breathing air. I also carry a portable monitor to track air quality wherever I am at any given moment. My monitor is connected to my in-home air purifying system in my bedroom and living room. I also have an air purifier in my car. I depend on my air purifiers and my personal air quality monitors, which provide up-to-date, "real-time" readings of PM 2.5 air quality. If the monitors indicate that the air quality has degraded to a certain level, I immediately turn on my air purifiers. In addition, I always consult my PurpleAir and portable monitors before going outside. Last winter, I did not become air pollution sick due to the readings I received from my PurpleAir monitor in my back yard.

17. I love to ride my bike and have been an avid outdoor person for my entire life, but now must spend most of my time inside my house. Because my activity level is so severely restricted, I now also suffer from unhealthy weight gain. To protect myself from pollutants, I always check the air quality before going to the gym to do some water aerobics. If there is an unexpected trigger when I do drive to the gym, I cannot walk from the parking lot to the gym because I begin to feel an asthma attack coming on. I end up having to go back home. Many of my friends and acquaintances and their children who live in Fresno or

elsewhere in the Central Valley suffer from asthma or other severe health complications because of the air pollution caused by motor vehicles. I am concerned for them as well and fear for their well-being. During periods when air pollution is above "moderate," many asthmatics end up in Central Valley Emergency Rooms and hospitals. I do all I can to avoid becoming so ill.

18. Now that EPA and NHTSA have proposed the SAFE Vehicles Rule, I am afraid that ozone-forming nitrogen oxides, PM 2.5, and greenhouse gases will increase. As a result, the air I must breathe will continue to be too polluted for me to participate or enjoy outdoor activities for fear of getting sick. My only option is to stay locked in my home as much as possible.

19. Because of the out-sized influence air quality has on my daily life, I am active in learning about and disseminating information about Fresno's poor air quality and its causes. When the air quality permits it, I speak about the effects of air pollution on my health at local, district, and state-level air quality board meetings. I routinely travel to Sacramento to speak to lawmakers on this subject. I also participate in air quality improvement workshops and training regarding California's array of electric vehicle programs. For example, I regularly attend the Air Resource Board's meetings and workshops regarding the Advanced Clean Truck Regulation, which, when implemented, will require manufacturers to sell zero-emission trucks as a greater percentage of their annual state sales from 2024

to 2030. I also participate in and follow Fresno City Plans to develop strategies to reduce city vehicle usage, including promoting and improving city transportation such as bus service. As a member of CVAQ, I advocated for much-needed infrastructure and investment to increase the adoption of electric vehicles in my community and throughout California. California's Zero-Emission Vehicle mandate makes it easier for advocates like me to persuade leaders and encourage communities to support the state's clean transportation initiatives and future.

20. I am a proud owner of a 2018 Chevrolet electric vehicle, which has a driving range of approximately 238 miles when fully charged. Due to the lack of dependable charging infrastructure in California, I must also own an internal combustion engine vehicle so that I can reliably travel from the San Joaquin Valley to the Bay Area and Sacramento without having to worry about whether or not I will be able to charge my vehicle when necessary. I would gladly trade in my gas-guzzling car if the range of ZEVs improved and if more charging infrastructure were available throughout the state. The SAFE Vehicles Rule causes direct and severe harm to me personally. I am concerned that my health will continue to suffer and get even worse, and that my quality of life cannot improve. I suffer emotional distress knowing that the 2012 Vehicle Rule has been withdrawn and has been replaced by the less stringent SAFE Vehicles Rule.

21. The announcement of the SAFE Vehicles Rule has deprived me of

vital information, including: an analysis of the environmental and health impacts of the proposed rule; an evaluation of scenarios with stricter fuel economy standards; the rationale behind the inclusion or exclusion of certain scenarios or assumptions; the effects of this proposed rule on federal and state air pollution control efforts; and the impact(s) to federally-listed or critically-imperiled species and habitats. Furthermore, the SAFE Vehicles Rule has limited my ability to effectively communicate with others about this action so it might be stopped, or to rely on the Center to do so. As such, the lack of information has harmed my procedural rights as a citizen and a member of the Center.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on January 5, 2021 at Fresno, California.

Janet DietzKamei

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

COMPETITIVE ENTERPRISE INSTITUTE, *et al.*, *Petitioners*, v. NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, *et al.*, *Respondents*.	)	No. 20-1145

DECLARATION OF CHRISTOPHER FLEMING

1. My name is Christopher Fleming. I am a member of Public Citizen, Inc.

2. I am a member of Public Citizen because I support its efforts to advocate for consumer interests, including interests in products that protect people and the environment and save consumers money.

3. My wife and I currently have a 2011 model car that we expect to give to our son, who is now 15, when he is old enough to drive on his own. As a result, we expect to replace that car with a new vehicle sometime in the fall of 2021 or in the next few years after that.

4. When buying a new car, it is important to my family that we choose one that is environmentally friendly and that has lower emissions of greenhouse gases that contribute to global warming. It is also important to us to have a car that gets good gas mileage so that we have to refill it less often and spend less at the pump. When we purchase our next vehicle, we would like a broad range of choices of cars with low emissions and good gas mileage.

5. I believe that government rules that require auto companies to sell lower-emission, higher-mileage vehicles protect my interest in having a wide range of choices of those vehicles when the time comes to buy our new car. For the same reason, changes to those rules that allow higher emissions and less fuel economy harm me by limiting my choice of low-emitting, high mile-per-gallon cars.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 28, 2020.

Chris Fleming

Christopher Fleming

DECLARATION OF KIM FLOYD

I, Kim Floyd, declare as follows:

1. I am over 18 years of age and competent to give this declaration. I have personal knowledge of the following facts, and if called as a witness could testify competently to them. As to those matters which reflect an opinion, they reflect my personal experience, opinion and judgment on the matter.

2. I live in Palm Desert, California, in Riverside County.

3. I am a member of the Sierra Club and have been for 30 years. I joined the Sierra Club to protect the environment, plant and animal species. I am currently the Conservation Chair for the San Gorgonio Chapter which covers Riverside and San Bernardino counties, and have served in that position for eight years. As Conservation Chair, I address a myriad of issues, including these two counties' bad air quality and environmental issues in the Salton Sea. I am also part of the Sierra Club Desert Committee which focuses on protecting desert areas in Southern California. Air quality is a significant issue for our chapter.

4. I am concerned about climate change for many reasons. Climate change is altering the living environment for humans and species that I am working to protect here in the desert. The species I watch in particular include the desert tortoise, the horned toad lizard, the Joshua tree and many other plant species, some not yet even catalogued, and I have observed and studied them for many years. I frequently go hiking to visit, observe and enjoy these species in Joshua Tree National Park, the Chocolate Mountains and the Mojave Preserve, all in the vicinity of where I live. These activities give me great aesthetic enjoyment, and I have firm plans to continue my visits, observations and studies throughout this year and hopefully for many years to come. The science is clear that these and other species are being directly and negatively affected

by climate change. The Joshua tree itself is projected to become extinct in the Joshua Tree National Park within the next 30 to 40 years through extreme weather conditions unless greenhouse gas emissions are reduced. The impact of climate change on this natural environment and its many species makes me anxious, and I fear that I will soon be unable to enjoy observing and studying them.

5. Climate change is also exacerbating the poor air quality where I live. Greenhouse gases help form ground-level ozone, brings increased temperatures and is now causing very cyclical and atypical rain events. The patterns for rain in the desert have changed significantly over recent years; we now have heavy rainfall all at once, instead of small amounts of rain multiple times during the year. These large rain events cause dangerous floods in our area once or twice a year. Though some flooding is normal in desert, the heavy rainfall we now experience causes much more damage and can severely erode the land and harm plant species.

6. The poor air quality in our area is in large part the result of emissions from the heavy traffic on our roads. Fossil fuel-driven vehicles emit large and fine particulate matter, nitrous oxides and sulfur dioxides, along with greenhouse gases; they foul the air and are terrible for the health of our communities, especially those with asthma.

7. I am particularly concerned about the role of the transportation sector in causing climate change and unhealthful air. In California, we already have significant air quality problems, including where I live and in adjacent areas, much of it caused by vehicle emissions. The pollution from vehicles has gotten worse over time and is exacerbating air quality issues, including ozone and particulate matter pollution. Riverside County is listed as a nonattainment area for these pollutants under the National Ambient Air Quality Standards, meaning that ozone and particulate matter levels here are unhealthy.

8. The poor air quality in Riverside County impairs my enjoyment of outdoor recreational activities. I have been hang gliding twice a week between the months of May and November since 1992 and have firm plans to continue to do so for as many years as possible. The poor air quality is obvious from high in the air. While hang gliding, I can see the darkness from the large amounts of pollution in the air, and it obscures the views. This haze is visible up to about 5,000 feet above sea level. The aesthetics of hang gliding are significantly affected by air pollution, and I am very concerned and troubled that things will only get worse if pollution from vehicles isn't significantly controlled, and that I may have to stop this activity in the future because the air quality will not improve or get even worse.

9. I also feel a tightness in my lungs while breathing in the afternoons and evenings near the City of San Bernardino. When I can see and feel that the air quality is bad here in the desert, I stay indoors in order to avoid triggering tightness in my lungs, but I cannot always prevent this from happening. I am also concerned about my grandchildren, and future generations broadly, because they have been living with poor air quality their whole lives. I worry that they will continue having to live with poor air quality and poor health outcomes unless we make drastic changes to reduce emissions from the transportation sector by cleaning up emissions from automobiles and light trucks.

10. I am very interested in making electric vehicles more widely and readily available for purchase so that both greenhouse gas and other harmful pollution from vehicles will be reduced and eventually stopped. I know that California has set a mandate for automakers to sell a certain percentage of zero emission vehicles (ZEV) per year, and I was very pleased that California has done so. Growing sales of EVs will begin to displace fossil fuels and lead to much better air quality as long as the program remains in place.

11. I am aware that the National Highway Traffic and Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) have issued a rule declaring that California is preempted from setting ZEV mandates and its own greenhouse gas standards, and that has also revoked California's Clean Air Act waiver which permitted these regulations. The rule also prohibits other states from adopting California's standards for themselves. I am extremely concerned about this. California has always led the nation on air quality matters, and other states have been able to follow California's example and bring the same measures to their own states. But NHTSA's and EPA's rule also prevent other states from taking those actions. Undoing California's and other states' ability to set ZEV mandates and greenhouse gas standards will increase greenhouse gas emissions, levels of ozone, particulate matter, and other harmful pollutants, which will only make my area's air quality worse than it otherwise would be. In turn, that will interfere with my enjoyment of hang gliding and continue or create even greater reductions in visibility because of vehicle pollution, and it may make me quit altogether. The roadside pollution will affect the species I care for and study as well. I am additionally concerned that stopping California's ZEV mandate and greenhouse gas standards will result in fewer electric vehicles coming to market. If that happens, I worry that the air quality where I live will get worse.

12. I am also aware that recently, NHTSA and EPA have revoked current fuel efficiency and greenhouse gas standards for the entire nation's passenger cars and light trucks, and have supplanted them with very weak standards that allow an enormous amount of additional fuel consumption and the harmful pollution that comes from it. This will exacerbate the poor air quality that causes me tightness in my lungs and interfere with my enjoyment of the desert and its species and my hang gliding activities. The environmental degradation and all the

effect it has on my health and my environment will become that much worse. Such weak standards also provide no incentives for the development of more and better EVs, which will become even less available than they are now.

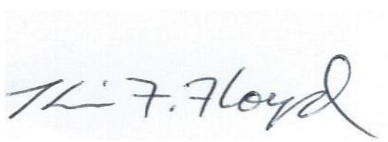
13. I understand that NHTSA did not prepare an environmental impact assessment for the rule prohibiting California's ZEV mandate and greenhouse gases, and that the impact statement for the weakened rule for national standards failed to consider and evaluate any alternatives that would actually lessen the environmental burdens caused by fossil fuel vehicles. These failures deprived me and others of important information about how to reduce the harms vehicle pollution causes me, as I have described, and prevented Sierra Club and others from commenting on them.

14. I support Sierra Club's lawsuit to overturn the rule declaring that California may not set ZEV or greenhouse gas standards and that its waiver to do so is revoked, and that other states may no longer follow California's rules. I also support the lawsuit seeking to overturn the new, much weaker fuel efficiency and greenhouse gas rule for the entire national vehicle fleet. If the court overturns either of these rules, I would directly benefit from improved air quality because reduced vehicle pollution would allow me to continue and enjoy hang gliding, and would improve my enjoyment of the aesthetics of what I can see from high in the air and slow the dangers facing the desert species I care for and enjoy. I also believe that the tightness I feel in my lungs would begin to lessen. Striking down the rule preventing California's ZEV mandate and separate vehicle greenhouse gas standards would assist the continued proliferation of electric vehicles and would have a significant positive impact on air quality and greenhouse gas emissions where I live, in California and elsewhere; it would help us mitigate the terrible climate disaster we are all facing. An order by the court striking down either of these rulemakings and

requiring NHTSA to prepare proper environmental assessments would give me the information I need and am entitled to. And restoration of California's ability to issue ZEV mandates and its own greenhouse gas standards would increase the availability of electric vehicles where I live and reduce emissions.

I declare under penalty of perjury that the foregoing is true and correct.

Dated: May 18, 2020, at Palm Desert, California.



Kim Floyd

DECLARATION OF ESTHER GOOLSBY

I, Esther Goolsby, state and declare as follows:

1. I am forty-three years old. Other than 10 months in Arizona, I have lived in Oakland, CA for my entire life. Oakland is a city in Alameda County. My address is 1144 82nd Ave, Oakland CA 94621.

2. I am currently a core member of Communities for a Better Environment (CBE). I joined CBE as a member in 2011 and was also a CBE staff member for three years. I decided to join CBE after taking one of their toxic tours. Even though I had lived in the same place for twenty years, I did not realize that there were toxic facilities surrounding my neighborhood. The toxic tour changed my life and I decided I had to become involved.

3. I spend a lot of time outdoors. I'm typically outside on a daily basis for more than eight hours. I mostly spend time with my community, talking and getting to know people. I also volunteer at the community garden and spend a lot of time gardening. When I worked for CBE, I spent a lot of time outdoors organizing.

4. Because of coronavirus and my health status I currently stay at home, but I plan to continue these outdoor activities when the pandemic ends.

5. I am very concerned about climate change - the state of our climate is an emergency. One very clear sign of that is that wildfires are getting worse. In my neighborhood, the smoke from the last wildfires was so bad that here on my street

we could not even see the cars in front of us. I took a lot of photos in my community, and around Oakland, just surrounded with smoke.

6. I was a CBE staff member when the last two fire seasons happened. We were like emergency responders, passing out masks to the unhoused communities and to our members. Thinking about the community being affected by the smoke was heavy and took an emotional toll on me. Working for an environmental justice group, we know there are so many toxins in the air that affect our development and affect us long-term, even when the air is invisible. But when wildfires happen, we know that that is when other people are suddenly paying attention. For me and my community, wildfires are making bad air quality even worse.

7. I suffer from asthma and Chronic Obstructive Pulmonary Disease (COPD), so breathing is almost always a problem. The wildfires and the heat exacerbate my health issues and there have been times where I have been outside and have felt like I was going to pass out. My asthma and COPD were worse in the wildfire smoke. You wear a mask even when it restricts your breathing, you wear it anyway because the air is so bad.

8. After the 2018 fires, in May of 2019, I had to go to the hospital because I was having trouble breathing. I had never been treated for not being able to breath before, but the previous fire season had an effect on my breathing. Just knowing

that my lungs are not in a position to handle more fires in the future has taken a toll emotionally.

9. Wildfires are not the only sign of climate change I see. I have noticed the effect of climate change on my neighborhood and my home. My home is shifting and there are backyard floods, so I am trying to fix it now by filling the yard with more dirt. I have also noticed that both of the exit routes from my neighborhood to the closest freeway get flooded in the big rainstorms, so it is harder for me and my neighbors to leave.

10. I also live in an area that does not have many trees, so we get the urban heat island effect. The hot asphalt smells and vapors come up off it. I also live near a lot of polluting industry, like foundries. When the heat happens, it makes everything worse. It makes it very hard to breath. I worry for the children with developing bodies at the elementary school near me.

11. My home does not have air conditioning, and I live on the top floor of the building. This means that heat incidents, when I am forced to be inside, are extremely uncomfortable and unhealthy for me.

12. I go to the Martin Luther King Jr. Shoreline to enjoy the wildlife and the plants, and I worry what climate change will do to the area.

13. My asthma gets worse during heavy traffic too. I live right down the street from International Boulevard, which is always busy with traffic. They took out a

lane of traffic to make a bus route, and you cannot make certain left or right turns, so the cars move even slower now. Sometimes the cars hardly move on International, and it causes drivers to take other streets to avoid the traffic. Drivers come down my street, which is a narrow residential street.

14. I am concerned that increasing emissions from cars will cause health problems for me and my family. I believe that pollution, wildfires, heat, and climate change are all affecting me. Not being able to afford the medication I need and not having insurance is a fear right now.

15. I have had to change my behavior because of all the pollution. I bought masks after the first wildfire and have them on hand all the time. If there is even more pollution from cars I would not to be able to go outdoors as much.

16. I bought an air-filtration system, but it is currently in my mother's home because she suffers from emphysema and asthma. I cannot afford to purchase another one, so I am very concerned about increases in pollution from cars and about climate change impacting me in my home.

17. Depending on grants or if I could afford one, I would buy an electric or hybrid vehicle.

18. If we do not change anything to slow climate change, and just keep going how we are, it is just going to keep getting hotter and wildfires are going to happen more. Knowing how the future looks and projections of wildfires and climate

change is an everyday psychological strain. Learning of my health issues and trying to advocate and still be out there, being able to breathe is a life and death situation for me. That is what this climate and this environment is doing – taking away that ability from me. It is very emotional. I have the whole understanding of the people making these decisions and they are not the people who suffer the trauma of the impacts. I am not saying that they do not care, but we should do some trading places some time so they can breathe the air where I live.

I declare that the foregoing is true and correct to the best of my knowledge and belief.

Executed this 18th day of June 2020, in Oakland, California.

/s/ Esther Goolsby (by permission)
Esther Goolsby

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

COMPETITIVE ENTERPRISE INSTITUTE, *et al.*,

Petitioners,

v.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, *et al.*,

Respondents.

No. 20-1145

DECLARATION OF MEL HALL-CRAWFORD

1. My name is Mel Hall-Crawford. I am the Director for Energy Programs at Consumer Federation of America ("CFA"). In that capacity, I am responsible for CFA's work advocating for energy efficiency standards that benefit consumers.

2. CFA is an association of more than 250 nonprofit consumer organizations that was established in 1968 to advance the consumer interest through research, advocacy, and education. Many of our member organizations are themselves membership organizations whose members are individual consumers. Our research, advocacy and education efforts seek to advance the interests of those consumers.

3. We have long supported energy efficiency standards for products of many kinds, including motor vehicles. CFA has participated in dozens, if not hundreds, of efficiency rulemakings, regulatory negotiations, and legislative hearings involving large and small energy using durables, ranging from automobiles to heavy-duty trucks, air conditioners, furnaces, water heaters, computers, and light bulbs. With respect to motor vehicles, we have been involved in advocating stringent fuel-economy standards for over a dozen years, and have submitted filings to and testified before both federal and state agencies including the Environmental Protection Agency (EPA), the National Highway Traffic Safety Administration (NHTSA), and the California Air Resources Board. In particular, CFA submitted comments in the joint EPA-NHTSA rulemaking that led to the standards at issue in this case.

4. Consumers, including individual members of CFA's constituent organizations, benefit financially from fuel-economy standards, which result in savings in fuel expenditures over the lifetime of a vehicle that substantially exceed any resulting increases in vehicle prices. Increases in the stringency of fuel-economy standards benefit consumers by increasing the availability and range of choices of high fuel-

efficiency vehicles in the market. Less stringent standards harm consumers, including members of CFA member organizations, who have an interest in purchasing fuel-efficient vehicles by limiting the range of choices of such vehicles available in the market.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 28, 2020.

Mel Hall-Crawford

Declaration of Brett Hartl

I, Brett Hartl, declare as follows:

1. I have personal knowledge of the matters asserted in this declaration, and if called upon to testify would state the same.

2. I have been a member and employee of the Center for Biological Diversity (the "Center") since 2013. I currently serve as the Center's Government Affairs Director.

3. I earned a Bachelor of Arts in Conservation Biology from Prescott College. I earned a J.D. from Lewis and Clark Law School.

4. Currently, I live in Prescott, Arizona.

5. As a result of my background and training in conservation, I consider myself an amateur naturalist. I look for, photograph, and record videos of wildlife, both in the United States and around the world. Looking for wildlife is my deepest passion and my main personal pursuit, and I go looking for wildlife almost every week of the year, and more so during key migration periods in the spring and fall. Thus far, I have observed 400 species of mammals and 3,400 species of birds around the world. While I try to view new species, I also try to obtain photos and videos of species that I was unable to capture images of in the past. I view and share my photos and videos with my friends, colleagues, and the general public in

various ways, including through my YouTube channel, which has over 1,000 subscribers.

6. As a conservation biologist and lawyer who has dedicated my career to preserving wildlife, I also take great professional satisfaction in observing the diversity of wildlife that remains extant due in part to my efforts and the efforts of those in the conservation community.

7. As a member of the Center, I support its efforts to secure a future for all species, great or small, and to prevent development, pollution, and climate change from driving species extinct. I have dedicated my life to the preservation, protection, and restoration of endangered species, functioning natural ecosystems, and a healthier planet.

8. I am particularly interested in viewing threatened and endangered species in their natural habitats. Among the endangered species I have viewed that are harmed by climate change or acid rain are several Hawaiian songbirds, including the puaiohi, akikiki, 'akeke'e, ‘ākohekohe, kiwikiu, ‘akiapōlā‘au, and ‘i‘iwi, the piping plover, the snowy plover, the whooping crane, and the Shenandoah salamander.

9. I am very concerned that the weakening of standards for new automobiles and light trucks under the Safer Affordable Fuel-Efficient Vehicles Rule (the “Rule”) will cause an increase in both conventional pollutants like sulfur

pollution and greenhouse gas emissions. I understand that the Rule will add over 900 million metric tons of carbon emissions to the atmosphere through Model Year 2029, compared to the standards that were previously in place. In addition, I understand that the Rule will add over twenty-two thousand metric tons of sulfur pollution to the air through Model Year 2029, over and above existing standards. I believe the Environmental Protection Agency's and the National Highway Traffic Safety Administration's complete failure to consider and consult on the Rule's effects to threatened and endangered species will have dire and even irreversible consequences for many species, and thereby will negatively impact my ability to view and enjoy these species.

Hawaii songbirds

10. I started becoming engaged with Hawaii songbirds in my first job after college. In 2005, I worked on the Kauai Endangered Bird Recovery Team. As part of that job, I released captive-bred puaiohi — also known as the small Kauai thrush — into the Alakai swamp in an attempt to augment the remaining wild population. The puaiohi still to this day has a wild population of just a few hundred individuals. I also conducted forest bird surveys of the other native species found in the high country of Kauai, including the ‘i‘iwi, akikiki, and 'akeke'e. I have returned to the Hawaiian Islands — including Kauai, Oahu, Maui, and the Big Island — at least a dozen times since working there. I intend to return to Hawaii in

2021 if the state lifts its quarantine and it is safe to travel. If not, I will return again in 2022 to observe the islands' native songbirds.

11. Hawaii's songbirds have been pushed towards extinction primarily through the spread of avian malaria, which is carried by non-native mosquitos. Warming temperatures play a key role in the spread of these mosquitos. Many species, like the puaiohi, used to be found all the way down to sea level, but have retreated to the last cool, mountainous areas on each island where mosquitos have not been as prevalent. However, even since 2005, as temperatures have slowly warmed in Hawaii, mosquitos have moved higher and higher into the mountains of the islands, spreading avian malaria more and more.

12. If temperatures continue to rise because of climate change, mosquitos will spread to even higher elevations. In 2005, when I would go birdwatching in the Alakai swamp on Kauai, it was normal in a given day to see dozens of ʻiʻiwi, ten or more 'akeke'e, and a few akikiki if you were lucky. Since 2005, the population of all three species has crashed, and all of them have been subsequently listed as endangered or threatened. During my last two trips to Kauai in 2018 and 2019, I didn't see any 'akeke'e or akikiki, and saw just one individual ʻiʻiwi in the Alakai swamp.

13. On Kauai, the situation is particularly acute because the highest point is now within the malaria zone, and the 'akeke'e, akikiki, ʻiʻiwi, and puaiohi will

likely be extinct — or relegated to captivity — within a decade. I am deeply disturbed and upset that for these four species, they may already be so rare that I may never see them again in the wild if climate change is not addressed.

14. The situation on Maui and the Big Island is only slightly better than Kauai because the islands are higher in elevation and there are a few refugia where mosquitos have not quite reached. Nonetheless, on my last visit to Maui in February of 2020 to the Waikamoi forest, I only observed one ʻākohekohe and did not see any kiwikiu. A recent attempt to translocate kiwikiu to a different part of Maui completely failed due to mosquitos. As a result, the kiwikiu could be reduced to captivity within a decade or two. On the Big Island, there are likely to be less than 1,000 ʻakiapōlāʻau left, and the species continues to decline. I only saw one the last time I visited the Hakalau Forest National Wildlife Refuge in 2016, and this species continues to decline as the mosquitos spread. I am very concerned that climate change and warming temperatures will make it very difficult to see any of these species, which will diminish my aesthetic and recreational interest in observing Hawaii's songbirds.

Snowy and Piping Plovers

15. I have periodically lived in and visited the San Diego area almost every year since 1997, most recently in January of 2020. My favorite birdwatching location in that area is San Elijo Lagoon, near Solana Beach, and I will return there again in January 2021. During the winter months, the cobblestone beach sections at the west end of the lagoon are excellent habitat for snowy plovers, and I have viewed plovers there many times. Here is a photo of a snowy plover on the beach that I took in 2010; it is still one of my favorite pictures I have ever taken:

16. On the east coast, I have observed piping plovers many times, including at Delaware Seashore State Park in Delaware, which I visit at least once a year to observe migrating shorebirds and raptors. I visited Delaware Seashore in May of 2019, and I intend to visit again in the summer of 2021 if it is safe to travel. Otherwise, I will visit again in the summer of 2022.

17. For both the snowy plover and the piping plover, these birds spend almost all of their lives on coastal beaches, only a few meters above sea level. At San Elijo Lagoon, the beach is already hemmed in by the highway, and during very high tides, the beaches are almost gone. As sea levels rise more, these beaches continue to shrink, leaving fewer places for snowy plovers to forage during the winter. Similarly, the Delaware Seashore State Park is a coastal barrier island that is especially vulnerable to coastal erosion from sea level rise and increased storm frequency, and the piping plovers are at risk of losing their home. I am very concerned that it will be harder to observe the snowy plover and the piping plover in the future if climate change is not addressed and sea levels continue to rise.

Whooping Crane

18. I traveled to coastal Texas, specifically in and around Aransas National Wildlife Refuge, to view whooping cranes in 2003, 2010, 2014, and most recently, in 2019. I plan to return again to coastal Texas in 2021 if it is safe given the COVID pandemic, but otherwise I will return in the winter of 2021-2022 to try to observe whooping cranes and other coastal species.

19. Whooping cranes are threatened both by climate change and by acid rain. Acid rain is a threat to whooping cranes on their wintering grounds, along the crane's migration route, and in their summer breeding grounds. Whooping cranes feed primarily on aquatic invertebrates, which are sensitive to decreased pH levels

caused by acid rain. If the prey of whooping cranes diminishes or disappears, this could have extremely serious consequences for the crane's population.

20. The only wild migratory flock of whooping crane winters in and around Aransas National Wildlife Refuge. The coastal marshes that contain the blue crab — the crane's favorite food item — are only a few feet above sea level, and are also vulnerable to hurricane and storm damage. If sea levels rise, much of the crane's wintering habitat and its main prey, the blue crab, will disappear, and surrounding development outside of the refuge would leave the whooping cranes without a winter home. For these reasons, I am very concerned for the future of the whooping crane and my ability to observe cranes in the wild in the future.

Shenandoah Salamander

21. I visited Shenandoah National Park many times between 2011 and 2017, when I lived in Washington, D.C. During that time, I would take at least one weekend summer camping trip every year to the park. During those trips, I would search for salamanders at night inside the park, since the Appalachian Mountains have some of the highest salamander diversity and abundance anywhere in the world. The Shenandoah salamander is one of the most challenging species to observe because it is nocturnal, lives only in the highest mountain areas of the park, and unlike with other salamanders, visitors are not permitted to flip over logs or rocks to look for it because it is an endangered species. Instead one must wait on

nights with high moonlight and hope to spot one. I have seen one Shenandoah salamander, in 2015, but would like to observe them again, and hopefully take photographs of them. I will likely return to Shenandoah National Park in the summer of 2021 assuming it is safe to travel.

22. The Shenandoah salamander is only found in very restricted habitats at the top of the highest mountains in Shenandoah National Park and is threatened by both acid rain and climate change. Acid rain is one of the primary threats to the salamander, which can harm the salamander's food supply, impair reproduction, and make the soil so acidic that it kills young salamanders. Furthermore, because salamanders feed preferentially during rainy and foggy weather, they are susceptible to impacts from acid deposition on their skin.

23. The Shenandoah salamander already is restricted to the highest parts of Shenandoah National Park. Much like the birds in Hawaii discussed above, the salamander is already at the top of the mountain and cannot escape any higher to avoid the heat as temperatures continue to increase with climate change. Over time, the remaining habitats will simply become uninhabitable. I am disheartened that these threats will continue to harm the salamander, making it harder for me to observe them again in the future.

24. I derive significant recreational and aesthetic benefits from seeing and photographing rare species in the wild. My ability to view and enjoy these species

is entirely dependent on the continued existence of the species. Any federal agency action — including the decreasing of vehicle emission standards — that harms these species or the habitat areas on which they rely also harms my interest and enjoyment in viewing the affected species.

25. My interests in observing and protecting imperiled species and the habitats they rely on would be not be harmed if the Environmental Protection Agency and National Highway Traffic Safety Administration had fully taken into account and consulted with the nation's wildlife experts on the impacts of the Rule. This includes the Rule's impacts on endangered and threatened species because of climate change (for example, warming temperatures and sea level rise), as well as impacts caused by higher emissions of conventional pollutants causing acid rain.

I declare under penalty of perjury that the foregoing is true and correct.

Signed on November 16, 2020, in Prescott, Arizona.

Brett Hartl

DECLARATION OF ELIZABETH KOENIG

I, Elizabeth Koenig, state and declare as follows:

1. I am over 18 years of age and competent to give this declaration. I have personal knowledge of the following facts and, if called as a witness, I would testify competently to them. As to those matters that reflect an opinion, they reflect my personal opinion and judgment on the matter.

2. I live in Redmond, Washington, and I have lived here since 1994. I have lived in the Seattle area since 1984. I am retired. Before retiring, I worked as a registered nurse.

3. I have been a member of Environment America since 2004. I became a member of Environment America because the health of our planet is in decline and we need to do something about it. There is power in numbers, and individual citizens can have more of an impact if they join together in a group.

4. I have a respiratory condition called chronic allergic asthmatic bronchitis, which is affected by both pollens in the air and also air quality. Through the years, my condition has steadily gotten worse. What used to be only a springtime irritant now lasts through most of the year. Previously, I was diagnosed with acute asthmatic bronchitis because it only affected me during the spring. On September 6, 2019, I was diagnosed with chronic allergic asthmatic bronchitis because the condition now affects me all year long. My primary care physician has told me that my condition is caused by allergies and air pollution.

5. My condition requires the daily use of a medically-prescribed inhaler to stop the chronic bronchospasms and cough. I use a cortisone inhaler to keep the inflammation down. I don’t like having to take medication. I take an antihistamine for allergies, and I also drink lots of water to keep my bronchial tubes from becoming too dry.

6. The increasing air pollution in what used to be an area with rather clean air has definitely impacted my quality of life. I love to sing, but now I have a hard time singing because of my condition. I have a hard time breathing if I haven't had enough water. I love to exercise and walk in the woods, but I can't do it too much now without experiencing difficulty breathing and endangering my blood pressure. My blood pressure is affected because my condition causes my lungs to take in less oxygen so my circulatory system has to work harder. I also enjoy gardening but I am unable to garden as much as I would like to because of the increased severity of my condition.

7. In addition, I have been negatively affected by the smoke and ash from wildfires. The smoke negatively affects my condition and makes it more difficult for me to breath. Both the smoke and ash act as bronchial and pulmonary irritants, which cause inflammation in the bronchial tubes making breathing difficult. There were several days during last year's wildfire season when the smoke was so thick that it obliterated the sun. Also, there were several days last year when ash was falling from the sky, and our air quality was deemed "poor." Outdoor events were cancelled or held indoors. Team practices, my granddaughter's outdoor marching band camp was delayed, and people, especially those with respiratory conditions, were advised to stay indoors. The poor air quality was an issue for weeks.

8. I know that air pollution from cars is damaging our environment. I drive a hybrid vehicle to reduce the amount of emissions from my vehicle. I know that the Obama administration put in place good clean car standards and that the Trump administration is trying to rollback those standards, which, if implemented, will increase the amount of air pollution from cars. I support Environment America's efforts to keep strong clean car standards in place.

I declare under penalty of perjury that the foregoing is true and correct.

DocuSigned by:
Elizabeth Koenig
5760EF7C306F436...

5/31/2020

Elizabeth Koenig
Redmond, Washington

Date

**IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT**

COMPETITIVE ENTERPRISE INSTITUTE, *et al.*, *Petitioners*, v. NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, *et al.*, *Respondents*.	No. 20-1145

DECLARATION OF IRENE E. LEECH

1. My name is Irene E. Leech. I work as an Associate Professor of Consumer Studies at Virginia Tech in Blacksburg, VA. I am an officer of the Consumer Federation of America ("CFA") serving as a Vice President. I have also long been a member of, and am currently President of, the Virginia Citizens Consumer Council (VCCC), which is a member organization of CFA.

2. The VCCC is a membership organization representing the interests of Virginia consumers in a broad range of areas, including advancing the availability of economical, energy-efficient, and safe consumer products, including motor vehicles.

3. I personally expect to purchase a car in the time-frame covered by the 2021 through 2026 model years. My current vehicle has over 140,000 miles on it and will need to be replaced during that period. When I search for a car to purchase, its fuel efficiency is a major issue for me. Over the past 40 years I have been frustrated by the limited availability of high gas-mileage vehicles and have struggled to find mid-size vehicles whose mileage exceeds around 30 miles per gallon. I am interested in having a broad selection of fuel-efficient vehicles from which to select. Government standards that will reduce or limit the required fuel-efficiency of vehicles during the 2021 to 2026 model years will hurt me as a consumer by limiting the range of choices of high fuel-efficiency vehicles available to me in the marketplace during that time.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 29, 2020.

Irene E. Leech

Irene E. Leech

DECLARATION OF SEAN MAHONEY
FOR CONSERVATION LAW FOUNDATION

I, Sean Mahoney, hereby declare and state:

1. This declaration is based on my personal knowledge, information, and belief. I am over the age of eighteen years and suffer from no legal incapacity.

2. I am the Executive Vice President of Conservation Law Foundation (CLF), a membership-supported nonprofit corporation organized and existing under the laws of the Commonwealth of Massachusetts. I have held this position since 2013. I also serve as the Director of CLF's Maine Advocacy Center, a position I have held since 2007.

3. In my capacity as Executive Vice President, I am familiar with CLF's mission: to protect New England's environment for the benefit of all people. CLF uses the law, science and the market to create solutions that preserve our natural resources, build healthy communities, and sustain a vibrant economy.

4. Given my role as Executive Vice President, I also understand the nature and scope of CLF's organizational structure. Founded in 1966, CLF has its principal office at 62 Summer Street, Boston, MA. CLF also has offices in Maine, New Hampshire, Rhode Island and Vermont, and its members reside throughout New England and other states. CLF has more than 5,000 members.

5. CLF works on behalf of its members toward comprehensive long-term solutions to environmental challenges. Our members rely upon CLF to

advocate for and safeguard the health, quality of life, and economic prosperity of our communities for generations to come, with a priority of meeting the challenge of climate change. CLF engages in federal and state regulatory and legislative advocacy as well as policy development and litigation to work toward a healthy climate and resilient communities across New England.

6. One of CLF's areas of focus is reducing emissions from the transportation sector to avert the worst impacts of climate change and protect public health. Across the country, the transportation sector is the greatest source of greenhouse gas emissions. In New England, the transportation sector contributes an even higher percentage of overall greenhouse gas emissions. CLF's mission entails working to reduce vehicular emissions.

7. CLF's work aimed at reducing emissions from the transportation sector includes, for instance: writing to former U.S. Environmental Protection Agency (EPA) Administrator Scott Pruitt opposing the roll back of environmental safeguards under the Clean Air Act that reduce pollution from motor vehicles and engines; commenting to urge the Department of Transportation's (DOT) National Highway Traffic Safety Administration (NHTSA) to conduct a comprehensive analysis of environmental consequences of revisions to fuel standards; writing to DOT to oppose weakening rules regarding fuel efficiency and fuel consumption; and filing a Petition for Review, along with other plaintiffs, challenging the EPA

issuance of the Mid-Term Evaluation of Greenhouse Gas Emissions Standards for Model Year 2022-2025 Light-Duty Vehicles.

8. At the state level, CLF's advocacy aimed at reducing vehicular emissions includes, for instance: promoting zero emission vehicle legislative policies, including by submitting oral and written comments; serving on the Massachusetts Zero Emission Vehicle Commission to recommend policies increasing access to electric vehicle infrastructure; intervening in utility rate cases and other utility proceedings before state public utilities commissions to advocate for investments and rate structures promoting beneficial electrification of the transportation sector; developing regional transportation policy white papers; and submitting comments on state transportation plans. CLF regularly submits comments on rulemakings and challenges regulations by petition for reconsideration to the agency or by seeking judicial review in court.

9. I am familiar with *The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks*, 85 Fed. Reg. 24,174 (Apr. 30, 2020) (Final Rule). CLF joined other groups to petition for review of the Final Rule on May 27, 2020. *See* Cases No. 20-1168, 1169. CLF also joined other groups to move for leave to intervene in Case No. 20-1145, which the court granted on October 8, 2020. Document #1865427.

10. The Final Rule harms CLF and its members. The Final Rule will increase vehicular emissions of both greenhouse gases and harmful air pollution

caused by pollutants such as oxides of nitrogen, volatile organic compounds, fine particulate matter, and sulfur oxides, as well as hazardous air pollutants. CLF's members' injuries include economic and recreational harms from property damage caused by climate change. CLF's members' enjoyment of and investment in their homes and coastal property is threatened by the amplified storm surges and higher sea levels that are a result of climate change. Climate change directly threatens CLF's members' coastal property and homes.

11. The Final Rule also harms CLF's members that work in or own businesses in the electric vehicle or electric vehicle service equipment industries. The Final Rule will inflict economic harm on these members by depressing demand for their services.

12. Additionally, the Final Rule harms CLF's members by negatively impacting air quality in New England states, both by increasing air pollution levels and by contributing to climate change, which increases the number and severity of bad ozone days. This exacerbates symptoms of respiratory illnesses suffered by CLF's members, such as asthma.

13. The Final Rule harms CLF because it frustrates the organization's mission to protect New England's environment for the benefit of all people, which entails reducing vehicular emissions. The Final Rule will prompt CLF to expend resources to counteract its harms. The Final Rule will necessitate additional federal and state rulemakings and other actions to achieve New England states'

decarbonization targets and other climate change objectives. CLF will be forced to devote time and resources to petitioning for and participating in those rulemakings.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 23rd day of December, 2020, in Portland, Maine.

Sean Mahoney

DECLARATION OF GERALD MALCZEWSKI

I, Gerald Malczewski, declare as follows:

1. My name is Gerald Malczewski. I am over eighteen years of age, of sound mind, and fully competent to make this declaration. I also have personal knowledge of the factual statements contained herein.

2. I have been a member of the Union of Concerned Scientists since January 2017. I have participated in climate change awareness and policy initiatives through state and local working groups, such as the One Region Forward Initiative, which develops climate mitigation and infrastructure resiliency in the Buffalo Niagara region. I have also been an active participant in the Transportation and Climate Initiative (a multistate northeast corridor effort focused on reducing transportation related carbon emissions), participating in webcasts and a local workshop.

3. I am a veteran, and served in the United States Naval Reserve from 1963 to 1969, including active sea duty from 1965 to 1967.

4. I received a Bachelor's degree in Mathematics from State University College at Buffalo in 1971 and a Master's degree in Mathematics from Indiana University Bloomington in 1973. I was employed as an information technology professional for over 30 years, primarily at M&T Bank and HSBC Bank, as a

systems analyst and project manager. I also was an adjunct mathematics instructor for 14 years, teaching at Erie Community College and Medaille College.

5. I have been an avid alpine skier for 35 years, and have skied both at local ski areas and in New England, Utah, and Wyoming. I enjoy skiing for the continuous challenges it presents (even to experienced skiers), its proximity to beautiful outdoor scenery, its social dimension, and its lessons for balancing physical risks against their rewards.

6. I was a ski instructor in Kissing Bridge Ski Resort in Glenwood, New York, for 28 years, and I estimate that I have instructed thousands of skiers. It was immensely rewarding to watch my students grow more comfortable in their skills and physical capabilities.

7. I am a volunteer mentor for a physics course offered by Coursera, an online learning platform. I have some familiarity with climate change models and the factors that drive global warming.

8. I have serious concerns about the impact of climate change on future generations. I worry about my generation's failure to safeguard natural resources for future generations, particularly my grandchildren. Unless this country's government—and particularly the federal government—accelerate efforts to combat climate change, I fear my grandchildren will conclude that we failed, through lack of will and willful ignorance, and in spite of overwhelming scientific evidence, to take the difficult but necessary action to save the planet.

9. I am particularly concerned about the effects of climate change on the ski and snow sports industries. In my three decades as a ski instructor, I witnessed the ski season shorten and winter weather destabilize, with fewer periods of prolonged snow cover. Ski resorts have closed or invested in expensive snowmaking upgrades to mitigate the loss of customers. As ski seasons contract (or disappear completely), I will be further deprived of one of my most beloved hobbies.

10. I live in Lancaster, New York, about seventeen miles east of Buffalo. The region lacks well-developed rail networks and bus lines.

11. Driving a car is therefore my normal means of transportation. Collectively, my wife and I drive roughly 13,000 miles per year, primarily for medical and dental appointments, shopping, recreation, volunteering, miscellaneous errands, vacations, and periodic road trips to see family.

12. My wife and I lease two vehicles: a 2017 Toyota RAV4 and a 2019 Honda Insight (a gas/electric hybrid vehicle). We drive both vehicles regularly for each of the above purposes.

13. We would like to replace the RAV4 with a comparable but cleaner lease if the option was available and affordable. Eventually we would like to drive fully electric vehicles, but the lack of charging infrastructure in our area and the cost of electric vehicles makes ownership in the near term difficult.

14. If cleaner, more affordable options to lease or buy were available, we would replace one or both cars as soon as possible.

15. When we look to replace the RAV4, our priorities will be to minimize our carbon footprint, reduce emissions of other pollutants, and find an automobile that is safe, reliable, and relatively inexpensive.

16. My choice of clean cars and my skiing depends in part on the federal government's vigorous regulation of fuel economy and greenhouse gas ("GHG") standards for passenger vehicles, which collectively force the development of cleaner cars and drastically drive down global greenhouse gas emissions. The emissions reductions, in turn, slow global climate change and help preserve the ski season.

17. Conversely, loosening fuel economy and greenhouse standards will reduce the pressure on the automobile industry to ramp up production of hybrids, electric vehicles, and more efficient conventional vehicles, and will exacerbate climate change and its effects on local ski resorts.

18. I am aware that, in 2013, EPA provided California with waivers under the Clean Air Act, which allowed California to set its own GHG standards for light duty vehicles and to create a program to incentivize the purchase of "Zero Emission Vehicles," or "ZEVs." I am also aware that, under the Clean Air Act, other states could and did adopt California's programs. One of these states is New York.

19. Because of the widespread adoption of these programs, availability of low or zero emission vehicles—and related infrastructure—has increased nationwide, and particularly in states that have adopted California's standards.

20. If the standards remain effective, I will have greater access to such vehicles, since the trends related to California's standards will continue or accelerate. Likewise, New York's maintenance of California's standards will trim GHG emissions and thereby help to protect downhill skiing and other winter sports.

21. I am aware that EPA has finalized an unprecedented decision to revoke California's waiver and to prohibit other states from enforcing the California standards they have relied on for the better part of a decade. I am also aware that the Department of Transportation has suddenly decided that its regulatory authority prevents EPA from issuing these waivers in the first instance, thereby barring EPA from enforcing any waivers it has granted and not withdrawn.

22. If the federal government consummates these actions—or lowers federal GHG or fuel economy standards—it will meaningfully undo and foreclose nationwide progress towards a wider availability of low or zero emissions vehicles. In so doing, it will curtail my access to the types of vehicles I most want to

.

purchase when replacing the cars I currently drive. Lower state and federal standards would also accelerate the regional effects of climate change, including the adverse effects in snow sports.

I declare under penalty of perjury that the forgoing is true and correct.

Executed in Lancaster, New York on MAY 27, 2020.

[signature]
Gerald Malczewski

DECLARATION OF MOLLIE MATTESON

I, Mollie Matteson, declare as follows:

1. I have personal knowledge of the following facts and if called as a witness could and would testify competently to them. As to those matters which reflect an opinion, they reflect my personal opinion and judgment on the matter.

2. I reside in Richmond, Vermont.

3. I have been a member of the Center for Biological Diversity ("the Center") for thirteen years. I actively participate as a Center member by signing onto the organization's action alerts, attending its advocacy events, and reading membership newsletters and related media. I support the Center because it is effective at protecting endangered species and the places they need to live. I care deeply about all wildlife and plant life and other life on the Earth, and I rely on the Center to represent my interests.

4. I am currently employed as an eco-therapist, for which I spend abundant time outdoors professionally. I previously worked as a senior scientist in the Endangered Species Program at the Center, where I focused on protecting forests, particularly on public lands, that provide habitat for species I care about. I have an undergraduate degree in zoology and natural history, and I earned my master's degree in wildlife biology in 1992. I am also an avid outdoors person and spend much time hiking, canoeing, and otherwise enjoying the forests, lakes, and

rivers of the northeastern United States, primarily Vermont and New Hampshire.

5. I regularly take canoeing trips in the streams and rivers of Vermont and New Hampshire. I plan to continue to use and enjoy the upper Connecticut River watershed in Vermont and New Hampshire on a regular basis. My last trip was in 2017. I plan to return in the spring of 2021 if it's safe to travel despite the coronavirus.

6. One of the species that I have particular interest in when I visit the water bodies and ecosystems in the upper Connecticut River watershed is the dwarf wedgemussel. The dwarf wedgemussel is a very rare and very small clam-like creature that is earthen-colored. It is the only North American freshwater mussel that consistently has two lateral teeth on the right valve but only one on the left. The beautiful dwarf wedgemussel was listed as an endangered species under the Endangered Species Act in 1990. One of the factors imperiling the mussel is acid rain. Although it once could be found from northern Canada all the way down to North Carolina, the dwarf wedgemussel's range has been severely truncated and can only be found in a number of small sites across the Northeast. The dwarf wedgemussel is both federally- and state-listed as an endangered species in Connecticut, Vermont, and other Northeast states.

7. When I take these recreational trips to canoe in the upper Connecticut River watershed, I am aware as to whether dwarf wedgemussels are present in the

rivers and streams. I derive great recreational, aesthetic, and spiritual value from knowing that dwarf wedgemussels are present and from being able to be in ecosystems that are intact due to the species' presence. I have not seen them directly through my own observation because it's difficult to see them, as they inhabit the bottom of streams and rivers. However, I am aware that the dwarf wedgemussel is present because the quality of the water differs depending on their presence. When dwarf wedgemussels are present and can carry out their filter-feeder functions, rivers and streams are clear. When they are not present, the rivers and streams are dirty and murky. The species is an important indicator of healthy ecosystems and is the canary in the coal mine. Their presence in streams and rivers guarantees a high-quality landscape and beautiful environment.

8. I understand that this year the U.S. Environmental Protection Agency ("EPA") and the National Highway Traffic Safety Administration ("NHTSA") issued new emissions and criteria pollutant standards for passenger cars and light trucks (the "SAFE II Rule"). I have learned that the SAFE II Rule will increase sulfur pollution by at least 22,400 metric tons ("MT") over the lifetime of vehicles by 2029. I am also aware that the SAFE II Rule acknowledges that sulfur pollution damages ecosystems and biodiversity by removing vital nutrients and creating inhospitable conditions for animals, fish, and plants.

9. In learning of the Trump Administration's issuance of the Rule, I was

in shock and disbelief that the Administration would have the brazenness to roll back existing vehicle standards, which have already led to the type of acid deposition that I have witnessed.

10. I am deeply concerned the SAFE II Rule will increase acid rain and further decimate the dwarf wedgemussel populations in the upper Connecticut River watershed, which I love to visit. Acid deposition directly threatens the dwarf wedgemussel's survival by adversely impacting the streams and rivers which they inhabit. Specifically, acid rain that falls into, or is otherwise directed into, water bodies increases the acidity and pH levels of the water, which in turn negatively impacts the dwarf wedgemussel's ability to reproduce. In addition, acid deposition in these waterways negatively impacts the food sources for the dwarf wedgemussel. As a filter-feeder, the dwarf wedgemussel feeds on plankton, bacteria, and other small organisms by circulating them through its systems and straining them out of the water. Higher acidity levels due to acid rain have killed available food sources for dwarf wedgemussels, thus also imperiling the species.

11. Any increase in acid rain and deposition due to the SAFE II Rule may cause additional harm to the dwarf wedgemussel and render them more vulnerable. They are already divided into fragmented and small populations in the streams and rivers of the upper Connecticut River watershed. Any increases in acid deposition will increase their vulnerability. The more the dwarf wedgemussel populations are

disrupted, the more vulnerable the entire ecosystem becomes. I mourn the loss of dwarf wedgemussels in the upper Connecticut River watershed. My recreational, aesthetic, and spiritual interests in the dwarf wedgemussel are injured if dwarf wedgemussel populations decrease and if the ecosystems for which they are stewards fall apart and die.

12. I am also deeply concerned about the increased acid deposition resulting from the SAFE II Rule, which will generally impact the forests, lakes, and rivers in the northeastern United States in the form of acid rain. Living in the Northeast in general, and speaking as a wildlife biologist, we have already lost myriad species in this part of the country. Because this part of the country has long been settled by human development and its ecosystems have been mismanaged far more than any other part of the country, I feel very strongly that we need to protect the species that we have because they are already too vulnerable and so few. The dwarf wedgemussel is but one of several critically imperiled species that have already suffered the insults of rapid development and industrialization. The impacts of sulfur pollution only make these impacts worse.

13. I have personally witnessed the impacts of acid deposition on the species and ecosystems of the Northeast. For example, I live within 5 miles of a trail that goes to the top of Camel's Hump, one of the highest summits in Vermont, and the highest wild peak in the state, with only foot trails to the top. Some of the

earliest studies on acid rain and its impacts on forests were conducted on this mountain, by Professor Hubert Voglemann at the University of Vermont. I first hiked to the top of this mountain with my two sisters when I was a high school student. Some 15 years later, I carried my baby daughter on my back up to the summit of Camel's Hump. I now live, and have lived for the last 18 years, within a few miles of this mountain, and I usually hike to the summit once a year. I last climbed to the peak in July of 2019.

14. The forests on Camel's Hump, like all the taller peaks in the Green Mountains of Vermont, exhibit an abundance of dead trees at the higher elevations. I understand that frequent and prolonged exposure to acidic mountain fog, more than actual acid "rain," is what damages and kills these trees, primarily red spruce. For nearly 40 years, I have visited the forests on Camel's Hump and witnessed the toll acid deposition has taken on the health and diversity of its high-elevation forests. I have observed similar degradation of high mountain forests on all the Northeast peaks I have climbed, including summits in the White Mountains and a dozen or so of the highest peaks in the Adirondacks. I usually climb at least one or two of the 46 highest peaks in the Adirondacks every summer. I know that acid deposition remains an enormous problem for the high elevation forests of the Northeast. I feel a sense of sadness that so many years after I first learned of acid rain as a young person in college, this issue has not been resolved.

15. The SAFE II Rule would exacerbate these impacts because of the associated increase in acid deposition. The recreational, aesthetic, and spiritual value I find in the forests, rivers, and streams of the Northeast will be injured due to the SAFE II Rule.

16. In addition, I am very concerned by the impact of increased greenhouse gases on other species and ecosystems and by how the SAFE II Rule will further exacerbate that problem. I understand that the SAFE II Rule will increase carbon dioxide emissions by nearly *one billion* metric tons through model year 2029. This is over and above what the emissions under the previous standards would have contributed.

17. I am already witnessing and being impacted by climate change in Vermont. In particular, climate change and the associated increases in temperature and heat waves have impacted my personal health and mobility. The hotter summers have increased the spread of ticks and tick-borne disease. I have witnessed this change over the course of 18 years. We used to have zero ticks, but now we have ticks year-round. The pervasiveness of ticks has impacted my decision to go to certain areas and limits my outdoor mobility to high-elevation areas only. I need to constantly test myself and check whether I have ticks. Many friends have gotten Lyme disease, and I feel like it's only a matter of time for me. I live in fear of getting Lyme disease.

18. The change in weather and its lack of predictability also impacts my ability to feed my family. I am a gardener and grow a significant amount of food that my family eats. The change in climate and increased temperatures have led to a greater number of plant diseases and insects that feed on garden plants. This makes it harder for me to grow food. It is more difficult to predict what kinds of food to grow because of more erratic weather conditions and the greater burden of diseases and garden pests.

19. Finally, climate change has also impacted the recreational, aesthetic, and spiritual interests I have in observing moose and other species where I live in Vermont. When I first moved back here in 2002, I would view and enjoy seeing an abundance of moose populations. Eighteen years later, there are no sign of moose. The climate crisis has increased temperatures, and this has brought about an increase in ticks. Moose have died in significant numbers from an increase in winter ticks, caused by global warming. These ticks can deplete moose of blood to the point of death. Moose can also get brain injuries and die from the brainworm. The brainworm is a parasitic nematode that is more prevalent now because deer populations are increasing with increasing temperatures, and deer are the hosts for the brainworm. I feel very sad about the impacts of climate change on our biodiversity and how it has decimated and killed the species that I highly value for the preservation of our planet. It leaves us permanently in a place of impoverished

biodiversity.

20. The SAFE II Rule will increase greenhouse gases and thereby increase the climate emergency and its impacts on Vermont. These increases will injure my health, my ability to grow food, and the recreational, aesthetic, and spiritual values I hold in seeing moose living in a functional ecosystem.

21. I am also concerned about the impacts of the SAFE II Rule because the SAFE II Final Environmental Impact Statement ("FEIS") fails to provide accurate, complete information so that I may assess the impacts of the Rule. For example, the FEIS explains the phenomenon of acid rain, and states that the Rule could lead to "pollutant emissions that cause acid deposition" (FEIS at 7-7) but does not lay out how increased sulfur pollution from the Rule might impact listed species. In addition, EPA and NHTSA's failure to consult with the wildlife agencies before finalizing the Rule harms my interests and the dwarf wedgemussel, moose, and other animals, fish, and plants.

22. I rely on the Center to protect the species and ecosystems discussed above as well as my interests in them, including by bringing the current case challenging the SAFE II Rule.

I declare under penalty of perjury that the foregoing is true and correct and was executed on December 29, 2020, at Richmond, Vermont.

Mollie Matteson

DECLARATION OF JOYCE CLARK NEWMAN

I, Joyce Clark Newman, declare as follows:

1. I have personal knowledge of the following facts, and if called as a witness, I could and would testify competently to them. As to those matters which require an opinion, they reflect my personal opinion and judgment on the matter.

2. I reside on Big Pine Key, Florida, and have lived there since 1975.

3. I have been a member of the Center for Biological Diversity ("the Center") since 2007. I actively participate as a Center member by signing on to the organization's action alerts, endorsing its positions, and reading membership newsletters and related media. I support the Center because it is effective at protecting endangered species and their habitat. I care deeply about all wildlife and the interrelated natural systems that keep our planet in balance. I rely on the Center to represent my interests.

4. I have an abiding interest in wildlife and nature. I was born and raised in San Diego, California, and, from the age of seven until I graduated from high school, I spent almost every Saturday at the San Diego Zoo, thereby becoming intrigued with animals, their countries of origin, features of their native habitats, and what they need to survive.

5. I am a retired public-school teacher. I chose to live in the Florida

Keys on Big Pine Key, which is primary habitat for the endangered Florida Key deer ("Key deer") and home of the National Key Deer Refuge ("NKDR"), because it enables me to live close to nature. I bought a home within walking distance of Watson Hammock (a large, protected area within the NKDR containing tropical hardwood hammock, pine rockland, and freshwater marsh habitat types) to engage in wildlife viewing, birdwatching, and observing nature. I helped form the Key Deer Protection Alliance ("KDPA"), an advocacy and public education organization whose primary goal is to protect the Key deer and its habitat, serving as its first president (1989-1993). I currently serve on the KDPA Board of Directors. I founded and directed Florida Keys Discovery (1995-2000), a non-profit community educational project, which sponsored hundreds of free programs highlighting the endangered species and various unique environmental aspects of the Florida Keys; the sessions were held in Key Largo, Islamorada, Marathon, and Key West.

6. I regularly walk in Watson Hammock to observe Key deer and other wildlife, native vegetation, and interactions between species. Observing Key deer reminds me how powerfully interconnected and interdependent all humans are with the natural world. At various locations on Big Pine, I often engage in conversation with island visitors, informing them about the Key deer, its habitat, its history, and threats to its survival. My vacation activities include camping, hiking,

fishing, watching wildlife, and birdwatching.

7. As president of KDPA, I learned all I could about the life history and biology of the unique Key deer. My mentors were Key deer researchers/academics and NKDR staff. I learned that the Key deer, as the smallest sub-species of the North American white-tailed deer, was stranded and isolated in the Florida Keys (a remnant coral reef system) by rising waters from melting glaciers of the last Ice Age (about 10,000 years ago). Through natural selection (survival changes produced by geographical isolation), the deer adapted to their Florida Keys island habitat by gradually reducing body size/weight, while at the same time retaining a larger hoof area – a survival trait enabling them to walk in shallow, muddy mangrove areas to forage. Also, they developed the ability to tolerate higher salinity in their drinking water than deer on the Florida mainland (15 ppm, about half the salinity of sea water). The deer originally inhabited all of the islands between Key West and Fat Deer Key, a west-to-east range of over fifty miles, and, with few predators (only alligators and crocodiles), the Key deer population flourished. Early island settlers hunted the deer for food; that hunting was prohibited in 1939, but the combination of poaching and habitat destruction reduced the population to only about fifty deer in the 1950s.

8. The National Key Deer Refuge was created in 1957 to protect the Key deer and its habitat. (Located in the lower Florida Keys, the NKDR now has

approximately 9,200 acres of land, including the habitat types of pine rockland forests, tropical hardwood hammocks, freshwater wetlands, salt marsh wetlands, and mangrove forests. It is home to 23 endangered and threatened animal and plant species.) Since the creation of the NKDR, human development has reduced the available habitat of the Key deer, so today they are only found on the islands between Sugarloaf Key and Big Pine and No Name Keys (the latter two islands providing habitat for about 75% of the population). The Key deer was listed as an endangered species by the U.S. Fish and Wildlife Service ("FWS") in 1967.

9. I have observed the vulnerability of the Key deer population while living close to the Key deer for over four decades. I believe climate-crisis factors have produced critical threats to the survival of the Key deer, primarily through loss of their upland habitat from sea-level rise. Sea-level rise is producing steady, incremental habitat loss, and this is happening too fast for evolutionary adaptation to protect the deer. I have personally witnessed the impacts of climate change on the Florida Keys as the result of more frequent and more intense hurricanes. I have observed that strong hurricanes in the lower Florida Keys (Georges, 1998; Wilma, 2005; Irma, 2017) have adversely affected the Key deer population and its habitat. The most recent monster storm, Hurricane Irma, killed many deer through drowning; the event delivered 60 consecutive hours of hurricane-force winds on Big Pine Key, first stripping leaves from shrubs and trees and then stripping the

bark off those shrubs and trees. Initially, the Key deer that survived Irma had very little forage, so they soon lost weight and developed related health problems. Much of the hurricane-damaged vegetation died, reducing forage for the deer for years. The combination of diminished available forage and reduced habitat area has forced congregation of Key deer, causing increased transmission of diseases within the surviving population.

10. Access to fresh water is critical to the survival of the Key deer. While Big Pine Key is large (the island is about four miles E-to-W, by eight miles N-to-S), it is of low elevation (perhaps at most eight feet above sea level in some areas). Hurricane Irma's huge storm surge (13 feet on the southeast side of Big Pine) produced saltwater intrusion in the island's system of natural freshwater drinking holes used by the Key deer ("solution holes" in the island's porous calcium carbonate geology [Miami limestone]). Those freshwater drinking holes are the Key deer's only source of moisture, except for that obtained through plant leaves. There is a "freshwater lens" system throughout Big Pine Key, involving lighter fresh water floating above heavier salt water. The saltwater intrusion event produced by Hurricane Irma forced FWS staff at the NKDR to modify their decades-long admonition not to interact with the deer ("keep the wild in wildlife – leave the Key deer alone") and to request Big Pine Key residents to put out containers of water for the thirsty deer.

11. Since creation of the NKDR, habitat protection measures and aggressive public education facilitated a Key deer herd recovery to about 350-400 deer in the early 1990s, culminating in a herd recovery high estimated to be 1,000 to 1,200 animals in the mid-2000s. Since the New World Screw Worm disease (2016-2017) killed 135 deer (the number officially documented; other carcasses were neither found nor tabulated) and because of animals lost to Hurricane Irma, the herd is currently estimated to be 600-700 deer. This is a precariously low level that could be quickly wiped out by another big hurricane or pushed to extinction within the next twenty years by loss of critical Key deer upland habitat from climate-crisis-produced sea-level rise.

12. Impacts of sea-level rise around Big Pine Key are already evident with higher tides. A National Oceanic and Atmospheric Administration ("NOAA") tidal gauge off of Key West, the oldest such tidal measurement structure in the nation (1845), has logged about 9 inches of sea-level rise over the past century. This means saltwater flooding has slowly become more of a norm; the previously unknown term of "king tides" is being used to describe this seasonal phenomenon. Permanent, non-floating boat docks are now often under water. Friends with homes in low-lying areas frequently have saltwater flooding their yards. The Federal Emergency Management Agency ("FEMA") is insisting on higher building elevation requirements in the Florida Keys ("base flood elevation")

to obtain flood insurance (required by lending institutions if a mortgage is involved). There is active discussion among attorneys and real estate professionals that sellers of Florida Keys real estate could be sued if they don't warn prospective buyers that the property is endangered by rising sea levels.

13. I understand that this year the U.S. Environmental Protection Agency ("EPA") and the National Highway Traffic Safety Administration ("NHTSA") issued new emissions and criteria pollutant standards for passenger cars and light trucks (the "SAFE II Rule"). In learning of the Trump Administration's rollback of vehicle emission standards in the SAFE II Rule, I was dismayed that the Administration would follow the short-sighted perspective of rolling back existing emission standards. Greenhouse gas emissions from vehicles have already led to climate change and the associated accelerating sea-level rise that we are witnessing.

14. I understand that the SAFE II Rule will increase carbon dioxide emissions by nearly *one billion* metric tons through model year 2029 and will add an additional 7.8 billion metric tons of carbon dioxide emissions between 2021 and 2100. This is well over and above what the emissions under the previous standards would have contributed.

15. I am deeply concerned these increased emissions, caused by the SAFE II Rule, will increase sea-level rise and further threaten Key deer habitat. Increases

in sea-level rise due to the SAFE II Rule place the Key deer in even more jeopardy than they are in now and render them more vulnerable to extinction from stochastic events, namely increased frequency and intensity of hurricanes.

16. The SAFE II Rule would exacerbate these impacts because of the associated increase in sea-level rise. I am also very concerned by the impact of increased greenhouse gases and accelerating climate change on other species and ecosystems and how the SAFE II Rule will further exacerbate that problem.

17. Climate change has already impacted the recreational, aesthetic, and spiritual interests I have in observing Key deer and other species where I live in the Florida Keys. In the late 1990s and early 2000s, I would see and enjoy seeing an abundance of Key deer all over Big Pine Key. Now, on my walks in the NKDR, I see only an occasional deer. I am sobered and saddened by the impacts of climate change on biodiversity, how it has decimated the Key deer, and how it places the deer's only habitat in a precarious situation – in a compromised state of biodiversity.

18. The SAFE II Rule will increase greenhouse gases and thereby worsen the climate crisis and its impacts on the Florida Keys. Reducing greenhouse gases is the only way to avoid further climate change. Instead, the SAFE II Rule causes massive increases in greenhouse gases. These increased emissions will thereby increase the climate crisis and its impacts on the Florida Keys. These increases

will injure my health, the survival of the Key deer, and negatively impact the recreational, aesthetic, and spiritual values I hold by viewing the Key deer in a vibrant, functional ecosystem.

19. I rely on the Center to protect the species and ecosystems discussed above as well as my interests in them, including by bringing the current case challenging the SAFE II Rule.

I declare under penalty of perjury that the foregoing is true and correct and was executed on December 10, 2020, at Silver City, New Mexico.

Joyce Clark Newman

Joyce Clark Newman

DECLARATION OF SAMRAT PATHANIA

I, Samrat Pathania, declare as follows:

1. My name is Samrat Pathania. I am over eighteen years of age, of sound mind, and fully competent to make this declaration. I also have personal knowledge of the factual statements contained herein.

2. I have been a member of the Union of Concerned Scientists ("UCS") since August 2016 and a member of its Science Network since October 2018. I am a former chair and coordinator of the New Paltz Climate Action Coalition, which educates the public about climate change science and supports short and long-range planning to deal with the local environmental and social consequences of climate change.

3. I received a Bachelor's degree in Mechanical Engineering in 2002 from the National Institute of Technology in Jamshedpur, India. I received a Bachelor's degree in Mathematics and Secondary Education Physics in 2013 and a Master's degree in Secondary Education Mathematics in 2018 from the State University of New York at New Paltz. I was formally employed as a software engineer with multinational corporations. I currently teach physics, mathematics, and software programming at Wallkill Senior High School in Wallkill, New York.

4. I live in New Paltz, New York, about six miles from the Shawangunk Mountains. Many visitors come to the region each weekend to enjoy the natural beauty.

5. This tourism means constant convoy of cars, trucks, and motorcycles bringing noise and air pollution to our community. The worst of this pollution is on the Main Street of New Paltz, which on weekdays is a beautiful place to walk with lots of small local businesses. I have to avoid this part of town during the weekends, since the increased traffic and pollution exacerbates sinus related health issues.

6. Beyond local pollution, I am concerned about global climate change. The primary driver of this change is our modern economy's reliance on fossil fuels to generate electricity, power our vehicles, and heat our homes. If we continue business as usual with respect to our use of and reliance on fossil fuels, then as per the Fourth National Climate Assessment, we will certainly face more frequent and intense extreme weather events, as well as changes in average climate conditions, both of which will damage infrastructure, ecosystems, and social systems that provide essential benefits to communities.

7. If left unchecked, climate change will injure me and my community. In 2012, Superstorm Sandy ravaged parts of New York and New Jersey. Many families of the students at my alma mater (SUNY New Paltz) were affected by the

flooding caused by Sandy. The loss and damage experienced by these families and friends was traumatic and interrupted the pursuit of attending college for some students. It is precisely this flooding damage that can be attributed to climate change. The Hudson Valley is expected to have more intense precipitation events in the coming years. This is clearly bad news for the thriving agriculture in our community, as flooding can adversely affect ecosystem function, farm economic viability, and land use. Small, multigenerational, owner-operated businesses (including farms) and natural resources form the core of our community's identity. These attributes of the local economy and community are what convinced many families, including mine, to make this part of New York home.

8. One way I and my neighbors can help ameliorate local pollution is by driving more zero emission vehicles, which are quieter and emit no exhaust.

9. Zero emission vehicles also address climate change. Every time we make a trip in our gasoline cars (whether to drive a loved one to the emergency room or to a soccer game) we make the problem of climate change just a tiny little bit worse.

10. I bought my first electric vehicle almost five years ago to do my part to address local pollution and climate change. I chose a Chevy Volt (a plug-in hybrid) because it fit my financial circumstances and driving needs.

11. At the time, the public charging infrastructure in my area was sparse and it was difficult to find information about electric vehicles. Fortunately, UCS published their comprehensive "Cleaner Cars from Cradle to Grave" report that answered many of my questions. Since then, I have helped fifteen friends purchase electric cars.

12. Given the clear benefits of electric vehicles—like greater fuel efficiency that doesn't sacrifice performance and an opportunity to reduce air pollution caused by vehicle exhaust—I believe more Americans would choose to purchase electric vehicles if cleaner, more affordable options to lease or buy were available, along with the necessary infrastructure.

13. The availability of clean cars and electric vehicles infrastructure depends in part on the federal government's vigorous regulation of fuel economy and greenhouse gas standards for passenger vehicles, which collectively force the development of cleaner cars and drastically drive down local pollution and global greenhouse gas emissions. The emissions reductions, in turn, slow global climate change and help reduce flooding and other natural disasters.

14. Conversely, loosening fuel economy and greenhouse standards will reduce the pressure on the automobile industry to ramp up production of hybrids, electric vehicles, and more efficient conventional vehicles, and will exacerbate climate change and its effects on communities like mine.

15. I am aware that, in 2013, EPA provided California with waivers under the Clean Air Act, which allowed California to set its own greenhouse gas ("GHG") standards for light duty vehicles and to create a program to incentivize the purchase of zero emission vehicles. I am also aware that, under the Clean Air Act, other states could and did adopt California's programs. One of these states is New York.

16. Because of the widespread adoption of these programs, availability of low or zero emission vehicles—and related infrastructure—has increased nationwide, and particularly in states that have adopted California's standards. Partially as a result of these standards, the public charging infrastructure in our area has expanded considerably, and the number of electric vehicles in the community has grown by a factor of 10. Yet electric vehicles owners remain a minority.

17. If the standards remain effective, I expect great penetration of electric vehicles and electric vehicle infrastructure, since the trends related to California's new standards will continue or accelerate. Likewise, New York's maintenance of California's standards will trim GHG emissions and thereby help to protect communities from the increasing severity of natural disasters.

18. Conversely, continued expansion of low emissions vehicles and infrastructure is unlikely if California's efforts to set higher emission standards are thwarted.

19. I am aware that EPA has finalized an unprecedented decision to revoke California's waiver and to prohibit other states from enforcing the California standards they have relied on for the better part of a decade. I am also aware that the Department of Transportation has suddenly decided that its regulatory authority prevents EPA from issuing these waivers in the first instance, thereby barring EPA from enforcing any waivers it has granted and not withdrawn.

20. If the federal government consummates these actions—or if it imposes less stringent federal standard for fuel economy and greenhouse gas emissions—it will begin undoing nationwide progress towards a wider availability of low or zero emissions vehicles. In so doing, it will impair the Hudson Valley's progress towards widespread and abundant electric vehicle infrastructure, which will in turn slow progress in reducing local pollution. The agencies' decisions would also accelerate the regional effects of climate change.

21. An order from this Court striking down the government's orders would redress my injuries by leaving stronger standards in place in New York and nationwide. The maintenance of more stringent standards would result in greater

consumer choice, more widespread electric vehicle infrastructure, reduced local pollution, and a reduction in the devastating effects of climate change.

22. I declare under penalty of perjury that the forgoing is true and correct.

Executed in New Paltz, New York on June____, 2020.

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Samrat Pathania

consumer choice, more widespread electric vehicle infrastructure, reduced local pollution, and a reduction in the devastating effects of climate change.

22. I declare under penalty of perjury that the forgoing is true and correct.

Executed in New Paltz, New York on June 15, 2020.

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Samrat Pathania

DECLARATION OF VICENTE PEREZ MARTINEZ

I, Vicente Perez Martinez, declare as follows:

1. I am over 18 years of age and competent to give this declaration. I have personal knowledge of the following facts, and if called as a witness could testify competently to them. As to those matters which reflect an opinion, they reflect my personal experience, opinion and judgment on the matter.

2. I live in Los Angeles, California, and have lived there since 2013. I am a film editor. I edit commercials, trailers for movies, and movies.

3. I am a member of the Sierra Club and have been for almost three years. I joined the Sierra Club because I became very concerned about environmental protection after the 2016 presidential election. I am a film editor, so I thought the best way to get involved was to become a member of a non-profit that knows how to do this work, rather than attempting to do the work myself. As a member of the local Angeles Chapter, I have attended some rallies and keep abreast of environmental issues.

4. I am aware that Los Angeles County is in nonattainment for ozone and particulate matter under the National Ambient Air Quality Standards, and I am worried about the poor quality of the air all around my home. I live about 500 feet from La Brea Avenue and less than a mile from La Cienega Boulevard, both of which are major traffic arteries and carry very heavy traffic. During the prolonged rush hours, cars sit bumper to bumper for extended periods of time, releasing harmful emissions. Our backyard is so close to La Brea Avenue that the soot and grime from vehicle traffic gets all over the backyard: a nasty, gray dust lies on top of everything. We no longer use the backyard more than a few days a month, restricting my use and enjoyment

of my property, and we have to clean the surfaces of furniture and other objects thoroughly before we do.

5. I track the air quality index daily through an app on my iPhone. I like to run outside every day, but, when the air quality is poor, I have to forgo that pleasure and run at my gym instead. I also monitor how much time my five-year old daughter spends outside during poor air quality days because I don't want her to breathe the unhealthful air and develop respiratory problems.

6. I am also very concerned about climate change. I try to follow climate science closely and I am aware that we are approaching a tipping point in which we have a narrow timeframe to turn things around if we truly want to tackle the climate problem. We are running out of time to take serious action to mitigate the impacts of climate change, but unfortunately, we are doing the opposite and exacerbate the current and coming damage by producing more greenhouse gases. I am particularly concerned about the role of the transportation sector in causing climate change, as I am aware that the transportation sector is the biggest emitter of greenhouse gases in the U.S. and is a major cause of climate change. I also know that greenhouse gases lead to the ground-level ozone that causes terrible health effects.

7. When my wife and I had a baby, my perspective on things changed. My daughter will live to see the 22nd century, and I often think about how my decisions will affect her and the world. As a parent, it is very important for me to do my part to leave behind a world that gives my daughter and other people of future generations a healthy environment and a chance to thrive. My desire to breathe cleaner air, to stop vehicle emissions of particulate matter, other dangerous pollutants and greenhouse gases, and to protect my and family's health are among the reasons

why I own electric vehicles, since I must have a car as it is very difficult to live and get to work without one in my neighborhood.

8. My wife and I currently own two used electric vehicles, a 2014 BMWI3 and a Tesla Model S. We drive them because they do not emit any tailpipe pollutants at all. We plan to replace at least one of them soon with another electric vehicle, when there are hopefully more options to choose from that are cheaper and have a larger array of features than currently available models. We will most likely replace our BMW, as it only has 65-70 miles of range. We use our BMW for shorter trips around downtown LA, but we are counting on further technology development and deployment so we can get a new electric vehicle with a better range. The electric vehicle options that are currently available are limited, have short ranges, and are sold at relatively high prices. For example, the used Tesla Model S is the cheapest model available that has at least close to 200 miles of range.

9. I believe that there are more electric vehicles available in California compared to most other states because of California's zero emissions vehicle (ZEV) mandate, which requires that car makers sell a certain number of new electric vehicles every year. I am aware that the National Highway Transportation and Safety Administration (NHTSA) and the EPA have issued a rule declaring that California's ZEV mandate is preempted by federal law, and that California may no longer set greenhouse gas standards for vehicles. I also know that the federal EPA has revoked a waiver California possessed which permitted California's ZEV mandate and the setting of greenhouse gas standards, and that many prior waivers have allowed California to set vehicle emissions standards that are more stringent than federal law. Other states that have adopted California's measures are now also precluded from doing so, and these actions therefore have effects on the entire national vehicle market.

10. I am very concerned that these actions will result in fewer electric vehicle options and fewer electric vehicles for sale here in California and elsewhere. That will drive prices up for whatever EVs may still be available, making it much harder to buy them. And it will stop or delay the technical innovation we need to get improved EVs on the market. The cancellation of the ZEV mandate directly affects me and my ability to buy another electric vehicle at better prices, better range, and to have other consumer choices in buying these vehicles.

11. Additionally, I invested a lot of money in a charger and solar panels in order to set up my home for electric vehicles. Because the ZEV mandate has been preempted and the waiver revoked, I am afraid that my investments in EV charging infrastructure will also be affected and that the expansion of available charging stations will considerably slow down or even stop. So, not only will I have fewer choices to replace my electric vehicle, but it will also become more difficult to operate my current ones due to limited infrastructure. Slowing down the drive for more electric vehicles will also decrease the value of the charging infrastructure in my home.

12. I am extremely concerned that declaring the ZEV mandate and California's ability to set greenhouse gas standards at levels more stringent than federal law, or at all, and the revocation of the waivers that allowed California to take these actions, will increase greenhouse gas emissions and levels of ozone and particulate matter, which will make my area's air quality even worse than it will be with these protections in place and negatively affect my outdoor activities. If that happens, I fear that I will need to further limit running outdoors and using my backyard. I also believe that these rollbacks will result in fewer electric vehicles on the market and impair my ability to purchase new electric vehicles and operate the ones I have.

13. I have learned that NHTSA and EPA also issued another final rule that makes greenhouse gas and fuel efficiency standards much weaker for all of the vehicles in the United

States. If that rule stays in place, a vast amounts of additional oil will be combusted and greenhouse gases emitted, all making the air quality much worse and climate change damage ever more devastating. Weakened national standards will also affect the availability of EVs, as automakers will have much less incentive to build them. That, again, will affect my ability to purchase the EV I want and diminish the value of my EV infrastructure investments.

14. I support Sierra Club's lawsuit challenging both of these rules. If the court overturns either of them, I would directly and personally benefit in many ways: I would be able to breathe cleaner air, be able to expand my outdoor physical activities, and use my backyard more often. I would also know that the air quality where I live will improve. I would know that greenhouse gas emissions are being reduced and the damage of climate change abated. Additionally, I would have more choices for a new electric vehicle and I could operate my used electric vehicles with the support of more infrastructure, and not lose the value of my investments in EV infrastructure at my house. All of these effects would improve my quality of life because I live in a really congested and polluted area. Finally, I will sleep better at night knowing that we are creating a more healthy future for my daughter.

I declare, under penalty of perjury, that the foregoing is true and correct.

Dated: May 20, 2020.

Vicente Perez Martinez

DECLARATION OF JENNY E. ROSS

I, Jenny E. Ross, state and declare as follows:

1. I have personal knowledge of the following facts, and if called as a witness could and would testify competently to them.

2. I live in Truckee, California. I received a bachelor's degree from Stanford University in 1983. I minored in biology and majored in philosophy, with an emphasis, and an honors thesis, on the philosophy of science and biomedical ethics. I earned a J.D. from Harvard Law School in 1986.

3. I care deeply about the natural world and biodiversity. I am a member of the Center for Biological Diversity ("Center"), and I rely upon the Center to represent my interests in environmental protection through advocacy and the enforcement of our environmental laws.

4. I practiced law for a number of years and am now a freelance photographer and writer specializing in wildlife natural history, conservation subjects, and environmental issues. I take photographs that capture the essence of wild animals and wild places, explain scientific research to non-scientists, inspire concern and action for wildlife conservation and ecosystem protection, and elicit a renewed appreciation of the natural world. My images and essays on natural history, conservation, and environmental issues have been displayed in numerous professional exhibitions and are frequently published in magazines, newspapers, and books. I also frequently collaborate with renowned scientists to create

presentations and articles that combine photographs with scientifically accurate and engaging information.

5. I have won numerous awards for my work, including the Nature's Best Award for Wildlife Photography, the Philip Hyde Award for Environmental Photography, the Vision Award of the North American Nature Photography Association, and an award for Arctic Biodiversity photojournalism from the Arctic Council's CAFF ("Conservation of Arctic Flora and Fauna") Secretariat. I have also received First Prize for Nature photojournalism in the World Press Photo awards, and have been honored in the Pictures of the Year International awards, the BBC Wildlife Photographer of the Year awards, and the Society of Environmental Journalists' Annual Awards for Reporting on the Environment.

6. For nearly two decades, much of my work has focused on Arctic species and ecosystems and climate change. I have observed significant changes in the warming Arctic that have directly affected my work and life. I first photographed polar bears and other Arctic species in 2000, and I was commissioned in 2002 to create a photographic exhibition partly about polar bears. Since then, I have continued to visit the Arctic to observe and photograph a wide variety of species, including polar bears, as well as Arctic sea ice, glaciers, and ice caps. I often work closely with scientists who study Arctic species, their ecosystems, and the earth systems they rely on, and I have reviewed much of the related scientific literature. This research and literature demonstrate unequivocally

that climate change is altering the Arctic, threatening the survival of many Arctic species, and harming human well-being globally (for example, the melting of the Greenland Ice Sheet is causing global sea levels to rise).

7. I have used the images and information I have obtained through my work in the Arctic for lecture-slideshow presentations, articles, and other ways of educating the general public about wildlife, ecosystems, and earth systems in the Arctic, and the significant and ominous changes resulting from human-caused climate change. For example, based on my study of polar bears, I created a slideshow and lecture entitled *Life on Thin Ice: Polar Bear Biology, Ecology, Behavior, and Conservation*, which includes more than 150 of my photographs, and engages the public in scientific issues concerning polar bears and the threats they face from climate change. I regularly update the presentation to ensure it includes the most recent scientific information. Past clients and venues for the presentation include: The Alaska Bear Forum, the Anchorage Museum of History & Art, California Audubon, the Desert Research Institute, Google, Heritage Expeditions, the Northern Nevada Science Coalition, Oceanwide Expeditions, Polar Bears International, the Pacific Grove Museum of Natural History, the San Francisco Zoo, and several private foundations.

8. Arctic species like seals, walruses, and polar bears are among the most important for me to photograph and study in their Arctic sea-ice environment. These species are exceedingly reliant on the ice, but the ice-free period is quickly

lengthening in many regions of crucial habitat. I plan to continue to use my work to highlight the plight of Arctic species and the transformation of the Arctic due to climate change. Due to the medical condition of a family member and the COVID pandemic, I haven't been able to go to the Arctic recently, but I plan to go back as soon as possible.

9. I am aware that in the spring of 2020, the Environmental Protection Agency and the National Highway Transportation and Safety Administration issued the Safer Affordable Fuel-Efficient Vehicles Rule ("the rule"), which sets new fuel economy and emission standards for passenger cars and light trucks. The rule is projected to increase passenger and light truck carbon dioxide ("CO_2") emissions by over 900 million metric tons by 2029.

10. The agencies issued the rule despite the urgent need for standards that cut emissions from light-duty vehicles. Stricter standards are a crucial tool to mitigate the severity of global warming because the transportation sector is the largest annual contributor to U.S. greenhouse gas emissions.

11. I believe that the rule will have serious and debilitating effects on our ability to mitigate global warming, and will make survival even harder for polar bears and the other Arctic animals I care about. It could even push some of these species towards extinction. This in turn would have direct, negative effects on my ability to make my living as a photographer of the Arctic wildlife I love.

12. I have traveled frequently to the Arctic and sub-Arctic to photograph

ice-dependent species and their habitat, and I have witnessed the effects of climate change on them. For example, in March 2006, I traveled to the Gulf of St. Lawrence to photograph adult seals and their pups on the sea ice. Although historically the Gulf has typically been nearly covered with massive floes of thick sea ice in early spring, that year the sea ice was very sparse, thin, and highly fractured as a result of a warm winter. Due to a lack of sea ice, we had considerable difficulty locating ice on which to land a helicopter and photograph seals.

13. Just a few weeks prior to that visit, a colony of grey seals — which normally give birth on the floating sea ice — were forced to pup on the beach at Pictou Island due to the absence of ice. A storm surge later engulfed the beach and drowned approximately seventy-five percent of the seal pups — over 2000 in total. This incident is representative of the profound impacts on the Arctic ecosystem that are occurring due to climate change.

14. In July 2006, I traveled to the Svalbard Archipelago, attempting to photograph polar bears and ice seals. Although there is typically extensive sea ice at that time of year, there was almost none during my trip. Even a mere 600 miles from the North Pole, the pack ice was absent. As a result, ice-dependent seals were impossible to find, and polar bears were very difficult to locate. The bears that we did find were limited to the last remaining bits of annual fjord ice or were marooned on land. I photographed several bears, including a small cub, that were

forced to swim from one island to another in search of food due to the lack of ice. Knowing that scientists have recently documented polar bears drowning in similar circumstances, I anxiously watched as the bears traveled through the ocean waves. It was poignant and upsetting to see the exhausted young cub, lacking body fat and poorly insulated from the cold, struggling to follow its mother.

15. On another trip to the Magdalen Islands in March 2007, I again struggled to find any seals or ice to photograph. The ice we did encounter was extremely thin and slushy, and melting rapidly. I saw just two harp seal pups and one family of hooded seals during a week in the region. My local guide told me that many newborn seal pups, which are unable to swim, drowned when the ice supporting them disintegrated. The one hooded seal family I photographed was on a small, isolated floe of ice that was moving extremely quickly because there was no other ice surrounding it to hold it in place. I could not remain on the floe photographing the seals for very long, because the floe was rapidly being carried eastward by the current, out of the Gulf toward the Atlantic Ocean.

16. In the summer of 2009, I traveled by ship throughout various regions of the Bering and Chukchi Seas, ultimately reaching the north coast of Wrangel Island in Russia. I had hoped to photograph ice seals on floes; however, I saw no sea ice or seals at all because the Arctic was unusually warm and the sea ice had melted very far to the north. While in the Chukchi Sea, I observed and photographed an adult polar bear swimming in rough waves during a storm. The

bear was far from land and even farther from the nearest sea ice, and I believe it may have drowned before reaching safety.

17. In October of 2009, I traveled to Greenland with a film crew from Arirang TV to work on a project about the warming Arctic. My photographs of landscapes, wildlife, and indigenous people in Greenland, and my experiences there, were featured in two internationally broadcast television documentaries about climate change, as well as in an associated photographic exhibition which was presented at the Total Museum of Contemporary Art in Seoul and at the United Nations Climate Change Conference in Copenhagen.

18. The Arirang film crew and I accompanied three experienced Inuit hunters on a multi-day subsistence hunt for walruses. We traveled in a very small motorboat because there was no sea ice on which we could travel by dog sled. The hunters had great difficulty finding any walruses, due to the lack of sea ice on which the animals ordinarily haul out. After searching for almost two days and traveling very far north, the hunters were able to kill two walruses.

19. To ensure the meat does not spoil, it is essential to butcher the animals immediately. In a remote bay, the men eventually found a single ice floe strong enough to hold our weight and were able to accomplish the butchering. By the time the hunters completed their task, however, it was evening and the temperature abruptly began plummeting. The wind also shifted, and the men suddenly realized that rapidly-forming sea ice had blocked off the bay and almost completely

surrounded our vessel. Despite their lifetimes of experience in the Arctic, the men had never encountered such a situation before. I knew from my research that climate change has caused freezing and thawing to become so erratic and unpredictable that conditions are often extremely dangerous for indigenous Arctic hunters. The men were exceedingly anxious as they struggled to push the ice away from our boat. At one point, the most senior hunter said to me in an uncharacteristically agitated tone, "This is bad! Very bad! Very dangerous!" The men were so concerned that they told us to go down below deck while they tried to deal with the crisis. We sat below listening to the straining engine, the hunters rushing back and forth above, and the grinding and thumping of ice against the hull of the boat. If we could not reach open water, we would be trapped in the ice for an indefinite period of time. If the hull were damaged by shifting, expanding, and scraping ice, there would be nowhere for us to go except into the frigid water, and that would be deadly. An expanse of rapidly-forming ice can be strong enough to trap and fatally damage a small boat, yet too thin to support a person. Thankfully, the hunters were able to free the boat, but our narrow escape impressed upon me how climate change has made my work increasingly hazardous.

20. In July 2010, I traveled to the Barents Sea and Svalbard Archipelago to view and photograph Arctic wildlife, ecosystems, and sea ice. I had hoped to photograph ice seals, including bearded seals (which are protected under the Endangered Species Act) and ringed seals (some of which are protected under the

Endangered Species Act), but there was insufficient sea ice to offer any good opportunities. The lack of sea ice also interfered with the polar bears' ability to hunt, and I photographed an extraordinary incident of polar bear cannibalism involving an adult male polar bear preying on a yearling cub for food. In December 2011, the journal *Arctic* published a scientific paper I wrote in collaboration with renowned polar bear biologist Dr. Ian Stirling describing this incident and analyzing the relationship between climate change and the occurrence of polar bear infanticide and cannibalism.

21. In July 2011, I traveled to Novaya Zemlya, Russia, and to a Russian Arctic archipelago in the Barents Sea, to observe and photograph Arctic species and ecosystems. In far northern Novaya Zemlya, I photographed a polar bear climbing on the face of a sheer cliff at the edge of the ocean, attempting to feed on seabird (guillemot) eggs and chicks in nests perched on the cliff. The bear was stranded on land and unable to hunt for seals, because the sea ice had melted throughout the region and had receded very far to the north. Because of his inability to hunt for his normal prey, this bear endangered his life by climbing precariously on the cliff face. His hunt was unsuccessful, and he ultimately abandoned his efforts. I believe this bizarre attempted predation of cliff-nesting seabirds has only been reported a handful of times in other Arctic locations where polar bears were marooned on land.

22. In the summer of 2012, I participated in the Norwegian Polar

Institute's ("NPI") Ice, Climate, and Ecosystems ("ICE") expedition to the Central Polar Basin of the Arctic Ocean to photograph and learn about a variety of scientific research activities for my magazine feature article about sea ice to be published in 2014, and to provide photographs for NPI's educational and outreach purposes. The sea ice was so sparse and thin that it was necessary for us to travel much farther north than originally anticipated — to a location above 82.5 degrees north — in order to find a floe of sea ice large enough and thick enough for the scientists to conduct their experiments. Often the weather was so unusually warm that wearing the required waterproof "survival suit" while working out on the ice was uncomfortably hot. During the course of the scientific work, in three separate incidents, three of the NPI researchers fell through thin, disintegrating sea ice and plunged into the frigid 4000-meter-deep ocean. The scientists were able to extract themselves from the water safely, but those dangerous events were distressing, and it was worrisome to be working out on the sea ice myself in such perilous conditions.

23. In May 2013, I visited the Prince William Sound region in Alaska to photograph sub-Arctic species as well as migratory birds traveling through the area on their way to the High Arctic for breeding. In particular, I planned to photograph spectacularly large numbers of western sandpipers that visit particular locations in the Prince William Sound region annually in the spring to rest and feed during their migration. Until recently, the timing of this epic gathering was quite

predictable, and I timed my trip to coincide with the time frame when, historically, the largest numbers of these shorebirds would be there. But, due to erratic and atypical temperatures caused by climate change all along the western sandpipers' migration route, very few of those birds were present during my visit, and I was not able to obtain the photographs I needed.

24. In August and September 2013, I traveled by ship to northeast Greenland to photograph Arctic wildlife, glaciers, and the Greenland Ice Sheet. During my trip, I saw and photographed countless shrinking glaciers coming off from the ice sheet. In one location, so many large icebergs had recently been calved that it was impossible to get near the front of the glacier, even in a highly maneuverable Zodiac boat. In many other locations, former tidewater glaciers had receded so much that they no longer reached the sea; instead, their meltwater poured down bare, previously ice-covered mountainsides into the ocean. Witnessing these stark and widespread effects of global warming, and knowing that global warming is causing the disintegration of the Greenland Ice Sheet and associated glaciers and is resulting in sea level rise, was very disturbing.

25. I have seen polar bears in the Western Hudson Bay region struggling to survive during the lengthy ice-free period that now extends from July through late November or even into December. On numerous occasions, I have witnessed the heart-wrenching spectacle of very skinny bears pacing along the shore of Hudson Bay in late fall and staring constantly at the open water, clearly desperate

for sea ice to form so that they can resume hunting seals. On one occasion, I observed an emaciated mother polar bear accompanied by her young twin cubs near the edge of the unfrozen Hudson Bay in mid-November. Her anxious demeanor, coupled with my knowledge that she would likely starve to death before the sea ice formed or be too weak to hunt once it did, and that her small offspring would then perish as well, caused me profound sadness.

26. In light of the rapidly declining extent and quality of Arctic sea ice, my research, and what I have and have not witnessed on my Arctic trips, I'm extremely worried about ice-dependent species in the Far North. The rapidly rising temperatures and melting ice cause me great apprehension and emotional distress. Of particular concern is the increasing lack of crucial sea ice habitat over the biologically-productive continental shelf. I am profoundly worried about thawing Arctic and sub-Arctic permafrost and the resulting additional carbon emissions that will further exacerbate climate change. I am similarly extremely concerned by the rapid melting of the Greenland Ice Sheet because its disintegration will cause major global sea level rise, destruction of crucial coastal ecosystems, and permanent flooding of numerous heavily-populated regions around the globe.

27. A 2016 scientific study by Dirk Notz and Julienne Stroeve published in the journal *Science* found that for each ton of carbon dioxide emitted, approximately three square meters of Arctic sea ice will disappear by the end of the melt season in September. The scientists predicted that if just 1000 gigatons

more carbon dioxide is emitted, there will be no summer Arctic sea ice at all throughout the entire month of September.

28. A healthy Arctic environment is necessary to pursue my photography career successfully, and it greatly enhances my personal life. Additional warming caused by greenhouse gas emissions from passenger cars, light trucks, and other sources has limited, and will continue to substantially limit, my ability to photograph Arctic ice-dependent species in their natural habitat by greatly increasing the expense and time it takes me to obtain photographs and scientific information, multiplying the risks of injury — and even death — to me personally while engaged in those endeavors, and generally interfering with my ability to pursue my profession in the Arctic. This will directly affect my income and livelihood. Indeed, global warming may cause the extinction of the polar bear and the bearded seal (both protected under the Endangered Species Act), the Pacific Walrus, and other Arctic species, and completely transform the Arctic environment. I may never again be able to photograph some species as sea ice continues to melt. I will also be harmed personally because I care greatly for the Arctic ecosystem and its amazing species and wish to see those species preserved and protected.

29. I have every intention of continuing my career as a wildlife and nature photographer and writer. The Arctic environment and Arctic species will remain a major focus of my work. For my articles, exhibits, lecture-slideshow presentations,

and a book about the changing Arctic, I will need to do many additional trips to the Arctic in the coming years. These trips are becoming increasingly difficult, risky, and expensive due to global warming.

30. I believe that these harms and losses will be significantly worsened if the rule is upheld and the agencies' weak fuel economy and emission standards are allowed to remain in place. The United States is the second-largest emitter of greenhouse gases in the world and the largest cumulative emitter. If such emissions are to be reduced, the United States must play a leading role. For meaningful reductions in greenhouse gas emissions to occur, reducing emissions from the transportation sector is an essential step. Doing so will lessen global warming and its impacts on my interests, and give the polar bear and other Arctic species a chance to survive.

I declare under penalty of perjury that the foregoing is true and correct and was executed on December 24, 2020 in Truckee, California.

Jenny E. Ross

Jenny E. Ross

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

COMPETITIVE ENTERPRISE INSTITUTE, *et al.*, Petitioners, v. NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, *et al.*, Respondents.	No. 20-1145

DECLARATION OF RONALD ROTHSCHILD

I, Ronald Rothschild, state and declare as follows:

1. I am a member of the Natural Resources Defense Council (NRDC). I joined the organization as a member in October 2016 to support its work protecting the environment and public health and reducing our dependence on fossil fuels.

2. I live in Greenwich, Connecticut, in Fairfield County in the southwestern corner of the state. Air quality is poor and violates federal ozone standards throughout Connecticut, but the southwestern portion of the state where I live suffers from an even more severe ozone problem. The American Lung Association rates Fairfield County an "F" for ozone pollution, and the county is within the New York City metropolitan area, which the Association regularly ranks as one of the most ozone-polluted regions in the country. Ozone can create and exacerbate respiratory problems.

3. Because cars and other motor vehicles emit ozone precursors, they are a major contributor to ground level ozone formation. Their emissions contain other harmful pollutants as well, such as greenhouse gases that are a major contributor to climate change. Climate change causes many harmful human health impacts, including making dangerous ozone smog conditions worse, because ground level ozone forms more easily when air temperatures are higher.

4. My home is about a quarter mile from the Merritt Parkway, a heavily travelled state highway. Tens of thousands of vehicles travel this stretch each day. I have lived in my house for the past seven years. I am close enough to the Merritt Parkway to hear the traffic if I am outside my house.

5. About three years ago, I was diagnosed with throat cancer. I had a golf-ball sized tumor removed from my tonsil and went through months of radiation therapy afterwards. It was a very difficult treatment process, physically and emotionally. Although I survived the throat cancer, I still suffer from the physical effects of radiation treatment. I have scarring and muscle stiffness in my neck, xerostomia (lack of saliva), and I find it harder to enjoy the food and drinks I love, like red wine and chocolate.

6. The experience has made me think more about the potential health risks of living close to a busy highway. I have become wary of the health risks from exposure to air pollution caused by fuel combustion in automobiles.

7. I have also long been concerned with the dangers posed by climate change, which I view as the number one issue facing society. Further, I recently became a new grandfather and am increasingly worried about the harmful effects that climate change will visit upon me and my family.

8. Even before my illness, I was passionate about clean cars and cleaning up our country's driving habits. I strongly support government policies—such as emission standards, fuel economy standards, and mandates to

sell electric vehicles—that encourage automakers to implement technology that reduces the combustion of fuel and associated emissions of dangerous air pollutants. These standards incentivize automakers to innovate and develop cleaner cars and trucks, as well as to try to sell cleaner cars to consumers.

9. I purchased my first Honda Civic hybrid in 2003. In 2006, I upgraded to another Honda Civic hybrid, and I purchased a third Honda Civic hybrid for my daughter in 2011.

10. My 2006 hybrid was one the best cars I've ever owned. It now has 187,000 miles on it, and still runs like a top. When I drive, I can get around 40 miles to the gallon.

11. Although I liked my hybrid Civics, I promised myself that I would never buy another fuel-combustion vehicle (or internal combustion engine of any type) for as long as I breathe. And so, at the beginning of this year, I purchased a Tesla Model 3 electric car.

12. The Tesla was one of the few full battery-electric vehicles available on the market with a "rated" travel range of at least 250 miles. I ultimately chose the Tesla from among the limited options because of its size, range, and U.S.-based manufacturing, but I had to forego characteristics and features commonly available to choose from in the combustion-powered vehicle market. Things as simple as a hatchback with decent cargo space (for

letting my two large dogs in and out of the car) are hard to come by in the battery electric vehicle market.

13. It is important to me, personally, that government policies continue to promote the development and marketing of improved electric vehicles. An expanded electric vehicle market will also help broaden electric car offerings (more hatchbacks, for example) and bring down their purchase price. I would personally benefit from such policies and developments. I intend to replace my wife's current vehicle with a long-range electric vehicle with a useful hatchback as soon as an affordable and acceptable model becomes available. And when it is time to replace my current vehicle, I intend to again purchase an electric vehicle and it is important to have a wider range of options to choose from.

14. I understand that the EPA sets federal emission standards for new vehicles and that the National Highway Transportation Safety Administration also sets federal fuel economy (CAFE) standards for new vehicles. Until recently, these agencies' standards required automakers to make meaningful improvements to the average greenhouse gas emissions and fuel economy of the new vehicles they bring to market each year. I further understand that California has set stronger state standards, and that other states, like my home state of Connecticut, have adopted California's standards. I understand, for example, that many of these states require automakers to offer for sale a

minimum number of zero emission vehicles, like battery-electric vehicles, each year. I strongly support all these standards.

15. It is apparent to me that stronger emission and fuel economy standards logically will lead automakers to develop and sell cleaner cars and trucks than they otherwise would. In turn, those cleaner vehicles emit less of the harmful air pollution that leads to health problems, ozone formation and climate change.

16. I also understand that automakers who fail to meet EPA and NHTSA standards can buy credits from other automakers who exceed those standards, and that credits become more valuable when standards are tougher, which helps incentivize the introduction of new electric vehicles into the market. Electric vehicle manufacturers have said that they rely on strong standards and credit sales as part of their business plans for developing and introducing new electric vehicles.

17. I understand that EPA and NHTSA have recently issued rules that would roll back and weaken preexisting federal greenhouse gas emission standards and fuel economy standards for new vehicles. I also understand that these agencies have issued rules that seek to block California from maintaining stronger standards, including requirements for zero emission vehicle availability, which would in turn prevent Connecticut and other states from following suit. I strongly oppose all of these efforts. The agencies are bizarrely out of sync

with scientific data and public opinion on our environmental crisis and our desires for innovative and ecological vehicles.

18. Unless and until the agencies' actions are reversed, they will result in increased emissions of air pollutants from the vehicles that travel the highway near my home. They will also result in increased emissions of greenhouse gases from vehicles across the country that all contribute to climate change. And, by reducing the incentives for automakers to invest in fuel-efficient technology and introduce new electric vehicles, they will reduce my options when I and my family search for electric vehicles to purchase in the coming years.

19. By contrast, if the stronger federal standards are reinstated, and/or if California and Connecticut are able to set stronger standards, automakers will once again have greater incentive to invest in fuel-efficient technology and introduce new electric vehicles onto the U.S. market.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief. Executed on May 27, 2020, in Greenwich, Connecticut.

Ronald Rothschild

<u>DECLARATION OF KASSIA R. SIEGEL ON BEHALF OF THE CENTER FOR BIOLOGICAL DIVERSITY</u>

I, Kassia R. Siegel, state and declare as follows:

1. I am the director of the Center for Biological Diversity's Climate Law Institute. I have personal knowledge of the following facts and statements, and if called as a witness could and would testify competently to them.

2. The Center for Biological Diversity (the "Center") is a tax-exempt non-profit membership organization based in Tucson, Arizona, though it also has offices in California and throughout the United States. The Center has approximately 81,000 members. The Center works to protect wild places and their inhabitants. The Center believes that the health and vigor of human societies, the integrity and wildness of the natural environment, and preservation of biodiversity are closely linked. Combining conservation biology with litigation, policy advocacy, creative communications and strategic vision, the Center is working to secure a future for animals and plants hovering on the brink of extinction, for the wilderness they need to survive, and by extension, for the spiritual welfare of generations to come.

3. The Center has developed several different practice areas and programs to achieve its goals, including the Climate Law Institute. The Climate Law Institute is an internal institution with the primary mission of curbing greenhouse gas and other air pollution, and sharply limiting the damaging effects

of climate change and air pollution on endangered species, their habitats, and human health, for the benefit of all who depend on clean air, a safe climate, and healthy ecosystems. In my role as director of the Center's Climate Law Institute, I oversee all aspects of the Center's climate work.

4. Climate change represents the most significant and pervasive threat to biodiversity worldwide, affecting both terrestrial and marine species from the tropics to the poles. Absent major reductions in greenhouse gas emissions, by the middle of this century upwards of a third or more of the earth's species could be extinct or committed to extinction as a result of climate change. Even under moderate warming scenarios, sea level rise will largely inundate otherwise "protected" areas like the Everglades and the Northwest Hawaiian Islands, threatening to make future biodiversity conservation efforts futile.

5. To prevent extinctions from occurring at levels unprecedented in the last 65 million years, emissions of methane and other greenhouse gases must be rapidly and deeply reduced. Given the lag time in the climate system and the likelihood that positive feedback loops will accelerate global warming, the world's leading scientists have warned in a landmark report that global emissions must be slashed in half in the next decade and must fall to zero by mid-century to limit warming to more than 1.5 degrees Celsius and avoid the most catastrophic

damages.[1] Deep and immediate greenhouse gas reductions are required if we are to save many species which the Center is currently working to protect, including but not limited to the polar bear, Pacific walrus, ribbon seal, Kittlitz's murrelet, American pika, Emperor penguin, Florida Keys mole skink, and many species of corals.

6. One of the Climate Law Institute's priorities is ensuring the full and immediate use of the Clean Air Act to limit and reduce greenhouse gases and other air pollutants. The Clean Air Act is our strongest and best existing tool for doing so, and we have long worked to enforce the Clean Air Act's mandates to accomplish this goal.

7. For instance, the Center was a Plaintiff in *Massachusetts vs. EPA*, which resulted in the landmark Supreme Court decision finding that greenhouse gases are pollutants under the Clean Air Act, which ultimately led to EPA's first-ever rulemaking to reduce greenhouse gas emissions from passenger cars and light trucks under section 202. *Massachusetts v. EPA*, 549 U.S. 497, 127 S. Ct. 1438 (2007).

8. The Center has submitted comments on all successive light and medium duty/ heavy duty vehicle rules, under both the Energy Policy Conservation Act ("EPCA") and the Clean Air Act. The Center successfully challenged the

[1] Intergovernmental Panel on Climate Change, Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (2018).

National Highway Traffic Safety Administration's ("NHTSA") 2006 light duty fuel economy standards issued under EPCA. The court invalidated the standards in part because NHTSA failed to monetize the value of carbon emissions, and because the environmental assessment failed to analyze whether the standards' greenhouse gas emissions would significantly affect the environment. *Center for Biological Diversity v. National Highway Traffic Safety Administration*, 538 F.3d 1172 (9th Cir. 2008). In 2017, when EPA issued a memorandum announcing that it would not enforce existing emission standards for glider trucks, the Center litigated to enforce the existing Clean Air Act standards. *Environmental Defense Fund v. EPA*, No. 18-1190. As a result, EPA withdrew the memorandum. When the EPA withdrew its final determination of the mid-term evaluation of greenhouse gas emission standards for model year 2022-2025 light-duty vehicles (83 Fed. Reg. 16,077-87 (Apr. 13, 2018)), the Center challenged the lawfulness of that withdrawal. *California v. EPA*, No. 18-1114. In 2019, when NHTSA issued a rule under EPCA preempting state greenhouse gas emissions standards and zero emission mandates, and EPA withdrew California's Clean Air Act waiver allowing it to set those standards (84 Fed. Reg. 41,310 (Sept. 27, 2019)), the Center challenged the preemption rule and waiver withdrawal. *Union of Concerned Scientists v. National Highway Traffic Safety Administration*, No. 19-1230. We also commented extensively on NHTSA and EPA's proposed rollback to the existing fuel economy and greenhouse gas vehicle emissions standards, which are the subject of this litigation. *See eg.*, docket nos: NHTSA–2017–0069–0605; NHTSA–2018–0067–12127; NHTSA–2018–0067– 12088; NHTSA–2018–0067–12123; NHTSA–2018–0067– 12000; NHTSA–2018–0067–12378; NHTSA–2018–0067–12439.

9. We have also worked to obtain an endangerment finding and emission standards for greenhouse gases from aircraft for over a decade. In 2007, we and others petitioned EPA to issue an endangerment finding and greenhouse gas standards for aircraft under Clean Air Act section 231. When EPA failed to respond, we and others sued EPA for unreasonable delay in 2010 and obtained a court order requiring EPA to undertake an endangerment finding for aircraft in 2011. *Center for Biological Diversity v. EPA*, 794 F. Supp. 2d 151 (D.D.C. 2011). When EPA failed to act, we notified it of our intent to sue for unreasonable delay in 2014. In 2015, EPA released a proposed endangerment finding and an advance notice of proposed rulemaking for aircraft greenhouse gases. 80 Fed. Reg. 37758 (July 1, 2015). When EPA failed to finalize the endangerment finding, we filed a second lawsuit in April 2016 to compel EPA to act. *Center for Biological Diversity v. EPA*, No. 1:16-CV-00681 (D.D.C). On August 15, 2016, EPA finally issued the Aircraft Endangerment Finding.

10. We also commented on EPA's proposed rulemakings to set standards and guidelines for greenhouse gas emissions from new, modified/reconstructed, and existing power plants under Clean Air Act sections 111(b) and 111(d) (the

"Clean Power Plan"). Center comments, EPA-EPA-HQ-OAR- 2011-0660-10171 (June 22, 2012); HQ-OAR-2013-0495-10119 (May 9, 2014); EPA-HQ-OAR-2013-0602-25292 (Dec. 1, 2014). When the Clean Power Plan was challenged, we intervened in multiple lawsuits to defend that rule. *In re: State of West Virginia*, No. 15-1277; *State of West Virginia v. EPA,* No. 15-1363; *State of North Dakota v. EPA*, No. 15-1381; *State of North Dakota v. EPA,* No. 17-1014 (and consolidated cases); *Nat'l Alliance of Forest Owners v. EPA*, No. 15-1478; *Biogenic CO2 Coalition v. EPA*, No. 14-1480. We commented extensively on EPA's advance notice of proposed rulemaking and draft rule to repeal the Clean Power Plan and replace it with weaker emissions guidelines for greenhouse gas emissions from existing electric utility generating units (the "ACE Rule"). Center comments, EPA-HQ-OAR-2017-0545- 0298 (Feb. 26, 2018); EPA-HQ-OAR-2017-0545-0256 (Feb. 26, 2018); EPA-HQ-OAR-2017-0355- 20656 (Apr. 26, 2018); EPA-HQ-OAR-2017-0355-19872 (Apr. 26, 2018); EPA-HQ-OAR-2017-0355-24260 (Oct. 31, 2018); EPA-HQ-OAR-2017-0355- 24415 (Oct. 31, 2018). The Center is a petitioner in an ongoing challenge to the ACE rule, *Appalachian Mountain Club v. EPA*, No. 19-1166, and an intervenor in several other consolidated cases related to the ACE Rule and Clean Power Plan repeal, Nos. 19-1175, 19-1176, 19-1179, and 19-1185.

11. The Center has also been involved in many other Clean Air Act administrative proceedings and legal actions seeking to enforce the Act's

provisions for greenhouse gases. For example, in September 2010, we petitioned EPA to issue greenhouse gas standards for locomotive engines pursuant to Clean Air Act section 213(a)(5). *Petition for Rulemaking Under the Clean Air Act to Reduce Greenhouse Gas and Black Carbon Emissions from Locomotives* (Sept. 21, 2010). In December 2009, we petitioned EPA to designate greenhouse gases as criteria air pollutants under Clean Air Act section 108 and to issue National Ambient Air Quality Standards ("NAAQS") sufficient to protect public health and welfare. *Petition to Establish National Pollution Limits for Greenhouse Gases Pursuant to the Clean Air Act* (Dec. 2, 2009). These examples are illustrative of our advocacy in this area, not exhaustive.

12. The Center has also worked through the Clean Air Act to address other pollutants that adversely impact biodiversity and human health. For example, we filed suit against EPA for failing to review and revise the air quality criteria for oxides of nitrogen and sulfur oxides and the NAAQS for nitrogen dioxide and sulfur dioxide. This case resulted in a court-ordered settlement agreement setting forth deadlines for EPA to update these critically important standards. On February 9, 2010, EPA issued updated primary NAAQS for nitrogen dioxide. Primary National Ambient Air Quality Standards for Nitrogen Dioxide; Final Rule, 75 Fed. Reg. 6474 (February 9, 2010). On June 22, 2010, EPA issued updated primary NAAQS for sulfur dioxide. Primary National Ambient Air Quality Standard for Sulfur Dioxide; Final Rule, 75 Fed. Reg. 35520 (June 22, 2010). When EPA

decided not to revise the 40-year-old secondary NAAQS for sulfur and nitrogen oxides, despite acknowledging ongoing harm to terrestrial and aquatic ecosystems from acid rain and other depositional pollution, we challenged the decision as contrary to the Clean Air Act. *See Ctr. for Biological Diversity v. EPA*, 749 F.3d 1079 (D.C. Cir. 2014). We also filed suit in 2010 against EPA for failing to meet numerous deadlines for limiting dangerous particle pollution, including deadlines for: (a) determining whether areas in five western states are complying with existing air pollution standards, and (b) ensuring that states are implementing legally required plans to meet the standards. *Ctr. for Biological Diversity v. Jackson*, N.D. Cal. No. CV 10-1846 MMC (filed April 29, 2010). This case resulted in another settlement establishing deadlines for EPA to carry out these important duties.

13. NHTSA and EPA's Safer Affordable Fuel-Efficient Vehicles Rule, ("Rollback Rule") harm the Center and its members and numerous ways. The Rollback Rule rolls back already weak existing fuel economy and greenhouse gas standards. According to the agencies themselves, the Rollback Rule will increase carbon dioxide emissions by nearly one billion metric tons through model year 2029. The Rule will also increase emissions of other potent greenhouse gases, methane and nitrogen oxides, as well as criteria pollutants like sulfur oxides. As explained in the concurrently filed declaration by Shaye Wolf, the Center's

Climate Science Director, and as explained in the Nonprofits' opening brief in this matter, the emissions from the Rollback Rule are likely to be even higher.

14. Air pollution and greenhouse gas emissions from vehicles and oil and gas production and refining harm the health, welfare, economic, recreational, and aesthetic interests of the Center's members. Climate change is already driving many animals and plants to extinction, increasing temperatures, and causing droughts, flooding and sea level rise, and affecting the livelihoods and property of Center members. Center members are increasingly less able to, and sometimes altogether prevented from, viewing, photographing, and enjoying wildlife threatened by climate change and from recreating in wilderness areas undergoing rapid climate change. They are deprived of the aesthetic and recreational enjoyment that stems from such activities, and experience worry, upset, and other significant emotional injury because of it. Some of our members suffer from pulmonary diseases such as asthma from the smog-forming co-pollutants emitted by vehicles and from refineries used to process fuels. Those co-pollutants include volatile organic compounds, sulfur dioxide, nitrogen oxides, and fine particulate matter.

15. The United States Transportation sector makes up nearly 30% of the United States' greenhouse gas emissions, the largest single sector contributing to emissions. The greenhouse gases emitted from all vehicles must be sharply reduced, and eventually eliminated to prevent harm to the Center and its members.

Indeed, quickly phasing out fossil fuel-powered vehicles is critical in keeping warming below 1.5°C—the level necessary to avoid catastrophic damages to people and life on Earth.[2] The Rollback Rule will allow greenhouse gas emissions from vehicles to increase and render the avoidance of the worst effects of climate change near impossible.

16. Any decision by this Court to uphold the Rollback Rule would harm the interests of the Center and its members. These interests include the procedural interests in enforcing all aspects of rulemakings that reduce greenhouse gas and air pollution, including but not limited to the requirements of the National Environmental Policy Act and Endangered Species Act to disclose and mitigate harm from these pollutants to protected species and the environment, about which the Center has commented extensively.

I declare under penalty of perjury that the foregoing is true and correct and was executed on January 8, 2021 at Joshua Tree, California.

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Kassia R. Siegel

[2] Christopher J. Smith et al., *Current fossil fuel infrastructure does not yet commit us to 1.5°C warming,* Nature Communications (2019), doi.org/10.1038/s41467-018-07999-w.

Declaration of Douglas Snower

I, Douglas Snower, state and declare as follows:

1. This declaration is based on my personal knowledge, information, and belief. I am over the age of eighteen years and suffer from no legal incapacity. Statements in this declaration expressing an opinion reflect my personal opinion and judgment on the matter.

2. I am a resident of Chicago, Illinois.

3. I am currently a member of the Environmental Law and Policy Center ("ELPC"). I first became an ELPC member in 2011.

4. I am the President and Founder of Green Wheels Inc. ("Green Wheels"), which is located in Chicago and incorporated in Illinois. Green Wheels is licensed as an auto dealer by the state of Illinois. I founded Green Wheels in 2011.

5. Green Wheels is an environmentally conscious auto dealership and service business located near downtown Chicago. Green Wheels specializes in selling, servicing, repairing, and renting electric, hybrid, and environmentally friendly vehicles. Green Wheels also installs and operates electric vehicle charging stations in and around Chicago. Green Wheels' customers include individuals, businesses, schools, religious institutions, and governmental entities. All of Green Wheels' services and products are geared toward the goal of promoting clean and efficient transportation.

6. The success of Green Wheels' business has been premised on the increasing availability of, and demand for, electric and hybrid vehicles, as well as the steady improvement in clean car technology and products. I believe that these improvements have been driven in substantial part by federal fuel economy and vehicle emissions standards requiring reduction of vehicle greenhouse gas ("GHG") emissions and increasing fuel efficiency. Manufacturers have an

incentive to meet these standards to avoid penalties, and an incentive to exceed the standards so that they can generate compliance credits that can be sold to other manufacturers whose vehicle fleets do not meet the standards. Because compliance with the standards is determined on a fleetwide basis, manufacturers are also able to offset their sales of large, higher-emitting cars with sales of low-emitting, fuel-efficient cars. These standards therefore push manufacturers to develop better and cheaper low-emitting and zero-emission vehicles ("ZEVs"), which can include battery electric, plug-in hybrid, and hydrogen fuel cell vehicles. The existence of federal standards that increase in stringency with each model year has thus expanded and improved the national market for the types of vehicles Green Wheels sells, rents, and services in Illinois and has bolstered Green Wheels' business.

7. I am familiar with the Trump administration's SAFE Vehicles Rule ("SAFE Rule"), which the Environmental Protection Agency ("EPA") and the National Highway Traffic Safety Administration ("NHTSA") recently finalized in two parts. I understand that among other things, Part One of the SAFE Rule states that NHTSA is declaring the California's vehicle standards that are stricter than the federal standards to be preempted by federal law. Part One of the SAFE Rule also purports to block other states from following California's regulations. Part Two finalizes new and amended federal GHG and Corporate Average Fuel Economy ("CAFE") standards for cars and light duty trucks that are far weaker than current standards, requiring only a 1.5% reduction in fuel use and emissions year-over-year for model years 2021 through 2026, rather than the average year-over-year reduction of nearly 5% that was required before Part Two was issued.

8. Part Two of the SAFE Rule promises to have a direct and detrimental effect on Green Wheels' business. With weaker federal fuel efficiency and vehicle emissions standards,

automakers can be expected to manufacture far fewer and less varied types of electric, hybrid, and environmentally friendly vehicles, which would slow the technological progress that has made them increasingly attractive to consumers. Automakers will also have less incentive to market and educate customers about electric, hybrid, and environmentally friendly vehicles, which would disincentivize them from working with Green Wheels to promote ZEV sales.

9. As a result of these changes that will naturally flow from Part Two of the SAFE Rule, Green Wheels will have fewer and less varied types of vehicles to offer customers and fewer customers will seek to buy or rent vehicles from us, which would depress the company's sales and rental business. This would, in turn, depress Green Wheels' service and repair business. It would also reduce the demand for new charging stations and reduce the revenue Green Wheels can earn from existing charging stations.

10. As the owner of Green Wheels, I stand to lose money if, as I expect, my company loses business due to Part Two of the SAFE Rule. The threat to Green Wheels' business, and to my financial stake in the company, would be averted if Part Two of the SAFE Rule is declared invalid so that the stricter fuel efficiency and vehicle emissions standards will go back into effect, which will continue to expand and improve the national market for the types of vehicles Green Wheels sells, rents, and services.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information, and belief.

Executed on May 26, 2020

Douglas Snower

Declaration of Laurence B. Stanton

I, Laurence B. Stanton, state and declare as follows:

1. This declaration is based on my personal knowledge, information, and belief. I suffer from no legal incapacity. Statements in this declaration expressing an opinion reflect my personal opinion and judgment on the matter.

2. I am a member of the Environmental Law and Policy Center, and have been a member since 2008.

3. I live at 515 Myrtle in Beverly Shores, Indiana. I live approximately one block away from the Lake Michigan beach. Beverly Shores is surrounded by Indiana Dunes National Park, which contains a variety of different ecosystems and extensive plant and animal biodiversity. My wife lives with me. We are both 66 years old. We have lived in Beverly Shores for 30 years.

4. I have a consulting business and work out of my home.

5. I spend a lot of time outdoors. Among other things, I garden, run, visit the beach a block from my house, sail on Lake Michigan, kayak, and cross-country ski.

6. I am concerned about the impacts that climate change is having and will have on the area in Northwest Indiana where I live and recreate. I try to keep up on news and science related to climate change. I've read the Environmental Law and Policy Center's report, *An Assessment of the Impacts of Climate Change on the Great Lakes*, which discusses climate change's impact on regional precipitation, invasive species, and extreme weather, among other things. What I've read about climate change confirms my worries that climate change is already negatively affecting the area in which I live and that if climate change increases, there will be even more harms to the environment in my area.

7. Climate change leads to warmer winters, which means that there are fewer big snows that create good conditions for cross-country skiing. It seems to me that recently there are a lot fewer good days each winter to cross-country ski in Indiana Dunes than there once were.

8. I am the immediate past president of the Beverly Shores Environmental Restoration Group. I've been on the board for 5 years. One focus of the Environmental Restoration Group is to remove invasive species and encourage people to plant native species. The Environmental Restoration Group recently published an updated edition of a book, *A Beginner's Guide to the Plants of the Indiana Dunes*, which educates people on the native and invasive species of the region in an effort to encourage them to plant native species. This recent edition was an update to the 2008 edition of the book. We've also recently produced a Dune Plants app that provides information on both native and invasive plants found in the Indiana Dunes.

9. The Environmental Restoration Group has removed numerous invasive species over the years, including Oriental Bittersweet and Burning Bush. The Group spends approximately $3,000 dollars each year removing the invasive Tree of Heaven.

10. The Environmental Restoration Group recently found invasive kudzu growing on private property in Beverly Shores, and paid to have it removed. Kudzu has overrun parts of the southern United States, devastating local plant communities, and the restoration group and local environmental experts we talked to were stunned that we found kudzu growing here.

11. Climate change increases the spread of invasive species and makes native species more vulnerable to being crowded out by invasives. When invasive species become a monoculture, they kill the native species. I am worried that as climate change increases, new invasive species will spread into Northwest Indiana, and existing invasive species will gain a stronger foothold,

harming the native biodiversity of the unique Indiana Dunes area. If this happens, the Environmental Restoration Group will need to spend even more money fighting invasive species.

12. Many of the invasive species in the area are also "deer candy," and contribute to the spread of deer in the area, which is a major concern. The Environmental Restoration Group used to perform a deer cull, which the National Park now performs. Before these deer were effectively managed, the understory of the woods was essentially all gone because it was eaten by the excessive deer population.

13. The Shirley Heinze Land Trust recently installed kayak launches on the east branch of the Little Calumet River. These launches were unusable for much of summer 2019 and early spring 2020 because the Little Calumet River has been so high. I'm aware of the high water levels because I follow the Northwest Indiana Paddling Association's Facebook page, which has been documenting the high water levels and the problems for paddlers on the Little Calumet, and because I often drive by the Little Calumet and have seen the high water levels myself.

14. I own a kayak, and looked forward to using it on the Little Calumet in summer 2020. High water levels, however, prevented me from doing so many days last summer and this spring that I intended to go kayaking.

15. Climate change is causing increased heavy precipitation in the Midwest. I believe that the recent high river levels in Northwest Indiana are partially attributable to increased precipitation caused by climate change. I am concerned that climate change will increase threats to water quality in the area because warmer water temperatures and increased run off from more frequent heavy storms caused by climate change will degrade water quality.

16. Lake Michigan water levels have increased to record levels. A section of Lake Front Drive, which runs along Lake Michigan shoreline in Beverly Shores, has been closed because it

is literally falling into the lake and the town of Beverly Shores just completed a $5 million bond sale to fund erosion protection. The beaches in Beverly Shores are gone. My property taxes will increase for the next 20 years as a result of the bond issue and the value of my home could decline because of loss of the beach.

17. I sail on Lake Michigan and the high water levels are also limiting sailing opportunities. The harbor in South Haven is closed for summer 2020 and docks at other harbors are underwater, making it impossible to use them.

18. As climate change accelerates, high water levels and impaired water quality will diminish my opportunities for recreation on the rivers and lakes in Northwest Indiana.

19. The Beverly Shores area's biodiversity and its proximity to the beach and to outdoor recreation opportunities area is why we live here. If climate change increases the spread of invasive species, decreases water quality, decreases biodiversity, and diminishes the recreational opportunities in the area, the value of my property will decrease because the area will no longer be such a desirable place to live.

20. I am concerned that the regulatory actions recently taken by the National Highway Transportation Safety Administration (NHTSA) and the Environmental Protection Agency (EPA), which purport to prevent states from setting vehicle greenhouse gas emissions standards and imposing zero-emission vehicle mandates (Part One of the "Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule"), will contribute to increased greenhouse gas emissions and increased climate change. I am also concerned that regulatory actions weakening the federal vehicle fuel efficiency standards and greenhouse gas emissions standards (Part Two of the SAFE Rule) will similarly contribute to climate change.

21. Because of our concerns about climate change and the environment, my wife and I have decided that in the future we will buy only electric or hybrid cars. We plan to buy our next car in 2020, to replace our current car, and anticipate buying another car in 2023.

22. I am concerned that the NHTSA and EPA actions in the Part One and Part Two SAFE Rules weakening federal emissions standards and purporting to revoke state authority to set stricter emissions standards or mandate zero emissions vehicles will lead to decreased availability of electric and low-emission cars and increase prices for such cars that are still available. This would hurt me as a consumer by decreasing the range of cars my wife and I will have to choose from and by increasing the price we will have to pay for a car.

23. I support the Environmental Law and Policy Center's efforts to ensure that the federal government does not improperly revoke states' ability to set greenhouse gas emission standards and zero-emissions vehicle mandates and does not weaken the federal vehicle emissions and fuel efficiency standards.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information, and belief. Executed in Beverly Shores, Indiana on May 21, 2020.

Laurence B. Stanton

DECLARATION OF JOHN STEEL

I, John Steel, declare as follows:

1. My name is John Steel. I am over eighteen years of age, of sound mind, and fully competent to make this declaration. I also have personal knowledge of the factual statements contained herein.

2. I am a member of the Union of Concerned Scientists and was a member at the time this litigation commenced.

3. I graduated Princeton University in 1956 with a Bachelor of Science in Engineering, Columbia University Law School in 1959 and New York University Law School with a graduate degree in Taxation. I was elected to the Town Counsel of Telluride, Colorado in 1994, became Mayor in 1999 and served in that capacity until 2006. As Mayor I dealt with several environmental issues of vital concern to our community ranging from compliance with standards for PM10 particles in the air to condemnation of a large landholdings for environmental and recreational purposes. Additionally, the Council confronted problems related to forest fires, mining waste removal, re-opening of uranium mines, green construction standards, water use for snow making, all of which presented environmental issues.

4. Not only was our community's economy dependent on the environment, I too was an avid hiker and cross-country skier.

5. I have been concerned for many years with environmental issues. My impetus for seeking election to the Telluride Town Counsel was entirely prompted by my concern for the delicate environment of Telluride. Now, as a parent and grandparent, and with increased knowledge and sensitivity to environmental degradation, my concern and my activism has deepened.

6. I live in Santa Barbara, California. For many years I was skeptical of Californians for their dependence on personal automobiles. However, once I moved here to be closer to my children and grandchildren and for medical reasons, I realized that automobiles were not only a personal necessity, but also essential for the economy. I constantly use my cars for doctor and dental visits (both here and in Los Angeles), for business, to offices and the airport, to go to the gym, for shopping, to visit my children and grandchildren, for short vacations nearby, and for easy access to the movies, theatres, and concerts. Despite the availability of public transportation, an active person my age (85) cannot satisfactorily do without a car.

7. Two years ago I traded in my Toyota Highlander for a far more efficient Lexus Hybrid. It achieves nearly twice the miles per gallon my Highlander did, without any compromise in size, power or comfort. I was told at the car agency that Lexus undertook to develop this vehicle to comply with governmental requirements and because of its concerns for the environment. I also

learned that hybrid vehicles were strong sellers and had higher resale values. I intend to replace or supplement my hybrid Lexus with a small, zero emission vehicle within the next few years. Most of my trips are local, and I can charge it at home. I hope with sufficient incentive car makers will produce what I want at a reasonable price.

8. As a car dependent person in a location crowded with other car dependent residents, it is painfully obvious on our crowded, sometimes congested roads, what we are doing to the air we breathe because of the vehicles we drive. And we drive these vehicles because they are the ones car manufacturers produce in the price range we can afford. Like so much else, necessity—and that means governmental requirements—will force car manufacturers to engage in research to develop more efficient affordable vehicles. We have seen this work in the past when car manufacturers have their feet to the fire. My hybrid is proof. So too is the smog reduction in many cities, Los Angeles being a prime example. There is no reason to remove the pressure to reduce dependence on expensive fossil fuel that pollutes the air with unhealthy particles and adds to the greenhouse gases. The technology already exists, if not the economic incentive.

9. My ability to purchase an affordable clean car depends in large part on the federal government's vigorous regulation of fuel economy and greenhouse gas standards for passenger vehicles, which collectively force the development of

cleaner cars available at affordable prices to the public. With widespread conversion of vehicle to more efficient ones, global greenhouse gas emissions will be drastically reduced. The emissions reductions, in turn, slow global climate change.

10. Conversely, loosening fuel economy and greenhouse gas ("GHG") standards will reduce the pressure on the automobile industry to do the necessary product development for increased production of economical hybrids, electric vehicles, and even more efficient conventional vehicles.

11. I am aware that, in 2013, EPA provided California with waivers under the Clean Air Act, which allowed California to set its own greenhouse gas standards for light duty vehicles and to create a program to incentivize the purchase of "Zero Emission Vehicles," or "ZEVs."

12. California (and the federal GHG standards) are good examples of the power of government regulation. Higher standards, and, in particular, the California waiver force car makers who wish to sell their vehicles here, in this most lucrative market, to comply with more stringent requirements.

13. California made this choice to protect its citizens and to provide them with wider choices for vehicles they—and I—could feel good about driving. That trend must continue as global warming continues to increase.

14. If the standards remain effective, I will have greater access to low emissions and more efficient vehicles, since the trends related to California's standards will continue or accelerate.

15. I am aware that EPA has finalized an unprecedented decision to revoke California's waiver and to prohibit other states from enforcing the California standards they have relied on for the better part of a decade. I am also aware that the Department of Transportation has suddenly decided that its regulatory authority prevents EPA from issuing these waivers in the first instance, thereby barring EPA from enforcing ant waivers it has granted and not withdrawn.

16. If the federal government consummates these actions, or if it lowers federal emissions and fuel economy standards, it will begin undoing nationwide progress towards a wider availability of low or zero emissions vehicles. In so doing, it will curtail my access to the types of vehicles I most want to purchase when replacing the cars I currently own. The agencies' decisions would also accelerate the regional effects of climate change.

17. An order from this Court striking down the government's orders would redress my lack of consumer choice by leaving intact more stringent

standards. The maintenance of more stringent standards would result in greater consumer choice.

18. I declare under penalty of perjury that the forgoing is true and correct.

Executed in Santa Barbara, CA., on June 01 2020.

John Steel

DECLARATION OF IGOR TREGUB

I, Igor Tregub, declare as follows:

1. I am over 18 years of age and competent to give this declaration. I have personal knowledge of the following facts, and if called as a witness could testify competently to them. As to those matters which reflect an opinion they reflect my personal experience, opinion and judgment on the matter.

2. I live in Berkeley, California, in Alameda County, and have lived here since 2003.

3. I have been a member of the Sierra Club since 2008. Getting involved in Sierra Club has been an excellent vehicle for advocacy and success on good policies on the issues of transportation and air quality, among other things. I am very involved in the Sierra Club San Francisco Bay Chapter and am part of its Transportation and Compact Growth Committee. I am also a member of the East Bay Chapter of the League of Conservation Voters, Indivisible Berkeley and its Science and Environment Team, California Young Democrats and its Environmental Caucus, and the California Democratic Party Environmental Caucus. I am currently an elected Commissioner on the City of Berkeley Rent Stabilization Board.

4. I am very concerned about the poor air quality in the Bay Area. West Berkeley and West Oakland tend to have some of the worst air quality of the nine counties in the Bay Area region, with high readings for particulate matter and ground-level ozone. My housing complex is in an air pollution and climate hotspot here in the Bay Area. I live about a half mile from the I-80 freeway, which – pre-COVID-19 – carried extremely heavy vehicle traffic, and around 7 miles away from the Richmond Chevron refinery, which refines gas and diesel that these vehicles burn. Both of those activities cause air pollution where I live, including particulate matter, ground-

level ozone and other noxious gases. I have seen firsthand how this has affected air quality in my area and the health of my constituents.

5. Because the area where I live is so close to the sources of harmful air pollution from tailpipes and oil refining, I know that my own life span will likely be shortened. This knowledge makes me anxious, but I am most upset about and fear for my neighbors, some of whom suffer respiratory conditions. I represent nearly 120,000 residents on the Berkeley Rent Stabilization Board, and I worry about how poor air quality affects them. I see firsthand how air pollution impacts the behavior of folks who have sensitive health receptors and how this can completely disable them for hours or even days. I run several times a week and I try to hike as often as I can on a loop parallel to I-80, and I intend to continue to do so as long as the air quality is improving. But I do not exercise outside on bad air quality advisory days and instead remain indoors. On bad air quality days I also try to minimize the use of my vehicle, but I currently work 40 miles away from home, which makes this difficult (the Bay Area's current shelter-in-place order notwithstanding). I hate it when I have to drive, especially on bad air quality days, because I do not want to contribute to the problem. These concerns are the reasons why I am trying to invest in an electric vehicle as it emits no tailpipe pollutants.

6. I am currently in the market for an electric vehicle and am fully committed to get out of my gasoline-powered vehicle in about three months. I will likely get a plug-in hybrid if I can get charging infrastructure in my multifamily housing complex. I think a lot about the harmful pollutants my conventional car emits that make people sick, and also about my carbon footprint and the fact that we have ten years to make dramatic changes to prevent the worst effects of climate change. I know that any changes I make at a micro level will not have the great impact that a broad policy change would, but I feel that I need to lead by example. My biggest

effort has been to craft a model local policy for electric vehicle sharing agreements with landlords that would result in the installation of charging infrastructure in multifamily housing, which will make it easier for me and others to buy and charge electric vehicles.

7. I know that California has led the nation for decades in setting more stringent emission standards for vehicle pollution, and also that California has had zero emission vehicles mandates and its own greenhouse gas emission standards for some time. California's regulations have caused electric vehicle sales to go up, helping to make the air cleaner. Other states have adopted California's standards, which has helped push the development of EVs and the necessary infrastructure nationwide.

8. I am aware that the National Highway Traffic and Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) have issued a rule in which NHTSA finds that federal law preempts California's zero emission mandate and greenhouse gas emission standards, and they are no longer in effect. EPA has cancelled a waiver under which California, until now, could set ZEV standards and its own greenhouse gas emission standards. I am also aware that other states have been able to follow California's example, but that EPA's and NHTSA's rule have cancelled the right of these other states to do what California does.

9. Because California's ZEV mandate no longer exists, automakers no longer have to sell ZEV vehicles. This means that the number of EVs available for sale and on the streets will diminish, and harmful pollution where I live will increase. It also means that more fossil fuel cars will be built and sold, which means they will consume more fuel and harmful emissions from the Richmond refinery are likely to increase as well, harming air pollution from both traffic and refining activities.

10. I am aware that NHTSA and EPA also have issued a rule that will significantly lower the stringency of the federal fuel efficiency and greenhouse gas standards for the light duty vehicle fleet, causing the combustion of huge amounts of additional fuel and increased emissions of ozone-forming greenhouse gases, particulate matter and other noxious air pollution. I am extremely concerned because taking away California's ability to issue these regulations will have an effect on automakers' incentive to build and sell zero emissions vehicles, which in turn will increase ozone and other pollution and make the Bay Area's air quality worse. I am additionally concerned that these rollbacks will result in more barriers to purchasing electric vehicles due to a lack of rebates and lack of investment in electric vehicle infrastructure. I worry that losing the ZEV mandate and the much more stringent federal fuel efficiency and greenhouse standards will make it more difficult for myself and others to purchase electric vehicles and will jeopardize incentives for consumers to do so, such as rebates. I fear that there will be fewer such vehicles to purchase, that they will be more expensive, and that I will have much less choice in which electric vehicle to buy.

11. I am also very concerned about climate change. Climate change obviously affects everything that we do, especially since I am a millennial and will likely have to deal with climate change for the rest of my life. I am extremely concerned that that science tells us that we only have about ten years to make dramatic shifts, and it is disheartening that we have the technology to do it, but lack the necessary will. The transportation sector plays an outsized role in causing climate change, as it is the biggest emitter of greenhouse gases in the U.S., and rolling back regulations that reduce the sector's emissions sets us back when we cannot afford to lose time.

12. I support Sierra Club's lawsuit challenging NHTSA's and EPA's rule stating that federal law preempts California's right to set zero emission vehicle sales mandates and its own

greenhouse gas vehicle standards, that EPA's waiver for California has been withdrawn, and that other states can no longer follow California's example. I also support the lawsuit trying to reverse the rollback of federal fuel efficiency and greenhouse gas standards for the national light duty vehicle fleet. If the court reverses either of these rollbacks, I would personally and directly benefit from cleaner air and fewer climate-disrupting and ground-level ozone causing greenhouse gas emissions. I will be able to pursue my outdoor physical recreational activities more often because there will be fewer bad air days because harmful pollution from vehicles and refining activities will be reduced. Additionally, I will have more choices for a new electric vehicle within my budget range. Keeping the ZEV mandate in place will also drive my ability as a policymaker to get more electric vehicle infrastructure for folks who are renters like I am. The lack of electric vehicle infrastructure is a significant barrier, and success in this litigation will provide more incentive for the government and the private sector to invest in this infrastructure, so that I and others can charge our electric vehicles at home.

I declare, under penalty of perjury, that the foregoing is true and correct.

Dated: May 20, 2020.

Igor Tregub

DECLARATION OF ABEL VALDIVIA

I, Abel Valdivia, state and declare as follows:

1. I have personal knowledge of the following facts, and if called as a witness could and would testify competently to them.

2. I live in Chapel Hill, North Carolina. I received a bachelor's degree in biological sciences from the University of Havana in 2001, a master's degree in marine ecology from the University of Havana in 2004, and a Ph.D. in marine ecology and conservation biology from the University of North Carolina at Chapel Hill in 2014. I am a marine biologist, with a special focus on tropical coral reef conservation. I am also an active nature photographer. Currently, I am employed as a Senior Manager for Monitoring and Evaluation at the non-profit organization Rare with headquarters in Arlington, Virginia.

3. I have been a member of the Center for Biological Diversity (the Center) since 2015. I receive and read the Center's newsletters, petitions, and investigative reporting pieces in its online news outlet, The Revelator. I also rely on the Center to represent my interests protecting imperiled species and ecosystems, including coral reef ecosystems. I especially rely on the Center to represent my interests in its work to reduce greenhouse gas emissions, and to protect imperiled species and their critical habitats. As a scientist, I understand and study the consequences of increased greenhouse gas emissions on marine species

and ecosystems, and I know that we ought to rapidly reduce greenhouse gas emissions to avoid the worst consequences of the climate crisis. I rely on the Center's work to achieve those rapid and needed reductions through advocacy for legal and policy solutions. I believe that the work the Center does is really important to achieving the greenhouse gas emission reductions needed in the United States that are necessary to begin to address the climate emergency.

4. I am aware that this year the U.S. Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) issued new greenhouse gas emissions and criteria pollutant standards for passenger cars and light trucks (the SAFE II Rule or the Rule). I have learned that the SAFE II Rule will increase carbon dioxide (CO_2) emissions by at least *one billion* metric tons (MT) through model year (MY) 2029, and it's likely the impacts will be even higher. I am also aware that the SAFE II Rule acknowledges that massive CO_2 emissions from the Rule will increase the harmful effects of climate change, including elevating temperatures, acidifying oceans, increasing sea-level rise, promoting heavy precipitation events, and increasing the strength of tropical storms.

5. Fossil fuel emissions from internal combustion engine vehicles (ICEVs) are a significant component of global and U.S. greenhouse gas pollution. In the United States, the transportation sector was the largest contributor to

greenhouse gas emissions in 2018, according to the EPA. In the same year, the transportation sector accounted for over a quarter of total U.S. CO_2 emissions from fossil fuel combustion, with passenger cars representing the largest source and light-duty trucks also comprising a significant percentage.

6. I am aware that the SAFE II Rule will result in dirtier, less efficient cars and more gasoline use, increasing CO_2 emissions from the U.S. transportation sector and worsening climate change and its effects. I believe EPA and NHTSA's power to regulate tailpipe and criteria pollutant emissions through the SAFE II Rule is essential to reduce the U.S.'s contribution of carbon dioxide to global emissions and to help in reducing global warming. I also believe that the implementation of the SAFE II Rule will directly affect my work as a marine biologist and my hobby of underwater photography because it will increase emissions that contribute to the negative effects of global warming (including acidification and increased ocean temperatures) on marine species and ecosystems that are critical to my work.

7. As a marine conservation biologist, I specifically study tropical coral reef ecosystems. Coral reefs have slowly grown over thousands of years, forming living barriers and atolls that can be seen from space (e.g., the Great Barrier Reef of Australia). Under good conditions, hard corals are the foundation species of these ecosystems, building calcium carbonate skeletons layer by layer and creating

a complex tridimensional structure that supports the entire reef life. Fish, crabs, lobsters, worms, urchins, sea turtles, marine plants, and hundreds of other species rely on the complexity of the coral reef framework for survival, shelter, reproduction, and food.

8. Importantly, over 1 billion people depend on coral reefs to sustain their livelihoods and food security, and healthy coral reefs are worth as much as USD $365 billion globally for every year they continue to provide these essential services to coastal communities, according to an analysis conducted by the UN Environment, International Coral Reef Initiative, and the UN Environment World Conservation Monitoring Center in 2018.[1]

9. However, coral reefs are highly threatened, and more than a quarter of coral reefs worldwide have already disappeared or are extremely degraded. This global decline is directly related to climate change driven by anthropogenic greenhouse gas emissions due to burning fossil fuels.

10. The emission of anthropogenic greenhouse gases negatively affects tropical and subtropical coral reefs through two main processes: by warming the oceans and by increasing the acidity of seawater. Greenhouse gases accumulate in the atmosphere and trap heat, increasing the average global temperature. This

[1] UN Environment, International Coral Reef Initiative, UN Environment World Conservation Monitoring Centre. 2018. Analysis of international funding for the sustainable management of coral reefs and associated coastal ecosystems. Available at: wcmc.io/coralbrochure.

process is called global warming. Anthropogenic carbon dioxide concentrations in the atmosphere have rapidly increased from 280 parts per million pre-Industrial Revolution to 412 parts per million in September 2020, for the first time in human history. The planet has not seen this carbon dioxide level in more than 3 million years, a time when the Earth was 2 to 3 degrees Celsius (3.6 to 5.4 degrees Fahrenheit) warmer than pre-industrial levels, sea levels were 16 meters (~53 feet) higher than today, and trees were growing at the South Pole.

11. Warming of the atmosphere due to greenhouse gas accumulation rapidly leads to ocean warming. Over 90 percent of the trapped heat, created by the excess of carbon dioxide and other greenhouse gases such as methane, is absorbed by the oceans. The global oceans have already warmed, on average, by 0.84 degrees Celsius in 2019, according to NOAA, since record keeping started 140 years ago. Ocean warming has been the main driver of coral reef decline in the past decades, because reef-building corals are very sensitive to changes in sea temperatures and disease outbreaks triggered by warming waters.

12. Increasing carbon dioxide concentrations in the atmosphere results in more dissolved carbon dioxide in the oceans, which leads to ocean acidification. The process and consequences of ocean acidification are discussed below.

13. The continued existence of coral reefs, where reef-building corals grow and support a complex life network, relies on a mutually beneficial

relationship (a symbiotic relationship) between the coral and millions of very small one-celled algae that live inside the coral host. The coral host provides shelter to the symbiotic algae, while the algae provide nutrients, oxygen, help in building the coral skeleton, and color to the otherwise bleached-white calcium carbonate skeleton. A thriving relationship between the coral host and the microalgae depends on a balanced set of environmental conditions that include a narrow range of sea temperatures, the right concentration of carbon dioxide, optimal water acidity, adequate levels of light and nutrients, and clean water. The disruption of this environmental balance due to ocean warming negatively affects the relationship between the coral host and its symbiotic algae, leading to the expulsion of the algae from the coral tissue, causing coral bleaching and eventually the death of the coral host.

14. Episodes of warmer-than-usual water temperatures or warming events, as a result of climate change, drive the disruption of the coral-symbiotic-algae relationship, leading to widespread coral bleaching and coral death. Small deviations outside the optimal range of temperatures can have devastating effects on coral reefs across large scales as seen around the globe in the past five to six years (Hughes, Barnes et al. 2017, Hughes, Kerry et al. 2017, Hughes et al. 2019) (Please see Exhibit A for a full list of sources referenced in this declaration). Dead corals eventually crumble down. Fewer live corals on a reef result in less

biodiversity, fewer ecological services, and threaten the viability and existence of the entire ecosystem and the marine species and people that depend on them.

15. The frequency and severity of warming events that lead to widespread bleaching has increased as greenhouse gas emissions have skyrocketed in the past decades. Scientists forecast that widespread bleaching events that cause coral mass mortality will become annual events, drastically reducing the capacity of coral reefs to recover between events. We have already seen back-to-back widespread bleaching events in recent years across Florida, Hawaii, and the Great Barrier Reef from 2015 to 2020. These annual warming anomalies have resulted in the loss of 50% of the corals in the Great Barrier Reef, leaving one of the best-preserved coral reefs on the planet in a very poor state.

16. Besides greenhouse gas emissions, two other threats negatively affect tropical and subtropical coral reefs: overfishing and coastal pollution (such as water contamination, eutrophication, and coastal runoff). The harms caused by ocean warming as a result of human-caused greenhouse gas emissions, however, are by far the greatest threat to coral reefs because warmer sea temperatures kill corals at a global scale. Overfishing and coastal pollution are localized threats that required localized actions. Warming events indiscriminately impact both pristine and isolated coral reefs, just as they kill coral reefs that are directly impacted by pollution and overfishing, such as those close to coastal human settlements and

cities. Addressing local overfishing and coastal pollution problems may buy some time as we reduce greenhouse gas emissions globally because less locally impacted coral reefs may have a better chance to recover from warming events. However, if we do not cut greenhouse gas emissions rapidly and drastically, coral reefs as we know them today will disappear. The only solution to truly protect and recover coral reefs and the ecological and socio-economic services they provide is to decrease the emission of greenhouse gases now.

17. We are already seeing the impacts of warmer temperatures resulting from greenhouse gas emissions in coral reefs throughout the world. In the United States specifically, the coral reefs in the Florida Keys have already declined and have continued to rapidly deteriorate due to ocean warming that leads to bleaching and disease outbreaks. The amount of live coral in a reef, or coral cover, is an indicator of reef health. The more live coral cover, the healthier a reef is, as it has more tridimensional structure to support a high diversity of marine life. Scientifically, a healthy reef may have approximately 50 percent or more live coral cover. In stark contrast, today coral reefs of the Florida Keys have less than 5 percent live coral cover, down from approximately 50-60 percent reported by scientists in the 1970s. In some areas, there are hundreds of hectares of dead corals that have never recovered from mass bleaching and disease outbreaks. This drastic coral reef degradation is also happening across the Caribbean, Australia's Great

Barrier Reef, Indo-Pacific coral reefs, and remote and isolated Pacific islands, mainly due to global warming.

18. New scientific studies have shown that the massive decline in coral cover in the Florida Keys is linked to global warming events that promoted disease outbreaks and that have been prevalent since the late 1980s. We know for certain that the decline of the Florida Keys' coral reefs has been primarily due to warming driven by anthropogenic greenhouse gas emissions increases because the Florida Keys coral reef system is one of the best managed reef systems in the world, where fishing is mostly regulated and pollution is managed. The Florida Keys is a prime example demonstrating that even under the best management of coastal pollution and overfishing, where most fish thrive, corals are not resistant to the impacts of climate change and have greatly suffered as a result of global warming. Global warming strikes reefs indiscriminately, and if we do not rapidly reduce greenhouse gas emissions, eventually the reef systems will become unrecognizable as we used to know them.

19. Furthermore, in Hawaii in 2016, I saw whole fields of corals that had turned white due to bleaching, then brown and black due to dying coral tissues and being overgrown by algae and other organisms. Unprecedented mass bleaching occurred across Hawaii in 2015, where an average of 60 percent of corals off the western side of Hawaii Island were bleached, with some reefs experiencing 90

percent mortality. Severe and widespread coral bleaching is happening now in Hawaii, with coral reefs off Maui and West Hawaii already showing white bleached corals. Mass bleaching and subsequent coral death can occur quickly, a drastic and surreal process that indiscriminately wipes out small and large coral colonies in just a couple of weeks. Corals take thousands of years to grow big colonies and form reefs, but once the corals die, those species that depend on corals for habitat are in peril. As coral reefs erode away, thousands of species no longer have the ecological services they need, including an ecosystem that gives them food and shelter.

20. Unfortunately, there are no pristine reefs left in the world, as human-driven global warming has reached far and wide. All coral reefs on the planet have already experienced bleaching and mortality due to ocean warming. There are still some minimally disturbed coral reefs in the Indo-Pacific and remote Pacific atolls that may have a better chance to recover from mass bleaching events. These reefs, however, are not resistant to the negative impacts of the increasing frequency of warming anomalies that are forecasted for the next decades. The frequency of these events reduces the time for recovery between bleaching events. The fact is that if the world does not seriously reduce greenhouse gas emissions, we risk losing all coral reefs as we know them in our lifetime.

21. In addition to global warming, greenhouse gases emissions affect tropical and subtropical coral reefs through a process called ocean acidification. Greenhouse gas emissions result in increased concentrations of dissolved carbon dioxide in sea water, which lowers the pH of the ocean and makes it more acidic due to changes in ocean chemistry. In short, as more dissolved carbon dioxide reacts with sea water, carbonic acid is produced, which is rapidly dissociated into bicarbonate and hydrogen protons. More freely available hydrogen ions lower the pH of seawater, increasing acidity. The excess hydrogen protons bind to free carbonate ions (a prime component used by corals to produce calcium carbonate skeletons) to produce more bicarbonate. As such, ocean acidification decreases the availability of carbonate ions to corals, reducing the capacity of reef-building corals to grow calcium carbonate skeletons that create complex structural reefs and support the entire ecosystem.

22. Increasing concentrations of carbon dioxide in the atmosphere and ocean result in substantial increases in water acidity, with deleterious effects on the early life of corals. Acidification harms many aspects of the life cycle of a coral and can affect the natural behavior of other reef species such as fish. Small decreases in pH, resulting in increased acidification, can have large impacts on coral reefs. The range of pH differences can also vary vastly in different parts of

the ocean, which the SAFE II Rule and the Final EIS do not consider because they use average global ocean pH.

23. Reduced pH can impact coral reef ecosystems, by for example, drastically reducing fertilization rates between male and female coral gametes in the water. It also affects the ability of coral larvae to find a place to settle and grow and affects the capacity of new coral spat to build a calcium carbonate skeleton and survive the first months to year of life. Thus, when waters are more acidic due to ocean acidification, there are fewer corals to survive and grow during the first stages of life. This survival and growth during the first stages of life are crucial for coral reef recovery. For already established coral colonies, growth rates are slower under more acidic conditions for most coral species.

24. Furthermore, with increasing ocean acidification, corals tend to build skeletons that are less dense and more fragile, making them more susceptible to breakage and physical erosion. When corals die after a bleaching or disease event, acidification increases the erosion rate of the calcium carbonate skeletons, accelerating the degradation of the reef matrix. As a result, fish and other species that depend on the reef structure for food and habitat are negatively affected. More acidic waters also affect the ability of younger reef fish to find a reef to settle into and avoid predators. The mechanism through which acidification affects fish

behavior is an emerging field, but studies point to disruption in the neurological system.

25. If ocean warming and acidification continue, the function and structure of reefs will change forever. Complex reef system that are coral-dominated with lots of competitive corals are disappearing and systems that are non-coral dominated with fewer coral species and more algae and other species like sponges that support fewer species are becoming the norm. At some point, these new emerging non-coral dominated systems will need to be renamed, as they can no longer be considered a coral reef.

26. Some coral species are already in danger of extinction and 22 species have been listed under the Endangered Species Act due to global warming, including several acroporid species. The Caribbean branching elkhorn and staghorn, which are species in the genus *Acropora*, are my favorite coral species because they are especially beautiful. For thousands of years, acroporid corals were the dominant coral species in the Caribbean and the Florida Keys, building spectacular shallow reef crests and banks that not only supported an amazing diversity of life, but also protected the coasts from storms and wave erosion. These coral species have mostly disappeared from the region; the current abundance is less than 1% of historical levels seen a few decades ago.

27. When I moved to the United States in 2004, I worked for the National Oceanic and Atmospheric Administration studying and implementing the recovery plan for the staghorn and elkhorn corals across the Florida Keys Coral Reefs National Marine Sanctuary. These coral species were listed under the Endangered Species Act in 2006. They were the first marine species to be listed under the Act as threatened with extinction due to anthropogenic climate change and are not likely to be the last ones. Most acroporid species are highly sensitive to small increases of water temperature, and ocean acidification already affects fertilization rate and recruitment of coral larvae to the reefs. This means that the recovery potential of acroporid corals, especially across the Florida Keys, is diminished by current warming and ocean acidification.

28. Acroporid corals grow relatively quickly (one branch at about 10 cm per year), so under normal conditions they outcompete other coral species and take over the reefs. But if they experience bleaching or disease, these coral species are the first to die because they are highly sensitive to warming. Dead coral branches tend to quickly break apart without replacement by living tissue and eventually erode away. In a matter of days, a complex reef can turn into a wasteland of dead branches and rubble crumbling down with the waves, causing the erosion of reef life such as fish and sponges. There are only two species of acroporids in the Caribbean. There are many more in the Indo-Pacific including

species in U.S. waters; all of them are highly sensitive to warming. As a result of mass bleaching and diseases outbreaks driven by ocean warming, we are seeing reefs shift from coral-dominated systems, with lots of competitive corals like *Acropora*, to non-coral dominated systems. Macroalgae and other organisms are taking over coral reefs and weedy small-growing corals, which don't create the large tridimensional reef structure to support a rich and healthy reef ecosystem, are the only coral survivors.

29. As a marine biologist, I have a great professional interest in the health of corals and coral reefs. My work focuses on studying how we can protect and conserve coral reefs. I observe and document the impacts of global warming and other threats to coral reefs, as well as monitoring and evaluating the effectiveness of fishing regulations and community-based management practices on promoting coral reef recovery. I undertake my scientific research and make that research public to educate policy makers and the public about the threats facing coral species and how we can work together with coastal communities to reduce and eliminate local threats. My professional interest is in protecting the health of hundreds of coral species from extinction by undertaking fair, comprehensive, and robust scientific research.

30. My work focuses on applying the vast scientific knowledge of marine ecology and conservation and finding solutions for coral reef recovery through

effective management and local community involvement. Specifically, I oversee a monitoring and evaluation program for a project called Fish Forever that has three main overarching goals: conserve biodiversity, sustain livelihoods, and increase food security of coastal communities that depend on coral reefs for sustenance. I believe that community involvement is part of the solution to the coral reef crisis because communities are the stewards of their natural resources. By reducing economic reliance on coral reefs, and limiting local threats such as overfishing and coastal pollution, we may buy time for corals and increase the chances of coral reef recovery after bleaching events and disease outbreaks driven by ocean warming. Since reducing global warming requires global action, I am also working with local communities on behavior change campaigns that increase awareness of climate change impacts and empower people to make decisions that reduce greenhouse gas emissions.

31. In my current job, I used to travel to different countries at least once per month to visit locations with coral reefs. However, with the current COVID-19 pandemic, my work travel has halted. Last year, I traveled to the Florida Keys to test a new underwater drone that may help us with conducting coral reef surveys in a more efficient way to evaluate reef health. If this new technology works, we intend to use it in the tropical countries where we are working to facilitate monitoring and evaluation of the Fish Forever program.

32. In past years, I have traveled to Belize, Costa Rica, Honduras, Indonesia, Mexico, and the Philippines to work with coastal communities to safeguard coral reefs and the ecological and social services they provide. Every place I visit, I try to get in the water to observe and monitor coral reefs as a part of our program. I intend to return to these locations regularly for the next several years to evaluate and monitor tropical coral reefs. Although paused right now because of the COVID-19 pandemic, I have work trips scheduled for the future for all the countries I have visited before, as well as regions within the U.S., such as Hawaii and the Florida Keys. I am also planning trips to new countries such as Mozambique and Brazil to visit coral reefs and their coastal communities, and to evaluate the effectiveness of new technologies from our program.

33. In addition to my professional interest in protecting coral reefs, I really enjoy diving and swimming on coral reefs for recreation. If it's safe to travel next year (given the COVID pandemic), I have plans to go to Wakatobi, near the Southeast Sulawesi in Indonesia. I specifically enjoy exploring coral reefs that have so far escaped the most devastating effects of warming and human activities. These places are unique and provide a baseline for comparison. Coral reefs support so much biodiversity, and I enjoy seeing the wide variety of marine life. High biodiversity is important for supporting a healthy ecosystem, but I believe greater biodiversity is inherently valuable. It enriches us as humans.

34. In fact, it was my recreational, aesthetic, and intellectual interests in biodiversity that fueled my professional interest in becoming a marine biologist. When I was in high school, I volunteered to go diving to collect samples of coral skeletons for an exhibition at my school's natural history museum. We went to the north coast of Cuba to collect dead branches of staghorn and elkhorn corals. Some of the big colonies of staghorn and elkhorn were already dying in the mid-1990s, and we wanted to showcase what coral reefs were formed of, and what their calcium carbonate skeletons looked like without living tissue. I loved that trip and thereafter I decided I wanted to be a marine biologist and study why these stony creatures were dying all over the Caribbean.

35. I find diving on coral reefs to be a kind of spiritual experience. Diving through coral reef channels and underwater caves that have formed over thousands of years by the incessant growth of corals is deeply meditative. Hearing the cacophony of sounds that reef creatures make is an incredible and exciting experience. Good diving requires practice, especially achieving calmed and relaxed breathing when underwater pressure is compressing your lungs. As such, diving in coral reefs requires focus, is very meditative, and is one of the best Zen environments. I have plans to go to coral reefs in Palau and Micronesia and remote U.S. Pacific islands in the summers of 2021 and 2022. While I am there, I

will take time to dive for enjoyment and meditation, and to photograph the reef systems and corals.

36. I really love underwater photography. Through photography I can capture the beauty of coral species and the signs coral reefs show due to threats. Coral reefs are one of the best marine systems to photograph because of the rich biodiversity, the bright colors, and the different textures. I take my camera every time I go out into the field.

37. The survival of elkhorn and staghorn corals, hundreds of other coral reef species, and with them the continued existence of healthy coral reefs is extremely important to me, both professionally and personally. The SAFE II Rule puts the survival of these species and the coral reef ecosystems at risk. The SAFE II Rule will undoubtedly exacerbate global warming, as well as ocean acidification. We need to drastically cut greenhouse gas emissions now, including from cars and light trucks, if we want to keep just 10 percent of coral reefs globally and prevent the functional extinction of coral reef species by mid-century. Rules like SAFE II compound the problem and accelerate the demise of coral reefs globally.

38. If global warming continues, my work will have to shift focus, and as a consequence my livelihood will be affected. Right now, I am focused directly on protecting tropical coral reefs from local stressors such as overfishing and coastal

pollution, with the hope that this will buy time while we solve the climate crisis. But if we do not cut greenhouse emissions and reduce global warming, there is no point in protecting reefs from these stressors, because they won't survive anyway. The increased warming and ocean acidification resulting from the SAFE II Rule will harm my interest in protecting and ensuring the survival of coral species, because it will lead to the worsening of global warming and ocean acidification that impinges on my interest in conserving healthy coral reefs.

39. It's so exciting to get in the water and see a reef full of life. And once you know what a healthy reef looks like, you have a totally different point of reference or baseline for what undisturbed coral reefs are supposed to look like. Experiencing a dying coral reef, however, is a totally different feeling. Every time I go to reefs that have been drastically affected by bleaching and disease outbreaks due to warming, it is sad, it is depressing, it is heart wrenching. I have worked and dived in coral reefs for more than 20 years, and experiencing dying coral reefs can deeply affect you and bring tears to your eyes. It can feel like a family member or a good friend has died. A dead reef is mostly flat, gray and brown, lacks colors, has no fish, and is littered with dead zombie coral stumps, crumbling corals, and rubble. Everything is covered in algae; fleshy algae move with the waves on dead corals and toxic cyanobacteria cover the substrate and rob oxygen from those creatures that live on the bottom. It's really devastating. It is the same feeling as

when seeing a familiar and lush old-growth forest cut down to stumps, where the big majestic trees are now in pieces on the once-forest floor. There are no animals, no movement—only black, greys and browns.

40. I have already experienced firsthand the effects of global warming on tropical reef systems. I cannot enjoy diving and studying dying coral reefs or meditating over them in the same way I enjoy living reefs. Diving in reefs where corals have died as a result of bleaching and disease, like those throughout the Caribbean and the Florida Keys, does not bring me the same level of enjoyment that I experienced many years ago, when reefs were in better condition. My intellectual interest in understanding the rich ecosystem that corals support is also harmed because I no longer can observe the high diversity that I once could.

41. I care deeply about tropical reef ecosystems, and I want to see them recovering and thriving. I have already been distressed by experiencing coral reefs that have been killed by bleaching and diseases triggered by warming, and this will only continue and worsen if global warming and ocean acidification continue. As a scientist and a human, I do not want to see any further loss of these ecosystems. If global warming continues unabated, I know that many species I study and photograph will decline and become functionally extinct. I will find it hard to find live *Acropora* corals, which I love the most, to photograph and enjoy. It will also be increasingly difficult to find, observe, photograph, and enjoy the

other species that rely on those corals for survival. Documenting dead corals and dying coral reefs is not an enjoyable activity; it is depressing. I only photograph dying reefs as a sad duty to document the succumbing ecosystems that once flourished and inspired me to become a marine biologist.

42. I have every intention of continuing my career as a marine biologist with the goal of studying and conserving tropical and subtropical coral reefs. I also intend to dive on, meditate in, and photograph these reefs in the years to come. I would like to once again go to pristine, living, and thriving reefs. Unfortunately, those are harder to find every year.

43. In 2021, assuming the COVID-19 pandemic situation improves, I'm planning to go Wakatobi, a series of coral reef islands off Southeast Sulawesi in Indonesia, which are considered some of the best diving spots in the world. I expect to see walls of living coral, manta rays, hundreds of fish species such as emperors and the amazing bump-head wrasses, and even whale sharks. I'm looking forward to taking my son diving when he is old enough. I want to make sure that the first time we go diving we visit an undisturbed and near-pristine coral reef. I want to show him what a healthy tropical coral reef should look like and perhaps spark in him the same feeling I had the first time I went diving during my high school trip on the northern coast of Cuba 20 years ago.

44. If greenhouse gases from cars and light trucks are not drastically reduced, enormous amounts of those gases will continue to be emitted into the atmosphere, contributing to warming and acidification of the oceans. Unabated warming will result in the further degradation of coral reefs that I study and want to protect and in the eventual extinction of coral species that I enjoy seeing and photographing.

45. Although I have already witnessed the harm to tropical reefs caused by the warming that has occurred so far, I believe that it is not too late to protect our surviving reefs and promote the recovery of degraded ones. I am an optimist. As I scientist I know that the main threats to tropical coral reefs will be lessened if greenhouse gas emissions from cars and light trucks are reduced. But we need to act now. Since 1750, the United States has cumulatively contributed the most to the global emissions, more than any other country in the world. Today the U.S. is the world's second largest emitter, despite recent gains in energy efficiency and cuts in emissions. So, the U.S. bears most of the responsibility for the climate crisis.

46. I believe that the SAFE II Rule will contribute to increased CO_2 emissions and worsen global warming. Reducing these emissions is not only morally required but is also essential to protect reef-building corals and tropical reef ecosystems that I value and upon which my work depends.

47. In addition, promulgation of the SAFE II Rule by EPA and NHTSA, without consulting with the wildlife agencies, harms my interests and harms coral reefs and the species that depend upon the reefs. Therefore, the SAFE II Rule should be vacated.

I declare under penalty of perjury that the foregoing is true and correct and was executed on November 5, 2020 at Chapel Hill, North Carolina.

Abel Valdivia

Exhibit A: List of References

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DECLARATION OF STUART B. WEISS

I, Stuart B. Weiss, declare as follows:

1. The facts set forth in this declaration are based on my personal knowledge. If called as a witness, I could and would testify competently to these facts. As to those matters which reflect an opinion, they reflect my personal opinion and judgment on the matter.

2. I reside in Menlo Park, California.

3. I am the chief scientist and proprietor of the Creekside Center for Earth Observation, which I co-founded in 2006 with the mission to apply the latest science and technology to address the most challenging conservation problems. I am a conservation biologist by training and have wide-ranging research experience in conservation and population biology, microclimate characterization, and statistical analysis. I worked for over fifteen years at the Center for Conservation Biology at Stanford University. I have authored more than 40 scientific publications and have served as principal investigator for more than 50 grants and contracts, including with the U.S. Fish and Wildlife Service (U.S. FWS) and the California Energy Commission. I received both my Ph.D. in biological sciences in 1996 and my bachelor's degree in 1984 from Stanford University. At the Creekside

Center for Earth Observation, I have worked with city, state, and federal agencies, as well as private companies and non-profit organizations.

4. I have been a member of the Center for Biological Diversity (the Center) since 2019. I read the Center's newsletters, follow its activities and litigation, and support the organization because we need strong advocates to conserve biodiversity. I rely on the Center to represent my interests in biodiversity protection.

5. I am aware that this year the U.S. Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) issued new greenhouse gas emissions and criteria pollutant standards for passenger cars and light trucks (the SAFE II Rule). I have learned that the SAFE II Rule will increase carbon dioxide (CO_2) emissions by approximately one billion metric tons (MT) through model year (MY) 2029, and it's possible that emissions from the Rule could be even greater. These emissions will increase the harmful effects of climate change, including by increasing heavy precipitation events and elevating temperatures.

6. In addition, I am aware that the Rule will result in cumulative increases of nitrogen oxides (NOx) of 20,500 to 25,500 metric tons over the lifetime of vehicles through model year 2029, over and above the standards that were previously in place. In 2035, the Rule will create 6,300 to 6,400 additional

metric tons of NOx compared to the No Action Alternative (the previous standards). In addition, I am aware that the Rule acknowledges the harms to ecosystems caused by increased nitrogen. For example, the Rule notes that increased nitrogen deposition can decrease the biodiversity of grasslands, meadows, and other sensitive habitats, and increase the potential for invasive species. 85 Fed. Reg. 24174, 24871.

7. I am the country's foremost expert on the federally threatened Bay Checkerspot Butterfly (*Euphydryas editha bayensis*), which I have studied since 1979. I also am an expert on the federally endangered Quino Checkerspot Butterfly (*Euphydryas editha quino*). I specifically study the threats to the continued survival of both of these imperiled species, one of the most important and insidious being atmospheric nitrogen deposition.

8. I have great professional, scientific, and economic interests in these two species. My work focuses on studying how we can protect and conserve the Bay Checkerspot Butterfly and Quino Checkerspot Butterfly. I observe and document the impacts of NOx and other threats to these species. I undertake my scientific research and make that research public to educate policy makers and the public about the threats facing these species and how we can address them. My professional, scientific, and economic interests are in protecting the butterfly species from extinction by undertaking fair, comprehensive, and robust scientific

research for agencies, private entities, and organizations.

9. I also have great aesthetic interests in the Bay Checkerspot Butterfly and Quino Checkerspot Butterfly. I cannot fully describe the immense beauty of seeing these butterflies in their habitat, surrounded by remarkable displays of wildflowers.

10. I will continue my research on both of these species into the future. I plan to do further fieldwork on the Bay Checkerspot Butterfly this year after the rains start, around late December 2020. As to the Quino Checkerspot Butterfly, I plan to return to study the species in March 2021, assuming it is safe to travel.

The Bay Checkerspot Butterfly

11. The Bay Checkerspot Butterfly was federally listed as a threatened species under the Endangered Species Act in 1987. The Bay Checkerspot Butterfly is a beautiful medium-sized butterfly with a wingspan of a little more than two inches. The top surfaces of its wings have black bands along all the veins that sharply contrast with its bright red, yellow, and white spots. Bay Checkerspots live near thin, rocky, inhospitable soils with an unusual chemical balance, which supports the plants on which the caterpillars feed.

12. Up to the point of the butterfly's listing, the largest driver of the species' imperilment was habitat degradation and loss primarily caused by

infrastructure development in the increasingly populous San Francisco Bay Area. Since then, however, the species continues to struggle for survival, notwithstanding the benefits from the habitat protection powers of the Endangered Species Act. While the butterfly's historical range spanned the entire San Francisco Bay Area, stretching from San Bruno Mountain to Mount Diablo to Coyote Reservoir, across seven Bay Area counties, the initial local extirpations radically truncated its range to just one Bay Area county, Santa Clara County.

13. For decades, I have studied and documented near extinctions of the threatened Bay Checkerspot Butterfly in grasslands following the removal of grazing. As I have uncovered in my decades-long scientific study, the proximate cause of the Bay Checkerspot Butterfly's continued imperilment is nitrogen deposition. Specifically, I have discovered that atmospheric nitrogen, and most importantly, emission-source nitrogen resulting from fossil fuel combustion in cars and trucks, is depositing on the Bay Checkerspot Butterfly's natural serpentine grassland habitat and driving the species' extinction. The Bay Checkerspot Butterfly relies on diminutive wildflowers that serve as both food sources, as well as larval host plants, for successful completion of the butterfly's reproductive cycle. These wildflowers are hosted on native grasses that grow in nutrient-poor, serpentine soils, which have been long resistant to invasion by non-native grasses and forbs that have dominated the vast majority of California grasslands. However,

when atmospheric deposition of nitrogen occurs, nitrogen builds up in the nutrient-poor soils. These native grasslands are extremely sensitive to nitrogen, and nitrogen fertilization of grasslands generally results in the loss of plant and species diversity when a few nitrogen-loving species become dominant (Huenneke et al. 1990). Nitrogen deposition ultimately facilitates the invasion and dominance of non-native annual grasses. In the case of the Bay Checkerspot Butterfly, the nitrogen deposition on the grassland habitat has acted as a fertilizer and enhanced the growth of non-native annual grasses at the expense of native annual forbs. As a result, the nitrogen deposition has enabled the invasion of non-native, nitrogen-assisted grasses that displace native serpentine plants whose wildflowers feed and host the larvae of the Bay Checkerspot Butterfly. Accordingly, populations of the butterfly have disappeared under a sea of non-native grasses. The population surveys I conducted showed that the butterfly experienced severe population crashes in 1994 and 1995 after grazing was removed from two sites in the Silver Creek Hills, with the proximate cause of the crashes being invasion by introduced non-native grasses.

14. My decades of study have shown that the largest source of nitrogen deposition that is threatening the survival of the Bay Checkerspot Butterfly is fossil fuel-combusting vehicles—mainly cars and trucks. Several lines of evidence indicate that nitrogen deposition by air pollution, primarily from cars and trucks, is

an ultimate cause of the non-native grass invasion that has driven the near extinction of the threatened Bay Checkerspot Butterfly. First, according to the state's emissions inventories, vehicular emissions dominate in the areas where the Bay Checkerspot lives. In other words, cars are the major regional source of nitrogen oxides (NOx). Fossil fuel combusting cars and trucks produce substantial amounts of NOx. They also emit another nitrogen compound, ammonia (NH_3), an unregulated byproduct of three-way catalytic converters in vehicles. Catalytic converters were introduced to abate combustion-source emissions of pollutants like carbon monoxide, hydrocarbons, and NOx in motor vehicles from tailpipes. Even as NOx emissions decline due to the use of catalytic converters, NH_3 emissions from roadways increase. The more internal combustion engines are on the road, the more NH_3 emissions they produce. For example, on-road NH_3 emissions increased 91 percent between 1990 and 2010 in the United States (Xing et al. 2013) and nitrogen deposition in this form has increased throughout many regions, even as NOx emissions have decreased (Li et al. 2020, Hůnová et al. 2017, Fenn et al. 2018) (Please see Exhibit A for a full list of sources referenced in this declaration).

15. Notably, zero-emission vehicles, like electric vehicles, do not produce NOx or NH_3. Both NOx and ammonia cause nitrogen deposition that harms endangered butterflies.

16. These nitrogen emissions have significantly increased the input of

both wet and dry nitrogen deposition (in the form of precipitation and gaseous deposition, respectively) to typically nitrogen-limited serpentine grassland ecosystems. I wrote about these impacts of fossil fuel cars on the Bay Checkerspot Butterfly and its native habitat grasslands in a 1999 publication in *Conservation Biology*, entitled "Cars, cows, and checkerspot butterflies: nitrogen deposition and grassland management for a threatened species," as well as two additional papers relevant to the issue. (*See* Exhibit B: Cars, Cows, and Checkerspot Butterflies, Weiss (1999) [hereinafter Exhibit B: Weiss 1999], Exhibit C: Nitrogen critical loads and management alternatives for N-impacted ecosystems in California, Fenn et al. (2010) [hereinafter Exhibit C: Fenn et al. 2010]. S*ee also*, Weiss 2006). In general, nitrogen deposition presents a major conservation challenge because the source of the problem is outside the boundaries of reserves and can be controlled only at the source by long-term measures. The ultimate solution is to eliminate sources of excess nitrogen. Little progress has been made in reducing car use despite chronic traffic problems. And the SAFE II Rule will only worsen nitrogen pollution.

17. The role of nitrogen deposition in altering serpentine habitat has been recognized by the U.S. Fish and Wildlife Service since at least 1998 (U.S. FWS 1998). The U.S. Fish and Wildlife Service has recognized the impacts from nitrogen deposition as "currently the most significant threat" to the Bay

Checkerspot Butterfly, concluding in its most recent 5-Year Review for the species that "the butterfly is still at great risk from invasion of non-native vegetation, exacerbated by nitrogen deposition from air pollution." (Exhibit D: Bay Checkerspot Butterfly 5-Year Review, U.S. Fish and Wildlife Service (2009) at 16, 31 [hereinafter Exhibit D: U.S. FWS 2009]). The 5-Year Review noted that nitrogen pollution comes from fossil fuel combustion from vehicle tailpipes and power plants, and it described my research for the Bay Checkerspot Butterfly at Edgewood Park, showing that non-native grass invasion resulting from nitrogen pollution increased with proximity to a major interstate highway. (Exhibit D: U.S. FWS 2009, at 13). The U.S. Fish and Wildlife Service's 2008 critical habitat designation for the Bay Checkerspot butterfly similarly recognized the significant threat to the butterfly's habitat from nitrogen pollution. (U.S. FWS 2008, at 50421, 50428.)

<u>The Quino Checkerspot Butterfly</u>

18. Separately, the federally endangered Quino Checkerspot Butterfly is also facing extinction due to nitrogen deposition resulting from car and truck emissions in the same way that such emissions are impacting the Bay Checkerspot Butterfly.

19. The tiny Quino Checkerspot has short, rounded wings with a

wingspan of 1.5 inches. The top side of the wings is a complex checkered pattern with vibrant colors of orange, black, and cream, while the bottom side is dominated by orange and cream colors. The Quino Checkerspot butterfly was federally listed as an endangered species in 1997.

20. I became involved with studying the Quino Checkerspot Butterfly about five years ago. I looked at the meta-population viability and tried to help the people in San Diego County to come up with plans and methods of how to augment the population through captive individuals. I also helped map out the habitat.

21. The Quino Checkerspot Butterfly was once a common spring butterfly of the open forblands, grasslands, and sparse shrublands of Southern California, where it typically laid its eggs on the small native forbs. As with the Bay Checkerspot Butterfly, grazing and development initially limited its habitat. The remaining populations in Riverside and San Diego Counties have been threatened by the invasion of nonnative grasses accelerated by atmospheric deposition of nitrogen, which chokes out the native forbs. This pattern has been repeated across the state (Exhibit B: Weiss 1999, Exhibit C: Fenn et al. 2010), further restricting the habitat for the butterflies and leading to their continued imperilment.

22. The U.S. Fish and Wildlife Service has recognized the threat nitrogen poses to the Quino Checkerspot butterfly, noting in the species Recovery Plan that

"Conversion from native vegetation to nonnative annual grassland will be the greatest threat to Quino checkerspot butterfly reserves." (U.S. FWS 2003, at 58. *See also*, U.S. FWS 2003, at 55, 57-58, 61-62). The Service ties this conversion to nitrogen pollution, along with fire, grazing, and off-road vehicle activity. (U.S. FWS 2003, at 61-62). This concern is well-founded, since additional nitrogen decreases the size and density of the larval host plant, the plantain *Plantago erecta* (Koide et al. 1988. *See also*, Huenneke et al. 1990, U.S. FWS 2003, at 57).

23. In addition, it is difficult to restore habitats that have been degraded by nitrogen deposition. Invasive grasses end up dominating the seedbank, to the point of completely excluding native plant species. Although fire has been suggested as a technique to reduce exotic seed banks, use of fire to restore degraded grasslands is generally not feasible because of air quality regulations and risk.

24. Critically, both the Bay Checkerspot Butterfly and Quino Checkerspot Butterfly are exemplary cases—and widely adopted examples by the scientific community—of a national and global phenomenon of the negative effects of nitrogen deposition on terrestrial and aquatic ecosystems of the United States. In particular, the Bay Checkerspot Butterfly is the poster child for the enormous negative effects of nitrogen on a species. Numerous scientific studies have documented how nitrogen deposition is often associated with considerable declines

in biodiversity and loss of rare or protected species on both local and regional scales in the country. The previously mentioned 1999 paper I co-authored in *Conservation Biology* documented the impacts of nitrogen on the Bay Checkerspot Butterfly. A 2010 paper (Exhibit C: Fenn et al. 2010) revealed the impacts on other ecosystems of nitrogen deposition of empirical nitrogen loads in California. A 2010 scientific review described the numerous pathways by which nitrogen deposition can harm terrestrial plant species, including facilitating the invasion of non-native grasses in Bay Checkerspot Butterfly habitat. (Bobbink et al. 2010). Most recently, a 2018 paper showed the increasing predominance of ammonia deposition relative to NOx deposition, with both ammonia and NOx coming from vehicle tailpipes. (Fenn et al. 2018. *See also* Sun et al. 2017).

25. The vast body of science documenting the impacts of nitrogen deposition on biodiversity has been adopted by wildlife agencies and regulators and has led to concrete mitigation plans. In the case of the Bay Checkerspot Butterfly, the science has driven the development of a series of mitigation projects in Santa Clara County, including mitigation due to a power plant project and highway expansion project. This mitigation plan set aside over 600 acres of land with a conservation easement on it and rigorous management measures and conservation in perpetuity. All this morphed into concrete conservation action, including a comprehensive regional habitat conservation plan (*See* ICF

International 2012).

26. But unfortunately, even mitigation plans like those in Santa Clara County that set aside habitat cannot save these butterflies without strong measures to reduce nitrogen deposition. To be clear, nitrogen deposition is a threat to habitats that have *already* been protected for conservation and are already being held in perpetuity for that purpose. Without a strategy to offset the impacts of nitrogen deposition, those investments will be in vain. Reversing the SAFE II Rule becomes even more important when one considers that even mitigation measures to lessen the impacts of nitrogen pollution will not adequately protect these species.

27. Overall, the emission of nitrogen negatively affects the Bay Checkerspot Butterfly and is driving its extinction. There are several pathways that can harm the species, but the biggest hazard to the survival of remaining Bay Checkerspot Butterfly populations comes from atmospheric nitrogen deposition.

28. If the SAFE II Rule is enforced and the rollback on vehicle air standards is made permanent, my concern is that this will highly impact the populations of Bay Checkerspot Butterfly and Quino Checkerspot Butterfly and exacerbate their precarious situations as threatened and endangered species. In general, we as a society have so overloaded our ecosystems and air with nitrogen. Every additional increment of nitrogen is putting us deeper in the hole. It's true

that strict regulations of NOx have led to their decrease in the atmosphere over time, but the rate at which they are coming down would be significantly slowed under the new SAFE II Rule because the Rule would exacerbate the problem well into the future. In addition, as mentioned above, ammonia has become a significant component of light-duty vehicle emissions, which is outlined in the 2018 paper mentioned above. The SAFE II Rule would slow down and undo the progress we have made in reducing nitrogen emissions in the past few decades. Natural systems will be under threat into the foreseeable future. We need to continue making progress toward reducing tailpipe emissions, including by increasing our adoption of vehicles with no tailpipe emissions, in order to protect the butterflies.

29. From years of research on butterflies, I understand the credible threat that the SAFE II Rule poses to the Bay Checkerspot Butterfly and Quino Checkerspot Butterfly. The increase in nitrogen emitted from cars will increase the nitrogen deposition in their grasslands and significantly increase the invasion of non-native grasses into their native grasslands. This will, in turn, severely alter the ability of both the Bay Checkerspot and the Quino Checkerspot to feed off of wildflowers and host larvae in the native grasslands. As a result, this will lead to direct effects, such as injury, death, and harm (harm is defined as "significant habitat modification or degradation that actually kills or injures wildlife") due to the increase of nitrogen deposition, which could cause this metapopulation to

collapse.

30. In addition to nitrogen deposition, both the Bay Checkerspot Butterfly and Quino Checkerspot Butterfly are incredibly sensitive to climate change impacts. Any slight increases in temperature have disproportionate impacts on the metapopulations. Higher temperatures, especially in the spring, lead to more rapid drying of their host plant, the dwarf plantain. Mortality rates of newly hatched larvae increase when plants dry earlier relative to the flight of the butterflies (Singer 1972, Weiss et al. 1988, Murphy and Weiss 1992). Populations can crash by an order of magnitude in response to back-to-back warm years, and local extinctions within metapopulations increase (Ehrlich et al. 1980). Increased variability in weather can also lead to population decreases and local extinction (McLaughlin et al. 2002).

31. I was shocked to learn that EPA and NHTSA failed to consult with the U.S. Fish and Wildlife Service on the impacts of the SAFE II Rule on endangered and threatened species. Refusing to comply with the cornerstone species protection law of our country makes a joke out of the existential crisis facing the Bay Checkerspot Butterfly and Quino Checkerspot Butterfly. I have dedicated my life to documenting and fighting this crisis, and it is a serious matter to me. EPA and NHTSA's failure to consult the Fish and Wildlife Service is just not the way the country's laws are supposed to work. Through the consultation

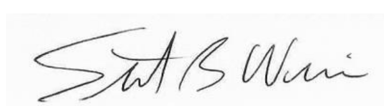
processes under the Endangered Species Act, the world's strongest law for protecting species, the federal government and non-governmental actors have been able to save more than 1,600 plant and animal species from extinction. The Trump administration's failure to abide by the consultation requirements under the Endangered Species Act flouts the rule of law in this country.

32. It is critical that EPA and NHTSA comply with Section 7 of the Endangered Species Act because it mandates that Federal agencies must ensure they do not jeopardize listed species or adversely modify or destroy critical habitat. Both EPA and NHTSA have not initiated, let alone completed, the Section 7 process for the Bay Checkerspot Butterfly and Quino Checkerspot Butterfly. It is clear that an ESA Section 7 consultation is fundamental to understanding the SAFE II Rule's effects on these listed species and their critical habitats. Without this consultation, EPA and NHTSA cannot determine if the SAFE II Rule will affect any or all of these listed species, including whether the Rule will affect the species' survival and recovery in the wild or adversely modify or destroy any or all of their critical habitats. Completion of the Section 7 process will ensure the effects are appropriately analyzed and, if necessary, the development of reasonable and prudent measures—or the appropriate conservation measures—are identified and implemented, as well as ensuring that EPA and NHTSA are in compliance with the ESA. Without the agencies' completion of Section 7 consultation, my professional

interest in ensuring that agencies adhere to the ESA is injured.

33. My professional, aesthetic, and procedural injuries would be redressed if EPA and NHTSA immediately and without delay completed consultation pursuant to Section 7 of the ESA with the FWS. Based on my over 30 years of participating as a technical expert in public comments for consultations, I believe it is highly likely the SAFE II Rule will affect the listed species and other non-listed but imperiled wildlife. Unfortunately, EPA and NHTSA have dropped a shroud of darkness over the Rule's effects on listed species, critical habitat, and other wildlife. The only way to shine the light of day on this is by vacating the Rule because EPA and NHTSA have failed to complete adequate ESA Section 7 consultation. Only then will the survival and recovery in the wild be assured for the Bay Checkerspot Butterfly and Quino Checkerspot Butterfly and only then will there be no adverse modification or destruction of critical habitat for these species. Vacating the SAFE II Rule will surely redress the professional harms I have suffered.

I declare under penalty of perjury that the foregoing is true and correct and was executed on December 15, 2020, at Menlo Park, California.



Stuart B. Weiss

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EXHIBIT B

Cars, Cows, and Checkerspot Butterflies: Nitrogen Deposition and Management of Nutrient-Poor Grasslands for a Threatened Species

Stuart B. Weiss

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Cars, Cows, and Checkerspot Butterflies: Nitrogen Deposition and Management of Nutrient-Poor Grasslands for a Threatened Species

STUART B. WEISS

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Abstract: *Nutrient-poor, serpentinitic soils in the San Francisco Bay area sustain a native grassland that supports many rare species, including the Bay checkerspot butterfly (*Euphydryas editha bayensis*). Nitrogen (N) deposition from air pollution threatens biodiversity in these grasslands because N is the primary limiting nutrient for plant growth on serpentinitic soils. I investigated the role of N deposition through surveys of butterfly and plant populations across different grazing regimes, by literature review, and with estimates of N deposition in the region. Several populations of the butterfly in south San Jose crashed following the cessation of cattle grazing. Nearby populations under continued grazing did not suffer similar declines. The immediate cause of the population crashes was rapid invasion by introduced annual grasses that crowded out the larval host plants of the butterfly. Ungrazed serpentinitic grasslands on the San Francisco Peninsula have largely resisted grass invasions for nearly four decades. Several lines of evidence indicate that dry N deposition from smog is responsible for the observed grass invasion. Fertilization experiments have shown that soil N limits grass invasion in serpentinitic soils. Estimated N deposition rates in south San Jose grasslands are 10–15 kg N/ha/year; Peninsula sites have lower deposition, 4–6 kg N/ha/year. Grazing cattle select grasses over forbs, and grazing leads to a net export of N as cattle are removed for slaughter. Although poorly managed cattle grazing can significantly disrupt native ecosystems, in this case moderate, well-managed grazing is essential for maintaining native biodiversity in the face of invasive species and exogenous inputs of N from nearby urban areas.*

Carros, Vacas, y Mariposas: Deposición de Nitrógeno y Manejo de Pastisales Pobres en Nitrógeno para una Especie Amenazada

Resumen: *Suelos serpentiníticos pobres en nutrientes en el área de la Bahía de San Francisco sostienen pastizales diversos que soportan muchas especies raras, inclyendo a la mariposa checkerspot (*Euphydryas editha bayensis*). La deposición de Nitrógeno (N) por contaminación del aire amenaza la biodiversidad en estos pastizales debido a que N es el principal nutriente limitante para el crecimiento de plantas en suelos serpentiníticos. Investigué el papel de la deposición de N mediante muestreos de mariposas y poblaciones de plantas a lo largo de diferentes regímenes de pastoreo, revisiones de literatura y con estimaciones de deposición de N en región. Varias poblaciones de la mariposa en el sur de San José se precipitaron después de cesar el pastoreo por ganado. Poblaciones cercanas bajo continuo pastoreo no sufrieron disminuciones similares. La causa de las disminuciones poblacionales fue la rápida invasión de pastos anuales introducidos que saturaron a las plantas hospedero de las larvas de la mariposa. Los pastizales serpentiníticos sin ramoneo de la península de San Francisco han resistido las invasiones de pastos por casi cuatro décadas. Diversas líneas de evidencias indican que la deposición de N seco del smog es responsable de la invasión de pastos observada. Experimentos de fertilización han demostrado que el N del suelo limita la invasión de pastos en suelos serpentiniticos. Las tasas de deposición de N en pastizales del sur de San José son de 10-15 kg ha^{-1} año^{-1};*

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los sitios de la península tienen deposiciones mas bajas (4-6 kg ha^{-1} año^{-1}). El ganado selecciona pastos y el ramoneo conduce a una exportación neta de N pues el ganado es removido al ser sacrificado. Sin embargo, el pastoreo pobremente manejado puede desequilibrar significativamente a ecosistemas nativos. En este caso el buen manejo del pastoreo es elemental para mantener la biodiversidad nativa de cara a invasiones de especies y entradas exógenas de N proveniente de áreas urbanas cercanas.

Introduction

Humans have greatly increased the flux of reactive nitrogen (N) in the biosphere, which is now recognized as a major component of global change (Vitousek et al. 1997). Extensive areas downwind of air pollution sources receive substantial inputs of N from wet and dry deposition. Many terrestrial ecosystems are presently N-limited and respond strongly to incremental additions of N, exhibiting changes in productivity, species composition, and nutrient retention. At global scales, N deposition may be responsible for a substantial part of the "missing carbon sink" (Townsend et al. 1996; Holland et al. 1997). At regional scales, N deposition has been implicated in a large number of ecosystem changes, including forest decline in Central Europe (Schulze 1989), grass invasions of heathlands in northwestern Europe (Aerts & Berendse 1988), and changes in grassland composition in the midwestern United States (Tilman 1988). Nutrient-poor ecosystems are particularly vulnerable to N deposition (Aerts & Berendse 1988; Bobbink & Roelofs 1995; Power et al. 1995).

At regional and local scales, N deposition on nature reserves may change vegetation, threaten the persistence of target species and communities, and greatly complicate reserve management. Nitrogen deposition presents a major conservation challenge because the source of the problem is outside the boundaries of reserves and can be controlled only at the source by expensive, long-term measures. Deposition is especially high near urban areas, where combustion sources (primarily cars, trucks, and industrial and home heating) produce substantial concentrations of nitrogen oxides (NO_x). Setting aside reserves on the fringe of urban areas is often difficult, contentious, and expensive, and loss of diversity in reserves because of exogenous factors such as N deposition needs careful consideration.

Native grasslands are among the most imperiled ecosystems in the temperate zones (Joern & Keeler 1995; Samson & Knopf 1996; Muller et al. 1998). Conversion to agriculture and urbanization has left only small remnants of many formerly extensive grassland ecosystems. Remnants are threatened by further development, isolation, invasion by introduced species, and increasingly by N deposition. Grasslands can be sensitive to added N (Huenneke et al. 1990; Wedin & Tilman 1996). Nitrogen fertilization of grasslands generally results in loss of plant species diversity when a few N-loving species become dominant (Silvertown 1980; Tilman 1987; Huenneke et al. 1990). Losses of plant diversity can lead to losses of animal diversity, especially of host-restricted herbivores.

Many grassland remnants need intensive management from grazing, fire, and mowing. Grazing is a traditional land use in many regions, and poorly managed overgrazing has been responsible for massive disruption of ecosystems worldwide. Yet properly managed, moderate grazing can be a useful management tool in specific instances, especially for species that require short, open grassland (Aerts & Berendse 1988; ten Harkel & van der Muelan 1995). For example, some of the most imperiled butterfly species in England require sheep or rabbit grazing to maintain suitably short grass swards (Oates 1995). Both fire and grazing have been used in management of prairie fragments in the midwestern United States (Samson & Knopf 1996) and have differential effects on butterflies (Swengel 1998). Management of N deposition in grasslands requires the removal of N-containing biomass from a site by fire, mowing, or grazing (Hobbs et al. 1991). Mowing for hay removal in Europe is a common management practice in "unimproved" grasslands set aside for conservation (Dolek & Geyer 1997).

I documented near extinctions of the threatened Bay checkerspot butterfly (*Euphydryas editha bayensis*) in grasslands following the removal of grazing. The proximate cause was the rapid invasion of nutrient-poor serpentinitic grasslands by introduced grasses. Several lines of evidence indicate that N deposition by air pollution—primarily from cars and trucks—is an ultimate cause of the grass invasion. The negative consequences of improper grazing management in these sites are great, and the story provides a striking example of the complexities of managing reserves adjacent to urban areas and of the interdisciplinary nature of effective conservation biology.

Methods

Study Organism and System

The Bay checkerspot butterfly is restricted to outcrops of serpentinite rock in the San Francisco Bay Area, California. Serpentinite weathers to a thin, rocky, nutrient-poor soil with low N, high magnesium, low calcium, local patches of heavy metals, and other unfavorable characteristics. Introduced annual grasses from the Mediterranean region have invaded the majority of California grasslands on richer soils (Huenneke 1989). Serpentinitic soils provide refugia for a diverse native grassland with more than 100 species of forbs and grasses (Murphy & Ehrlich 1989), including dense stands of the host plants (*Plantago erecta*, *Castilleja densiflorus*, and *Castilleja exerta*) and nectar sources (*Lasthenia californica*, *Layia platyglossa*, *Allium serratum*, *Muilla maritima*, and *Lomatium* spp.) of the Bay checkerspot butterfly. Several serpentinite-endemic plants are listed as endangered or threatened (U.S. Fish and Wildlife Service 1998). Numerous patches of these grasslands have been destroyed by urban development (Murphy & Weiss 1988*a*), and their protection is a major conservation priority in the San Francisco region (U.S. Fish and Wildlife Service 1998).

The Bay checkerspot butterfly is listed as threatened under the U.S. Endangered Species Act and serves as an "umbrella species" for the serpentinitic grassland ecosystem (Murphy & Weiss 1988*a*; Launer & Murphy 1992). As of 1998, there was one extant population on the San Francisco Peninsula, at Edgewood County Park (EW; Fig. 1). Many former Peninsula populations are extinct because of urban development, and the small population at Jasper Ridge Biological Preserve (JR) appeared to be extinct as of 1999 (S.B.W., unpublished data). The majority of the habitat surrounds the Coyote Valley in south San Jose and supports a reservoir-satellite metapopulation of the butterfly (Harrison et al. 1988). The major sites I considered were the Silver Creek Hills (SC), Kirby Canyon (KC), and adjacent areas of Coyote Ridge (CR) (Fig. 1).

I estimated densities of postdiapause larvae with the stratified sampling design described by Murphy and Weiss (1988*b*). During the study period (1991–1998), several areas in the Silver Creek Hills were surveyed, along with sites south along Coyote Ridge (CR) and at Kirby Canyon (KC). For conservation planning purposes, the Silver Creek Hills were divided into subareas (SC1, SC2, and SC3) corresponding to property boundaries. Coyote Ridge was subdivided into four areas (CR1, CR2, CR3, and CRlow).

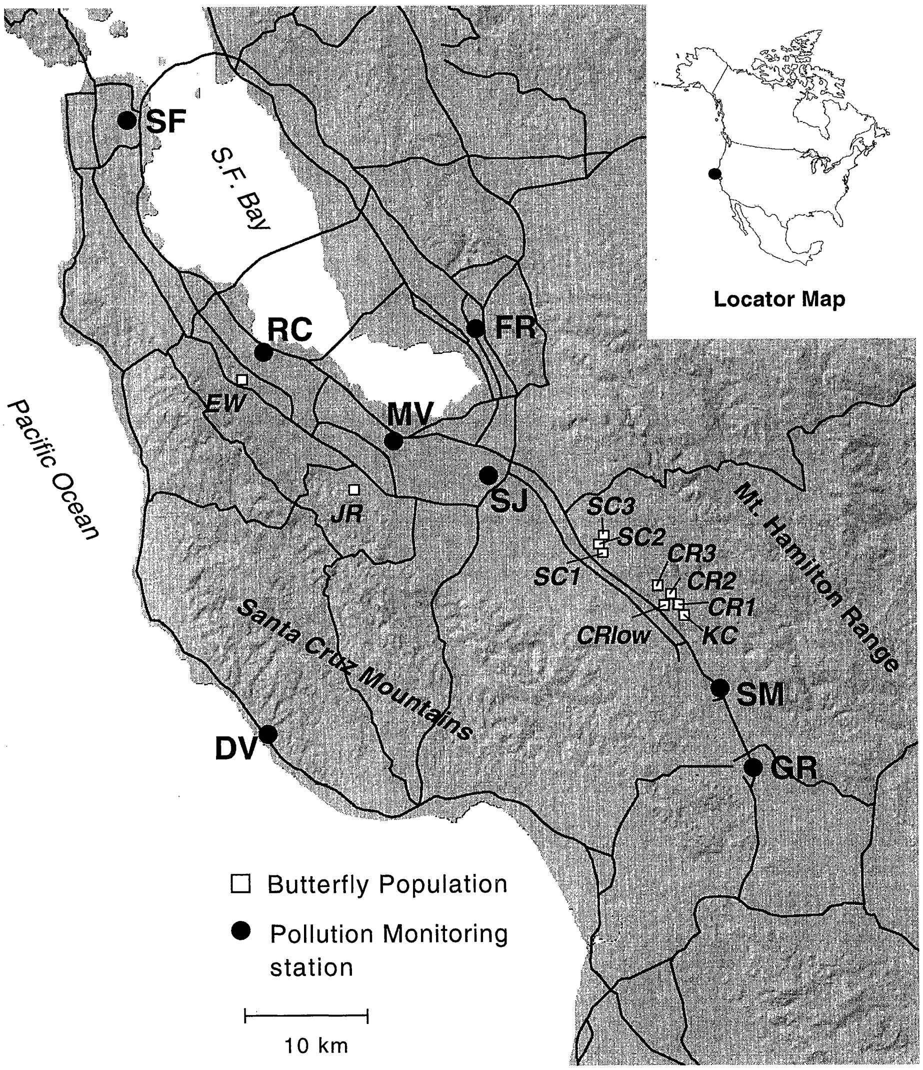

Figure 1. Map of regional air pollution monitoring stations and populations of the Bay checkerspot butterfly in the San Francisco Bay area. Only those air pollution stations and butterfly populations used in this study are identified. Site abbreviations are as follows: KC, Kirby Canyon; CR, Coyote Ridge, numbers 1-3, distinct sites along the ridgetop; CRlow, low-elevation site; SC, Silver Creek Hills, numbers 1-3 are separate properties within the Silver Creek Hills; JR, Jasper Ridge Biological Preserve; EW, Edgewood County Park. Pollution stations are SF, San Francisco; RC, Redwood City; MV, Mountain View; SJ, San Jose; SM, San Martin; GR, Gilroy; and DV, Davenport.

Data on the composition of plant communities across different grazing treatments at KC, CR, and SC were collected in 1996. The treatments were (1) continuously grazed in winter and spring (CR1 and CR2); (2) continuously grazed in summer and fall (CR3); (3) ungrazed since 1990 (SC1); and (4) ungrazed since 1985 (fenced areas adjacent to KC). Transects consisted of five 0.25-m^2 quadrats spaced 5 m apart and were sampled for percent cover of all vascular plant species. Comparisons of vegetation composition across grazing regimes was limited to undisturbed upland transects that made up the primary habitat for the butterfly. From 1995 through 1998, I sampled three such transects at site SC1 to monitor the effects of reintroduced cattle grazing.

A literature review on the effects of N and other nutrient additions to serpentinitic soils provided data on the response of native and introduced species to fertilization (Turitzen 1982; Koide et al. 1988; Huenneke et al. 1990; Hull & Mooney 1990).

Nitrogen deposition estimates were taken from Blanchard et al. (1996). I modified surface composition and pollutant loads to more closely estimate deposition on serpentinitic grassland in south San Jose. Air pollution data were taken from public documents (California Air Resources Board 1990–1996).

To measure relative deposition among sites, ion exchange resin bags were strung between poles 2 m off the ground at JR, SC, and KC. Resin bag construction and analysis followed standard methods (Reynolds et al. 1997). Twenty bags were hung at each site on 1 October 1997. The poles at Jasper Ridge fell during an intense windstorm on 18 November and were discovered on the ground on 24 November. All JR bags were collected then, and 10 bags each from SC and KC were collected the following day. The JR bags were on the ground for the final 6 out of 54 total days (slightly changing the deposition environment), but the bags were still exposed to reactive N in the air and rainfall. Because those last 6 days also had low pollution levels because of windy, rainy weather, the position of the bags should have made only a minimal difference in the total nitrate collected over the 8 weeks. October-November is the regional smog season, so relative deposition among sites during that period is a good indicator of relative rates over the entire year.

Results

Population Declines of Butterflies

Population estimates in the Silver Creek Hills (SC) showed a pattern of initial growth followed by rapid declines to extinction (Fig. 2). The number of postdiapause larvae rose substantially from 1991 to 1993. From 1993 to 1994, the numbers in the northern section (SC2) fell by a factor of 10. Numbers in the southern section (SC1) fell by 30%. Larval numbers fell from 14,000 in 1993 to 9000 in 1994 in a smaller property (SC3) to the north (not shown on

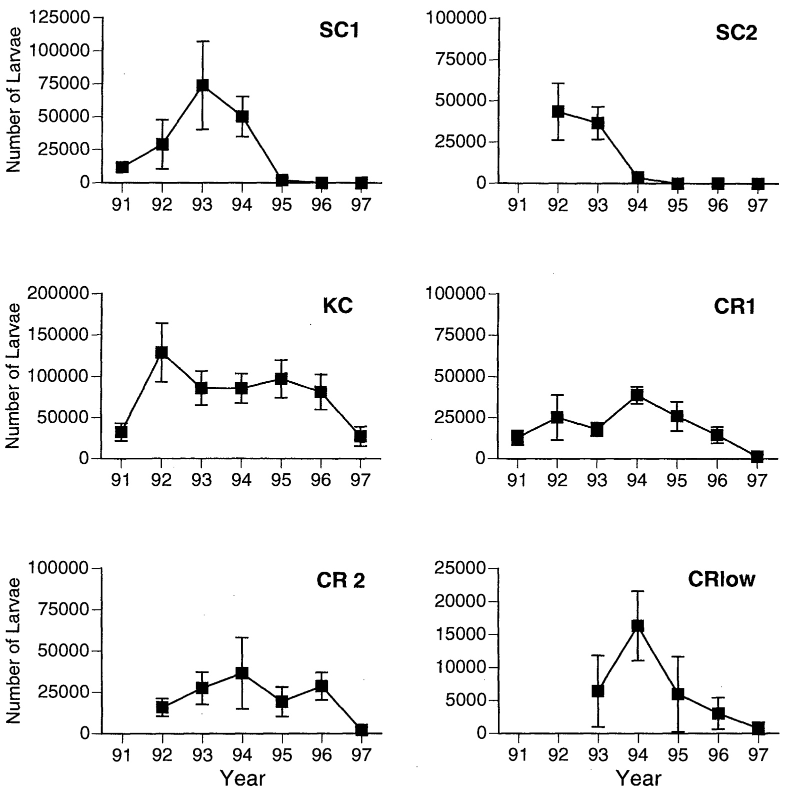

Figure 2. Mean larval densities at sites SC1, SC2, KC, CR1, CR2, and CRlow for the period 1991–1997. Error bars are 95% confidence intervals.

graphs). From 1994 to 1995, larval numbers in SC1 fell by a factor of 20. No larvae have been found at SC1 and SC2 since 1995. Demographic units at KC and CR did not crash over the 1994–1996 time period (Fig. 2).

The cause of population declines was obvious during field surveys (S.B.W. & A. E. Launer, personal observations). Dense stands of *Plantago erecta* and other native forbs were widespread across SC1 and SC2 prior to 1994. By 1995 the grassland was overrun by introduced annual grasses (*Lolium multiflorum*, *Avena fatua*, and *Bromus hordaceous*) that dominate nearby grasslands on richer soils. *Plantago* was found only on thin soils around rock outcrops and in some areas of gopher disturbance.

The invasion of grasses followed the removal of grazing from sites SC1 and SC2. All three properties in the Silver Creek Hills had been grazed for decades. Grazing was stopped in SC1 in 1989 and in SC2 in 1992, whereas SC3 has been grazed continuously. Although I did not quantitatively sample larval densities in SC3 after 1994 (because of limited access to private property), the grasslands in those areas maintained the forb-rich community typical of serpentinitic grasslands, and a detectable population of larvae persisted in SC3 through 1997 (R. R. White, personal communication). No larvae were found in either SC1 or SC2, and only three adults were observed in SC1 in 1997. No larvae or adults were observed at SC1, SC2, and SC3 in 1998.

Quantitative Vegetation Data

Qualitative field observations were confirmed by quantitative vegetation data. Vegetation plots from 1996 showed the differences in plant composition between grazed and ungrazed serpentinitic grasslands in south San Jose (Fig. 3). Both winter-spring and summer-fall grazing regimes had significantly higher densities of *Plantago* and significantly lower densities of introduced grasses than sites where grazing was removed in 1985 and 1990. The amount of grass cover followed the gradient in grazing intensity and time since grazing removal. Grass cover increased and *Plantago* cover decreased along the gradient from winter-spring grazing (CR1 and CR2), to summer-fall grazing (CR3), to grazing removal in 1990 (SC1), and finally to removal in 1985 (adjacent to KC). Of the introduced grasses that invade serpentinitic grassland, *Lolium multiflorum* was most common and was responsible for differences among sites (Fig. 4).

At Kirby Canyon in 1985 and 1986, forb-dominated plots within a grazing exclosure that received no fertilization rapidly responded to the removal of grazing (Koide et al. 1988). Following two growing seasons without grazing, grass numbers and biomass greatly increased: by the spring of 1986 *Avena* appeared in forb plots, *Bromus* numbers and biomass tripled, and *Lolium* increased in biomass by two orders of magnitude. *Plantago* maintained high numbers and biomass over the 2 years. By 1987 the exclosure was dominated by dense stands of *Lolium*. *Plantago* and other small forbs were restricted to shallow soils around rocks. Similar plots outside the exclosure retained high forb biomass and low annual grass biomass (Huenneke et al. 1990; S.B.W., personal observation)

Not all serpentinitic grasslands have been invaded in the absence of grazing. Serpentinitic grasslands at JR on the San Francisco Peninsula have not been grazed since 1960, have maintained high forb diversity and density (especially *Plantago erecta*), and have not been heavily invaded by *Bromus*, *Lolium*, or *Avena* (Hobbs & Mooney 1995). *Lolium* remained a rare occurrence there until 1998, when it increased greatly during record El Niño rains (S.B.W., personal observation). In contrast, within heavily grazed serpentinitic grassland at KC and CR during average to dry years, *Lolium* is often found where soils are deeper (Huenneke et al. 1990) and is a substan-

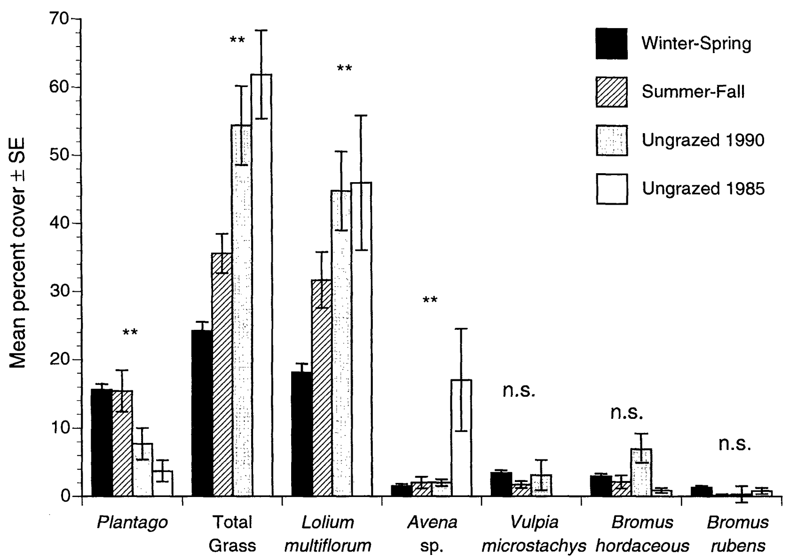

Figure 3. Percent cover of Plantago *and annual grasses in 1996 at winter-spring grazed, summer-fall grazed, and ungrazed sites (stopped in 1985 near Kirby Canyon, and 1990 in SC1). Grazing was reintroduced at SC1 in 1995. **p < 0.001, Kruskal-Wallis test (nonparametric analysis of variance); n.s., not significant.*

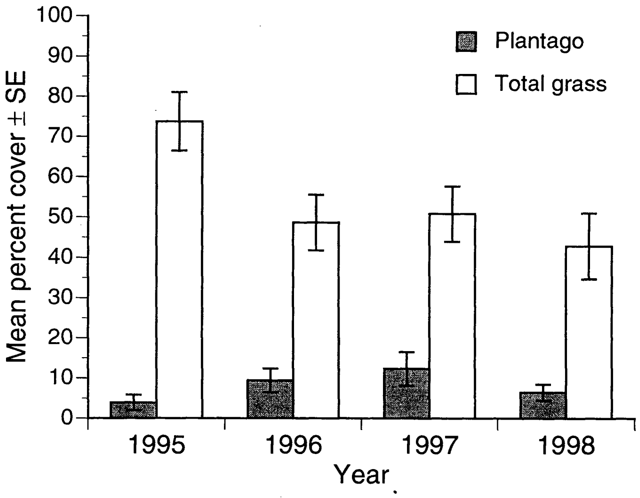

Figure 4. Response of total grass cover and Plantago *cover to the reintroduction of grazing in site SC1 in summer 1995. Differences in grass cover were significant* ($p = 0.01$*, Kruskal-Wallis nonparametric analysis of variance), but differences in* Plantago *cover were not.*

tial component of the grassland community. Koide et al. (1988) describe "a distinct vegetation patterning present at Kirby Canyon which is not present at Jasper Ridge. This consists of alternating patches of annual forb- and grass-dominated vegetation varying in extent from less than 1 m^2 to greater than 10 m^2." In the 1996 vegetation survey, *Lolium* averaged about 20% cover in the winter-spring grazing site (Fig. 3). *Lolium* cover was highest in swales (often >50%) and in deeper soils, but it was also found at low levels (1–20%) throughout the site.

Recovery of Habitat Value

In 1988 the electric fence around the 2-ha exclosure at KC was breached. By 1993, following 5 years of drought, the plot supported high *Plantago* cover, and larval densities (0.25 larvae/m^2) were indistinguishable from surrounding larval samples (S.B.W., unpublished data).

In the summer of 1995 following the population crash, cattle were reintroduced into site SC1. In 1995, grass cover was around 75%, dominated by *Lolium* (Fig. 4). Following 3 years of grazing from 1996 to 1998, grass cover dropped to about 45%. *Plantago* densities did not increase significantly across the habitat, however, but overall forb densities increased from 10% to about 30%, and the habitat appears to be recovering even if the small remnant butterfly population is not (Fig. 2).

Nitrogen Limitation in Serpentinitic Grasslands

Experimental work has addressed nutrient limitations in serpentinitic grasslands. Nitrogen additions in pots (equivalent of 200 kg/ha) greatly enhanced the growth of grasses (Turitzen 1982). Fertilization with a nitrogen-phosphorus-potassium slow-release fertilizer (313 kg N/ha/year) stimulated dense growth of grasses at Jasper Ridge (Hobbs et al. 1988). In field experiments at Kirby Canyon, addition of 100 kg N/ha/year into forb-dominated plots stimulated rapid increases of annual grasses (Koide et al. 1988), and factorial design with other nutrients (phosphorus, potassium, calcium) showed that N was the primary limiting factor for grass growth (Huenneke et al. 1990).

Lolium is the introduced grass that accounts for most of the community biomass increases observed under N fertilization (Koide et al. 1988; Huenneke et al. 1990). Detailed studies of *Lolium* and other grasses show that *Lolium* has high N assimilation rates and relative growth rates (Hull & Mooney 1990), and it responds rapidly to fertilization in the field and greenhouse.

Estimates of Nitrogen Deposition

In many regions, such as Europe and eastern North America, wet and dry deposition may be of equal magnitude (Vitousek et al. 1997). Because of the long, dry summer and the winter rains directly off the Pacific Ocean, N deposition in urban coastal California is dominated by dry deposition (Blanchard et al. 1996; Bytnerowicz & Fenn 1996), often by a factor of 10–30. Dry deposition is difficult to measure, and estimates of total deposition rely on models that combine aerial concentrations of reactive-N species with deposition velocities (Hicks et al. 1985, 1987). Deposition velocities are surface specific and may change with meteorological conditions. Expected uncertainties in dry deposition estimates by this inferential method are on the order of 30–50% (Blanchard et al. 1996).

Although the complexities of smog photochemistry and modeling dry deposition fluxes are beyond the scope of this paper, some background is essential (Seinfeld & Pandis 1998). The major N species responsible for dry deposition are (1) nitrogen dioxide (NO_2), (2) nitric acid vapor (HNO_3), (3) ammonia (NH_3), (4) particulate nitrate (pNO_3^-), and (5) particulate ammonium (pNH_4^+). Nitrogen dioxide is formed by oxidation of nitric oxide from combustion in a series of rapid reactions involving ozone (O_3). Nitrogen dioxide is taken up primarily through plant stomata and has a relatively low deposition velocity on inert surfaces. Nitric acid vapor is formed by reactions of NO_2 with hydroxyl radicals (OH^-) on a time scale of hours. Nitric acid vapor "sticks" to virtually all surfaces equally and has a high deposition velocity. Ammonia is produced from soils and animals, and like NO_2 is taken up primarily by plant stomata. Particulate nitrate and ammonium are formed by reactions between soot and dust particles and gases and have relatively uniform deposition velocities among different surfaces.

Blanchard et al. (1996) provide the best current estimates of dry and wet deposition at various sites in California. The only deposition station in the San Francisco Bay area is at Fremont (Fig. 1). Estimated rates of dry N deposition at Fremont were around 6 kg N/ha/year, with 47% from NO_2 and 21% from HNO_3 (Fig. 5a). Wet N deposition at a station in San Jose was 0.89 kg N/ha/year (<15% of dry N deposition) and contributed amounts comparable to NH_3, pNO_3^-, and pNH_4^+.

The estimates for Fremont are not directly applicable to the serpentinitic grasslands from Silver Creek to Kirby Canyon. Several adjustments need to be made for (Fig. 5a): (1) surface composition, (2) seasonality of the grassland, and (3) higher pollution levels. The surface composition used for deposition modeling in Fremont was 70% inert surface (asphalt, roofs, etc.), 15% grass, and 15% tree. When 100% grass was used, deposition from NO_2 increased from 2.2 to 5.2 kg N/ha/year because NO_2 has a much higher deposition velocity on grass than on inert surfaces. Ammonia deposition increased from 0.91 to 2.9 kg N/ha/year. Nitric acid vapor deposition did not change appreciably because it has similar deposition velocities on all surfaces. The total deposition at Fremont for a 100% grass surface was estimated at 10 kg N/ha/year (C. Blanchard, personal communication.).

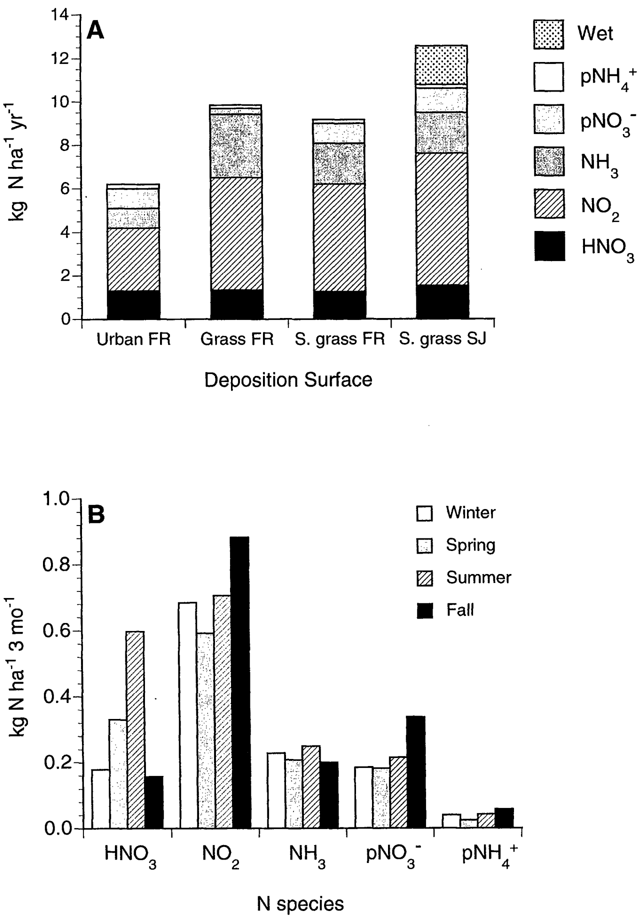

Figure 5. (a) Adjusted estimates of nitrogen deposition for grassland and seasonal (S) grassland at Fremont (FR) and San Jose (SJ). (b) Seasonality of nitrogen deposition by species at Fremont, California. (Adapted from Blanchard et al. 1996.)

Nonirrigated grasslands in California are green in the rainy season (November–April) and largely brown in the dry season (May–October). Deposition varies seasonally because proportions of N species vary over the year (Fig. 5b). Nitrogen dioxide deposition is highest in fall, whereas HNO_3 deposition is highest in summer. To simulate this seasonality, the figure for 100% grass was used only for the fall and winter months, whereas the figure for the "urban" mix was used for the spring and summer. At Fremont this adjustment reduced deposition to 100% grassland to 9 kg N/ha/year (Fig. 5a)

South San Jose has more air pollution than Fremont. Deposition from a N species is generally proportional to concentration. The ratio in annual NO_2 concentration between San Jose and Fremont is around 1.3 (Fig. 6a), and the ratio of pNO_3 concentrations is around 1.2 (Fig. 6b, both comparisons $p < 0.01$, paired t test by year). Increasing ozone levels (Fig. 6c) indicate that HNO_3 increases toward the south because there is generally a tight relationship between ozone and HNO_3 vapor in polluted areas (Blanchard et al. 1996). The ratio of 1:1.2 in ozone concentration between Fremont (FR) and San Martin (SM, the site closest to Kirby Canyon, paired t test by year $p < 0.01$) suggests a 20% increase in HNO_3 deposition. Based on these adjusted pollutant concentrations, the estimate for dry deposition into seasonal grassland in San Jose increased to 11 kg N/ha/year (Fig. 5a).

The average yearly input of wet deposition at San Jose has been 0.89 kg N/ha/year for a total of around 12 kg N/ha/year. Wet deposition within a region usually varies proportionally with rainfall. Because the ridgetop at KC receives about 640 mm rainfall, twice that at the wet deposition station in San Jose (330 mm), wet deposition at Kirby Canyon is estimated to be about 1 kg N/ha/year greater. Given uncertainties in deposition calculations, 10–15 kg N/ha/year is a reasonable approximation for sites such as Silver Creek and Kirby Canyon.

Jasper Ridge lies upwind of most pollution sources and receives much of its air as northwest winds off the Pacific Ocean that pass over the virtually undeveloped Santa Cruz Mountains (Fig. 1). Marine air is low in NO_2, as evidenced by low levels at Davenport, directly on the coast (Fig. 6c). That prediction is confirmed by the resin-bag sampling. Aerial bags at JR collected about 40% of the NO_3, compared with bags at SC and KC (JR = 2.3 ± 1.1 μg/mL extracted, SC = 5.3 ± 1.1 μg/mL, KC = 6.8 ± 0.7 μg/mL, mean ± SE, $n = 4$ for all sites). The difference between JR and two other sites was highly significant ($p < 0.001$), but the difference between SC and KC was not (Tukey-Kramer HSD test). If that ratio holds for total deposition throughout the year, then JR may receive about 4–6 kg N/ha/year.

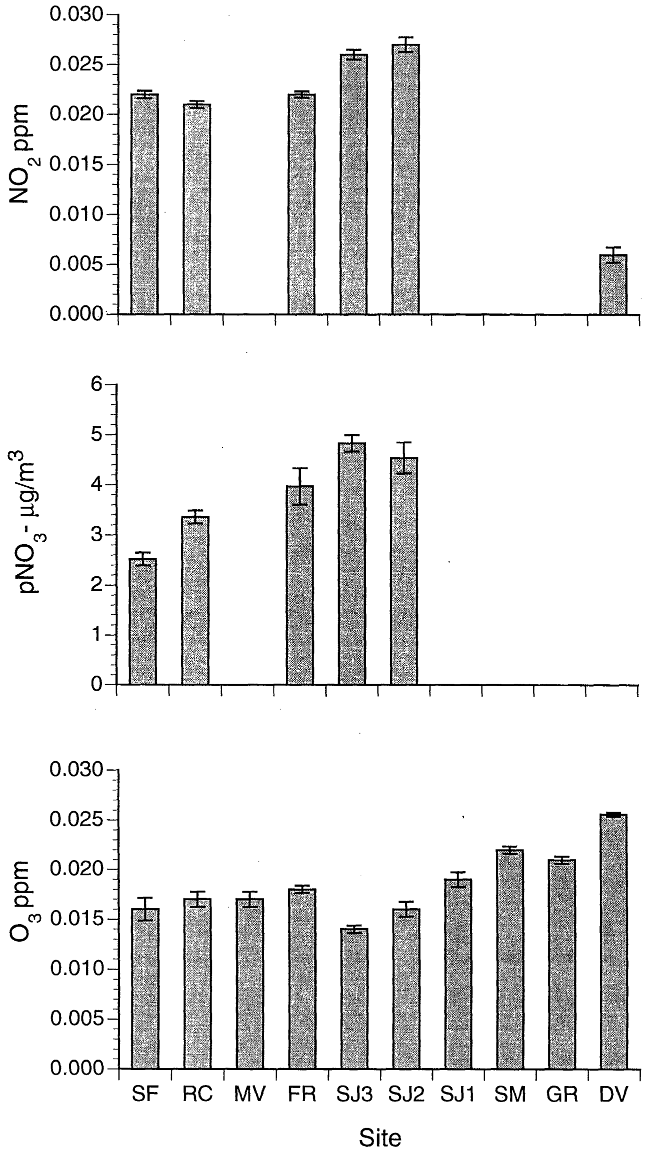

Figure 6. Annual average concentrations (1990–1996) of ozone, NO_2, and particulate NO_3^- at pollution monitoring stations in the San Francisco Bay area (data from California Air Resources Board 1990–1996).

Discussion

The population surveys showed that the Bay checkerspot butterfly experienced severe population crashes in 1994 and 1995 after grazing was removed from two sites in the Silver Creek Hills. Concurrently, other populations in continuously grazed areas did not crash, indicating that widespread climatic factors such as drought were not responsible for the population crashes at SC1 and SC2.

The proximate cause of the crashes was invasion by introduced grasses. The dense sward of grasses, especially *Lolium multiflorum*, reached heights of 0.75 m and crowded out small native annual forbs, especially *Plantago erecta*. Similar invasions of serpentinitic soils by annual grasses have been observed around the Santa Clara Valley (Ehrlich & Murphy 1987; Murphy & Weiss 1988*a*; Huenneke et al. 1990). Extensive serpentinite outcrops in Santa Teresa County Park, where grazing was eliminated in the late 1970s, are dominated by grasses (S.B.W. & A. E. Launer, personal observation). Few if any checkerspot butterflies are found in ungrazed areas. Similar grass invasions have not occurred at JR, despite the removal of cattle grazing in 1960.

These observations suggest a fundamental difference between JR and the south San Jose sites. My review of experimental work showed that serpentinitic grasslands are largely N limited and can be rapidly invaded by introduced grasses when N is added. The most responsive species is *Lolium multiflorum*, the most common grass at ungrazed sites in south San Jose. *Lolium* has been rare or absent from Jasper Ridge.

I estimated that N deposition levels in grasslands in south San Jose are 10–15 kg N/ha/year. Total deposition may be even greater. My calculations did not include nitric oxide (NO), which may also dry-deposit into grasslands (Hanson & Lindberg 1991); average NO concentrations are not reported, nor was NO included in the Blanchard et al. (1996) estimates. In addition, areas of bare soil typical of serpentinitic grasslands may have high deposition velocities for NO_2, greater than that of the plants themselves (Judeikis & Wren 1978; Hanson et al. 1989). Nitrogen deposition levels at Jasper Ridge are much lower, based on local meteorology and preliminary measurement with aerial resin bags.

These levels of N deposition in south San Jose are high enough to act as fertilizer and enhance the growth of annual grasses at the expense of native annual forbs. Over the course of several years, the amounts of N deposition at SC and KC approach the yearly amounts used in fertilization experiments. Most grassland ecosystems respond incrementally to N additions (Tilman 1988). For example, the effects of the addition of 50 kg N/ha/year on annual grass growth were intermediate between 0 and 100 kg N/ha/year in field experiments at JR (Hull & Mooney 1990). Serpentinitic grasslands are highly retentive of N (Reynolds et al. 1997; Hooper & Vitousek 1998), and leaching losses are small (Hooper & Vitousek 1998). Thus, incremental additions of N are incorporated into plants and microbes and may build up over several years.

The magnitude of dry N deposition flux in south San Jose is comparable to the measured yearly N uptake by plants in serpentinitic grasslands. Hungate et al. (1997) measured plant N uptake at 30–50 kg N/ha/year. Hooper (1996, personal communication) estimated similar uptake in high-diversity experimental plots. A substantial portion of dry deposition (especially NO_2) is directly absorbed by stomata and is ready for immediate assimilation into the plants.

The evidence indicates that N deposition is greatly affecting the habitat suitability of serpentinitic grasslands for the threatened Bay checkerspot butterfly and other native species. Invasion of grasses following grazing removal is not a subtle phenomenon, can occur rapidly, and takes many years to reverse. Given the repeated responses of these grasslands to the removal of cattle grazing, the key conservation recommendation is that well-managed, moderate grazing must be maintained on sites that are expected to support the butterfly. Any conservation plan that sets aside land must include long-term grazing management.

The mechanisms by which grazing directly and indirectly affects the plant community and the N cycle are diverse. Most directly, cattle selectively graze introduced annual grasses in preference to forbs. The taller grasses can rapidly outgrow shorter forbs; grazing maintains a low, open plant canopy. Grasses also outcompete native forbs through buildup of dense thatch (Huenneke et al. 1990). Cattle break down the thatch by trampling and feeding in the dry season. Cattle also disturb the surface and compact soils, but the effects of this disturbance alone on plant composition are not well understood.

Grazing effects on the N cycle are complex. On an ecosystem-wide basis, cattle remove N as they gain weight and are removed for slaughter. Some N may also be exported via ammonia volatilization from droppings and urine (Holland et al. 1992). Although cattle droppings and urine lead to local deposition of N, in terms of N, cattle "eat globally and deposit locally." Local fertility islands (<1 m^2) immediately around cattle droppings support lush stands of annual grasses (usually *Lolium*). Cattle grazing can also lead to enhanced N availability in the soil by speeding up the rate of N cycling via allocation patterns of plants (Holland et al. 1992).

Grazing regimes must be well managed and of moderate intensity. The rancher at KC and CR regularly monitors cattle weight gain and grass availability. When biologists asked for removal of cattle from KC during drought years to prevent overgrazing, the rancher had already made the decision to move his cattle to other pastures. This self-regulation of the grazing regime has been a great benefit for the Bay checkerspot butterfly and for many of the native plant species that survive on serpentinitic soils.

The butterfly also persists in areas where grazing is concentrated in the summer and fall. Although grass cover is higher in these areas than in the winter-spring grazed areas (Fig. 3), *Plantago* and numerous nectar sources are still abundant. Multiple management regimes may help to spread risks associated with particular grazing regimes. For example, grazing during the winter and spring undoubtedly leads to some direct mortality of butterfly larvae, eggs, and pupae by crushing; this source of direct mortality is avoided by summer-fall gazing at the cost of higher grass cover in the habitat.

Some plant species do not do well with grazing. *Dudleya setchellii* (listed as endangered) lives on rock outcrops, is often chewed up by cattle, and tends to be more abundant and vigorous in ungrazed areas (U.S. Fish & Wildlife Service 1998; personal observation). Fencing off selected rock outcrops that provide little habitat value for the butterfly is effective mitigation. Grazing may not be the perfect solution to grass invasions, but, given the current state of our knowledge, existing moderate grazing regimes appear to be a suitable management prescription for most serpentinitic grasslands in south San Jose.

Ungrazed, grass-dominated sites can recover to acceptable levels of habitat quality for the butterfly following the reintroduction of grazing, but recovery may take years. Introduced grasses perform well during wet years and poorly during droughts, and *Plantago erecta* performs well during droughts (Hobbs & Mooney 1995). The years following reintroduction of grazing in SC1 (1995–1998) all had above-average rainfall, including the record El Niño winter of 1997–1998, so grass growth was favored. Conversely, a severe drought period may slow the grass invasion and speed recovery; recovery of the KC grazing exclosure took place over 5 years of drought.

Fire and mowing may not be appropriate management tools for serpentinitic grasslands. Fire in these grasslands is poorly studied, and extensive controlled experimental studies would be required to properly assess the effects of fire. Fire may kill Bay checkerspot larvae that are in summer diapause beneath rocks and in the soil. Mowing and hay removal are not feasible because of rock outcrops and steep slopes.

Documenting the effects of grazing removal creates a dilemma for scientists and conservationists attempting to protect biologically rich serpentinitic grasslands. Removal of grazing is a rapid route to diminished habitat quality and population-level extinctions of the one protected species that can stymie broad development plans on serpentinitic soils. One landowner (SC2) has already followed that course in hopes of eliminating the habitat value from his parcel. The U.S. Fish and Wildlife Service (1998), however, is aware of the problem and still regards the degraded habitat as important to protect. Whether the Endangered Species Act can be invoked to force landowners to continue grazing is an open question.

Although N deposition on the peninsula is lower than in south San Jose, it still may have chronic long-term effects. *Lolium* may require several years of drier weather to disappear from JR. Edgewood Natural Preserve, which has consistently supported patches of high-density *Lolium* throughout the grassland (S.B.W., personal observation), may be affected by short-range deposition from an eight-lane freeway that bisects the site. Introduction of grazing or fire at EW and JR would be difficult without careful research and planning to address scientific and political concerns.

The ultimate solution is to eliminate sources of excess N, a much larger societal problem that will take decades to solve. Air pollution standards based on direct human health issues may not be stringent enough to avoid negative effects on N-sensitive ecosystems. The San Francisco Bay area (and all of California) presently meet federal and state standards for mean annual NO_2 concentrations (California Air Resources Board 1996). Cars are the major regional source of NO_x (60% or more), and little progress has been made in reducing car use despite chronic traffic problems. Proposed new air quality rules will only incrementally decrease NO_x levels and offer no short-term relief.

The threads of this story highlight the interdisciplinary nature of conservation biology. Much of the evidence linking N deposition to the grass invasions is still circumstantial and inferential. More research is needed in a number of areas: (1) refinement of deposition estimates; (2) effects of low-level chronic N additions over several years; (3) effects of grazing regime on serpentine, both in terms of plant composition and N dynamics; (4) time course of restoration following the reintroduction of grazing; (5) recovery of Bay checkerspot populations; and (6) alternatives to grazing, especially fire. Such research would necessarily draw on atmospheric chemistry, plant ecology, ecosystem ecology, range management, population biology, and other disciplines and would be a major, long-term research program.

The number and identity of rare species in California beyond the Bay checkerspot butterfly that are being negatively affected by N deposition is unknown. Dry N deposition in California varies greatly with location (Blanchard et al. 1996): 24–29 kg N/ha/year in the Los Angeles Basin; 10–20 kg N/ha/year in Central Valley cities (Bakersfield and Sacramento); 6 kg N/ha/year in Fremont and Santa Barbara; and around 1 kg N/ha/year in rural locations at Gasquet (far northern California) and at Sequoia and Yosemite National Parks in the Sierra Nevada. Other estimates of N deposition in California range up to 45 kg N/ha/year in forests in the San Bernardino Mountains in the Los Angeles basin, which are showing signs of N saturation (Bytnerowicz & Fenn 1996). Coastal sage-scrub communities are being transformed by the invasion of annual grasses driven by N deposition (Allen et al. 1998).

Conclusions

The enhancement of the global N cycle is but one aspect of global change. Land-use alterations and invasive species are two widely recognized components of global change (Vitousek 1994), and the plight of the Bay checkerspot butterfly demonstrates how all three factors interact to threaten local biological diversity. Land-use change (urbanization) directly threatens the serpentinitic grasslands of the San Francisco Bay area (Murphy & Weiss 1988*a*). The invasive grasses that have dramatically changed California's grasslands are poised to dominate the last refugia for the native grassland flora and fauna, given the chance. That chance is provided by smog-induced fertilization, but only with the additional land-use change of removing grazing. The economics of grazing adjacent to major urban areas may not be viable over the long term. It is ironic that grazing, which has contributed so greatly to the transformation of California's native grasslands, may prove necessary for their maintenance on nutrient-poor soils downwind of major pollution sources.

Nitrogen deposition is a long-term regional and global problem that deserves increased attention from scientists and policymakers (Vitousek et al. 1997). Many other rare ecosystems, communities, and species worldwide may be affected by N deposition from nearby (or even distant) air pollution sources. The effects of additional N may be obvious, as observed in this study, but also may be more subtle, such as changes in soil chemistry and plant tissue that can affect herbivores and overall nutrient cycling. Identification of the problem and establishment of suitable management regimes will undoubtedly take much research and experimentation by conservation biologists and managers.

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EXHIBIT C

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Review

Nitrogen critical loads and management alternatives for N-impacted ecosystems in California

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Epiphytic lichens

ABSTRACT

Empirical critical loads for N deposition effects and maps showing areas projected to be in exceedance of the critical load (CL) are given for seven major vegetation types in California. Thirty-five percent of the land area for these vegetation types (99,639 km^2) is estimated to be in excess of the N CL. Low CL values (3–8 kg N ha^{-1} yr^{-1}) were determined for mixed conifer forests, chaparral and oak woodlands due to highly N-sensitive biota (lichens) and N-poor or low biomass vegetation in the case of coastal sage scrub (CSS), annual grassland, and desert scrub vegetation. At these N deposition critical loads the latter three ecosystem types are at risk of major vegetation type change because N enrichment favors invasion by exotic annual grasses. Fifty-four and forty-four percent of the area for CSS and grasslands are in exceedance of the CL for invasive grasses, while 53 and 41% of the chaparral and oak woodland areas are in exceedance of the CL for impacts on epiphytic lichen communities. Approximately 30% of the desert (based on invasive grasses and increased fire risk) and mixed conifer forest (based on lichen community changes) areas are in exceedance of the CL. These ecosystems are generally located further from emissions sources than many grasslands or CSS areas. By comparison, only 3–15% of the forested and chaparral land areas are estimated to be in exceedance of the NO_3^- leaching CL. The CL for incipient N saturation in mixed conifer forest catchments was 17 kg N ha^{-1} yr^{-1}. In 10% of the CL exceedance areas for all seven vegetation types combined, the CL is exceeded by at least 10 kg N ha^{-1} yr^{-1}, and in 27% of the exceedance areas the CL is exceeded by at least 5 kg N ha^{-1} yr^{-1}. Management strategies for mitigating the effects of excess N are based on reducing N emissions and reducing site N capital through approaches such as biomass removal and prescribed fire or control of invasive grasses by mowing, selective herbicides, weeding or domestic animal grazing. Ultimately, decreases in N deposition are needed for long-term ecosystem protection and sustainability, and this is the only strategy that will protect epiphytic lichen communities.

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1. Introduction

An estimated land area of 52,823 km^2 of California (13% of the state) is exposed to N deposition greater than 10 kg ha^{-1} yr^{-1} (Fig. 1). A significant portion of the Central Valley, and montane sites in the SW Sierra Nevada, and in southern California receive deposition inputs ranging from 15 to 20 kg ha^{-1} yr^{-1} or greater (Fig. 1; Fenn et al., 2008). Forests in the more exposed regions of southern California experience the highest N deposition in North America (30 to over 70 kg ha^{-1} yr^{-1}), while at the opposite end of the deposition spectrum in California large acreages of forests, woodlands, shrublands, grasslands, desert, high elevation ecosystems, and other ecosystem

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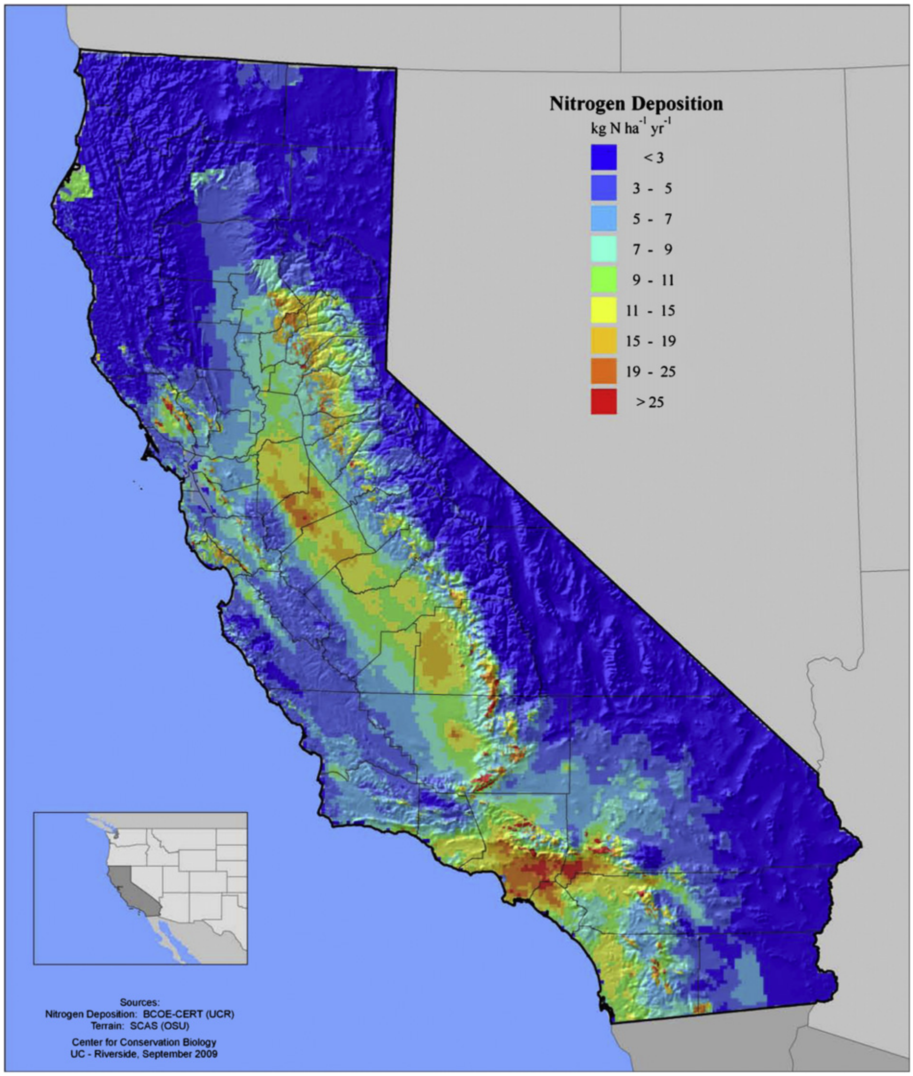

Fig. 1. Map of total annual N deposition in California based on CMAQ simulations. As described in the text, simulated N deposition in forested areas has been adjusted based on the linear relationship with empirical throughfall data.

types are exposed to low deposition (ca. 2–5 kg ha^{-1} yr^{-1}; Fig. 1; Fenn et al., 2003a, 2008).

Nitrogen emissions in California are 3–10 times greater than in the other ten western states (Fenn et al., 2003a). Emission estimates are more uncertain for ammonia (NH_3) than for nitrogen oxides (NO_x), but available data suggest that NH_3 comprises 20–30% of N emissions in California (Cox et al., 2009; Fenn et al., 2003a; USEPA, 2008). A recent study found that 25% of the N emissions from light-duty vehicles in three California cities are in the form of NH_3 and in newer cars this fraction increases (Bishop et al., 2010). Nitrogen deposition studies (Fenn and Poth, 2004; Fenn et al., 2003a, 2008) and monitoring networks of gaseous pollutants (Bytnerowicz et al., 2007; Hunsaker et al., 2007) suggest that NH_3 emissions in California are underestimated. Satellite observations of atmospheric NH_3 also show that concentrations are greater than previous data indicated in several regions of the world, including central and southern California (Clarisse et al., 2009). Emissions of NH_3 appear to be increasing as NO_x emissions decrease (Cox et al., 2009; Fenn et al., 2003a).

Eighty-six percent of NO_x emissions in California are from mobile sources and 11% from stationary sources. The largest source of NH_3 emissions is livestock waste, estimated as approximately 80% of the statewide emissions by the California Air Resources Board (Cox et al., 2009). However, as discussed above, on-road emissions appear to be a more important source of NH_3 emissions than the emissions inventories indicate (Bishop et al., 2010), particularly in urban areas (Battye et al., 2003) or near highways (Fig. 2). In montane and desert regions downwind of greater Los Angeles and in the Central Valley of

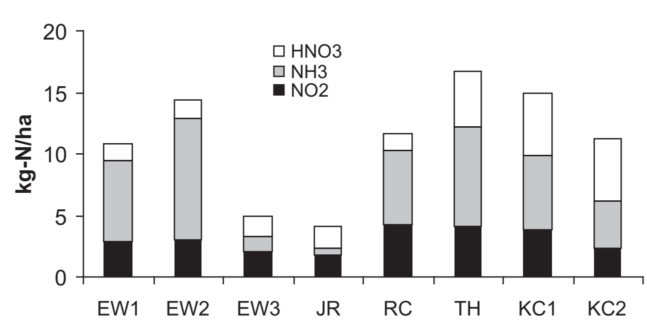

Fig. 2. Passive sampler estimates of dry gaseous deposition at serpentine grassland sites. The Edgewood sites (EW) are from a local gradient adjacent to Highway 280. From these sites the critical load was derived.

California, N deposition and atmospheric concentrations of gaseous pollutants have similar or even higher proportions of reduced than oxidized N (A. Bytnerowicz, unpublished data; Fenn and Poth, 2004; Fenn et al., 2003a, 2008).

Until recently, little was known regarding the thresholds at which various ecosystems in California are impacted by chronic N deposition or the geographic extent of these impacts (Weiss, 2006). Herein we review our current understanding of the empirical critical loads (CLs) of N deposition at which undesirable effects are observed for seven of the most extensive vegetation types in California. A critical load (CL) has been defined as: "A quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge" (UBA, 2004).

Affected vegetation communities include mixed conifer forests, chaparral, oak woodlands, coastal sage scrub, grasslands, pinyon-juniper, and desert ecosystems (Fig. 3). The land cover distribution shown in Fig. 3 represents potential natural vegetation before urbanization and modern agriculture (U.S. Bureau of Reclamation, 1996). A number of biotic communities and ecosystem components and processes are known to be affected by these chronic N inputs, and empirical CLs have been established for key endpoints. Predominant effects are those associated with excess N or the CL for 'N as a nutrient' effects ($CL_{nut}(N)$; Reynolds et al., 1998; UBA, 2004). Soils in these Mediterranean ecosystems are typically high in base saturation and are well buffered, thus tolerating the acidification impacts caused by chronic N deposition. However soil base saturation and pH have decreased significantly in forests and chaparral sites in the Los Angeles air basin where N deposition is $\geq$25 kg ha^{-1} (Breiner et al., 2007; Fenn et al., 1996; Wood et al., 2007).

Critical loads for terrestrial systems can be calculated from models of varying complexity and are determined for eutrophication or nutrient N effects as well as for soil acidification (UBA, 2004). Models for the latter also include acidification effects from sulfur deposition. In California, sulfur deposition is rarely of concern and N eutrophication effects are much more widespread than acidification effects, particularly in terrestrial ecosystems in California. In this study we focus on empirically derived CLs for 'N as a nutrient' effects. Much of this work is based on data collected at sites across N deposition gradients or from N amendment studies.

The primary objectives of this report are to provide a synthesis of empirical CLs for N across major vegetation types in California and to look for spatial patterns and the extent of CL exceedances. The empirical CL values given in this paper include previously

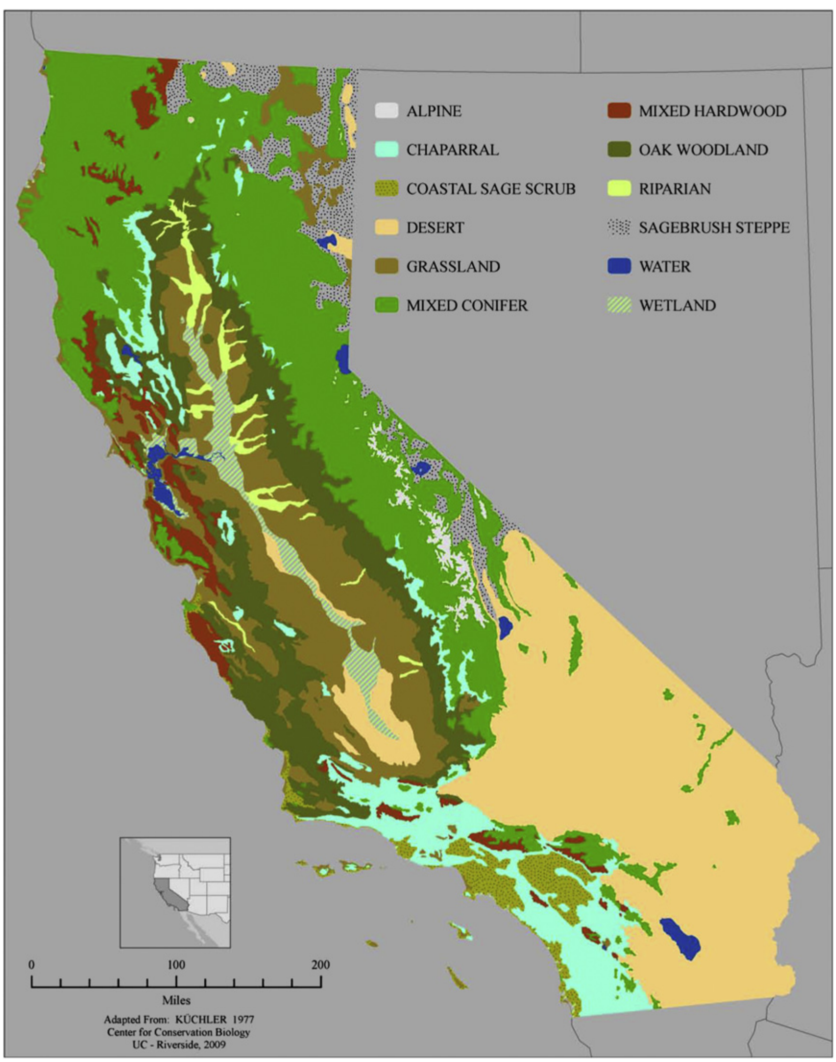

Fig. 3. Map of the distribution of vegetation types and land cover in California (U.S. Bureau of Reclamation, 1996). Land cover presented in this figure represents potential natural vegetation before urbanization and modern agricultural development.

published CLs and newly established CLs, most of which are also reported in a comprehensive monograph on N CLs in the U.S. (Pardo et al., in press). This assessment will provide a broad-scale assessment of the geographic extent over which ecosystems in California are at risk of deleterious ecological effects from N deposition and will serve as a guide for future research in key vegetation types. Finally, management options for mitigating the effects of excess N in these vegetation types are discussed.

2. Materials and methods

A variety of methods were used to measure N deposition and to determine the CLs for the seven vegetation types discussed in this paper. Methods for determining the CL were adapted based on the sensitive responders to chronic N deposition within each vegetation type and measured or simulated N deposition. Finally, CL exceedance areas were mapped by overlaying statewide vegetation maps with a California N deposition map (Tonnesen et al., 2007).

2.1. N deposition

Because of the importance of dry deposition in California and the difficulty in measuring dry deposition, particularly to shrublands, several approaches (Fenn et al., 2009) were used to estimate total annual N deposition inputs in the different vegetation types evaluated in this study. In some cases a combination of methods was used for a given vegetation type. Throughfall deposition data were used to determine the CLs in forest and chaparral ecosystems (Fenn et al., 2003a, 2008; Meixner and Fenn, 2004). Simulated deposition data from the USEPA CMAQ (Models-3/Community Multiscale Air Quality) model (Byun and Schere, 2006; Tonnesen et al., 2007) were used for chaparral and oak woodlands in the Central Valley, for coastal sage scrub, and for broad scale estimates of deposition to grassland. The CMAQ model is designed to represent both wet and dry deposition of aerosol and gas-phase species. However, the CL for serpentine grassland was based on local scale deposition in the environs of a major highway as determined using the inferential method (Fenn et al., 2009) for dry deposition, combined with estimates of wet and particulate deposition. Atmospheric concentrations of NO_2 (Ogawa, 1998), NH_3 (Roadman et al., 2003) and HNO_3 (Bytnerowicz et al., 2005) were measured in the grassland with passive samplers (Fenn et al., 2009) that were deployed along a deposition transect. Deposition data for desert vegetation in Joshua Tree National Park were determined from a combination of CMAQ simulations, bulk deposition and throughfall measurements. The CMAQ deposition data in the desert were confirmed by inferential deposition calculations determined from passive sampler data (A. Bytnerowicz and M.E. Fenn, unpublished data). Throughfall and bulk deposition samples collected in forest, chaparral and desert vegetation were obtained using ion exchange resin samplers (Fenn and Poth, 2004; Fenn et al., 2009).

2.2. Empirical critical load determinations

Critical loads within each of the vegetation types were determined based on the responses of biological or chemical response variables to varying levels of N inputs. These response variables include epiphytic lichen community changes, elevated streamwater nitrate leaching, reduced biodiversity of native plant species, invasion of exotic grass species, and changes in mycorrhizal communities. When more than one response variable was used within a given vegetation type, a CL was estimated for each response variable. Low productivity ecosystems respond to low levels of N by changes in plant species composition and productivity (Bowman et al., 2006; Allen et al., 2009), while high productivity ecosystems may not show changes in species composition even with relatively high N inputs, but may experience detectable changes in soil or streamwater chemistry (Fenn and Poth, 1999; Fenn et al., 1996, 2003c). However, epiphytic lichen communities in high production ecosystems can respond to low N levels (Fenn et al., 2007, 2008; Jovan, 2008; Jovan and McCune, 2005).

2.2.1. Mixed conifer forest, chaparral and oak woodlands

Empirical CLs in mixed conifer forests were determined for elevated streamwater NO_3^- concentrations and shifts in epiphytic lichen community functional groups. A preliminary CL was also determined for reductions in fine root biomass in ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.; Fenn et al., 2008; Table 1). Responses to N have also been reported for increased bark beetle activity and associated tree mortality (Jones et al., 2004), changes in ectomycorrhizal fungal communities (Sirajuddin, 2009), understory biodiversity (Allen et al., 2007), and soil acidification (Breiner et al., 2007; Wood et al., 2007) but further studies are needed to determine more certain estimates of the CLs for these effects. Similar approaches to that used for forests were employed to determine the CLs for elevated NO_3^- leaching in streamwater and epiphytic lichen community changes in chaparral and oak woodlands (Table 1; Fenn et al., 2003a–c, in press; Fenn and Poth, 1999; Meixner and Fenn, 2004; Riggan et al., 1985).

Table 1
Summary of CLs and methods used to determine empirical CLs for the 7 vegetation types described in this study.

Vegetation type	Response variables for CL determination	CL values ($kg\,N\,ha^{-1}\,yr^{-1}$)	References
Mixed conifer forest	Exceedance of peak streamwater NO_3^- concentration threshold (0.2 mg NO_3-N L^{-1})	17	Fenn et al., 2008
Mixed conifer forest	Enriched N in tissue of the lichen *Letharia vulpina* (above 1.0% N)	3.1	Fenn et al., 2008
Mixed conifer forest	Epiphytic lichen community shift away from acidophyte (oligotroph) dominance	5.2	Fenn et al., 2008
Mixed conifer forest	Extirpation of acidophytic (oligotrophic) lichens	10.2	Fenn et al., 2008
Mixed conifer forest	Fine root biomass reduction (26%) in ponderosa pine trees	17	Fenn et al., 2008
Chaparral	Exceedance of peak streamwater NO_3^- concentration threshold	10–14	Fenn et al., in press
Chaparral and oak woodlands	Epiphytic lichen community shift to eutrophic lichen species dominance	5.5	Fenn et al., in press; Jovan, 2008; Jovan and McCune, 2005
Coastal sage scrub	Decrease in native plant species and forb richness	7.8–10	Fenn et al., in press
Coastal sage scrub	Decrease in arbuscular mycorrhizal spore density, richness, and percent root infection	10	Fenn et al., in press
Grassland	Exotic grass invasion	6	Weiss, 1999; This study
Desert scrub	Exotic grass biomass accumulation sufficient to sustain fire	3.2–9.3	Rao et al., 2010
Pinyon-juniper woodland	Exotic grass biomass accumulation sufficient to sustain fire	3.0–6.3	Rao et al., 2010

2.2.2. Coastal sage scrub

Critical loads have been estimated for coastal sage scrub (CSS) vegetation with respect to loss of diversity of native plants and diversity of mycorrhizal fungi. Elevated N may also increase exotic grass biomass that may be responsible for frequent fires. CSS is a semi-deciduous shrubland that occurs in the Mediterranean-type climate of southern and central coastal California, extending southward to Baja California, Mexico. The understory forbs, primarily annual, are especially high in diversity, with many species of concern throughout the range of CSS in California. Coastal sage scrub is subject to N deposition levels of approximately 20 kg ha^{-1} yr^{-1} (estimated total N deposition from the CMAQ model; Tonnesen et al., 2007) in inland Riverside and San Bernardino Counties, where it has been rapidly converted to exotic annual grassland in the past 30–40 years (Allen et al., 1998; Talluto and Suding, 2008). The conversion to grassland is likely caused by a combination of elevated N deposition that promotes increased grass biomass and frequent fire, which in turn prevents establishment of native shrubs and forbs (Allen et al., 1998; Minnich and Dezzani, 1998). Coincident with increasing exotic grass cover is the loss of native diversity. The CL approach taken here was to determine a threshold N deposition at which there is a distinct decline in native species diversity. To this end a survey was done in 2003 along an N deposition gradient in CSS with an estimated deposition range of 8.7–19 kg N ha^{-1} yr^{-1}, according to the CMAQ model (Tonnesen et al., 2007). The inferential method (Fenn et al., 2009) yielded a corroborating range estimate of 6.6–20.2 kg N ha^{-1} yr^{-1}. Because measurements for the inferential method were taken at only three points, both modeled and measured values are used to set the CL.

Another analysis was done along the same gradient to determine the N CL for effects on colonization and diversity of arbuscular mycorrhizal fungi (AMF) in CSS (Egerton-Warburton and Allen, 2000; Fenn et al., in press). AMF are found in the roots of most plant species, and are important mutualists that promote plant growth. High levels of nutrients such as N decrease the percentage of roots colonized by AMF and decrease the number of spores found in the rhizosphere (Egerton-Warburton and Allen, 2000; Egerton-Warburton et al., 2007). The CL for AMF responses in CSS was based on a steep decline in mycorrhizal root infection and spore species density at the second lowest, compared to the lowest, level of N deposition observed across the N deposition gradient (Fenn et al., in press).

2.2.3. Grassland

In the San Francisco Bay Area, nutrient-poor soils derived from serpentinite bedrock support diverse grassland, dominated by native herbs and perennial grasses that produce spectacular spring wildflower displays. Most California grasslands on richer soils are dominated by non-native annual grasses and herbs. Serpentine grasslands provide a refuge for imperiled native California grassland flora and fauna (Harrison and Viers, 2007), including the federally "Threatened" Bay checkerspot butterfly (*Euphydryas editha bayensis*) and more than 10 rare, threatened, and endangered plant taxa (USFWS, 1998). The Bay checkerspot butterfly and serpentine grasslands have been intensively studied since the 1960s, and are recognized as model systems for population, conservation, and ecosystem ecology (Huenneke et al., 1990; Hobbs and Mooney, 1995; Ehrlich and Haanski, 2004).

The only remaining viable population complex of the butterfly occupies approximately 2000 ha of serpentine grassland around the southern Santa Clara Valley, just downwind of the San Francisco–San Jose urban agglomeration. N deposition from urban emissions allows non-native annual grasses, especially *Lolium multiflorum* and *Bromus hordeaceus*, to vigorously invade serpentine soils and displace the native herbs, including the checkerspot larval host plants (*Plantago erecta* and *Castilleja* sp.) and numerous adult nectar sources (Weiss, 1999). Short-term experimental studies, using 100 or more kg N ha^{-1} have demonstrated that N is the limiting nutrient for annual grass growth in these soils (Huenneke et al., 1990; Hull and Mooney, 1990). Increased grass growth and accumulation of undecomposed litter lead to losses of larval host plants and adult nectar sources, and local population extinctions of the butterfly.

On the coastal San Francisco Peninsula, upwind of most pollution sources, serpentine grasslands have remained relatively free of vigorous grass invasions, except at Edgewood Natural Preserve (EW) adjacent to Highway 280, an 8-lane high speed road carrying 100,000+ vehicles/day in a relatively clean air region. In this 15 ha habitat the local Bay checkerspot population declined from 5000 in 1997 to zero in 2002. During this period, a wave of *L. multiflorum* over-ran larval host plants up to about 400 m east from the road, leading to the loss of 80% of the available habitat.

A monitoring network of passive samplers (Fenn et al., 2009) in serpentine grassland provided monthly average atmospheric concentrations of NO_2, NH_3, and HNO_3 from which dry deposition estimates for these gases were calculated using published deposition velocities. Wet deposition from CMAQ is estimated at a maximum of 0.5 kg N ha^{-1} yr^{-1}. Dry particulate deposition is estimated at <0.5 kg N ha^{-1} yr^{-1} (Blanchard et al., 1996). The CL for invasion of exotic annual grasses was determined at the Edgewood Natural Preserve along a transect from highly traveled Highway 280. The EW3 air monitoring station was deliberately placed where the grass invasion visibly diminished (as of 2001).

2.2.4. Desert

Nitrogen fertilization was applied at four sites along an N deposition gradient in Joshua Tree National Park (JTNP). Fertilization rates were 0, 5 and 30 kg N ha^{-1} yr^{-1}, applied for three consecutive years from 2003 to 2005 as pelleted NH_4NO_3 (Allen et al., 2009). Nitrogen deposition along the gradient ranged from 3.4 to 12.4 kg N ha^{-1} yr^{-1} as measured by bulk throughfall deposition samplers (Fenn et al., 2009) and also as simulated with the CMAQ model (Tonnesen et al., 2007). Highly similar values for dry deposition (the predominant input form) were determined with the inferential method (Rao et al., 2009). The fertilization plots were in two vegetation types, creosote bush scrub in the Colorado Desert portion of JTNP, and pinyon-juniper woodland in the Mojave Desert. The two vegetation types represent two of the most abundant vegetation types in JTNP, as well as the extremes in elevation. Creosote bush scrub is also the most abundant vegetation type across the Mojave and Sonoran Deserts. The sites have been invaded by exotic annual grasses, especially *Schismus barbatus* and *Bromus madritensis*, both of which are highly responsive to N fertilizer. The empirical CL was determined as the lowest N treatment plus background N deposition that caused increased biomass of invasive grasses and decreasing biomass of native species (Allen et al., 2009).

Critical loads were also determined for creosote bush scrub and pinyon-juniper woodlands by simulating winter annual vegetation production under a range of soil textures, precipitation regimes, and N deposition levels. Simulations were conducted using the biogeochemical process model DayCent, and are described in detail in Rao et al. (2010). Briefly, the model was calibrated and validated using soil and vegetation data from the four fertilization sites in JTNP described above and in Allen et al. (2009). Once parameterized for each vegetation type, DayCent was used to simulate winter annual biomass production under increasing N deposition loads from background (1 kg ha^{-1} yr^{-1}) to twice the level observed in this region (15 kg ha^{-1} yr^{-1}). Production was simulated for 100 years at each N deposition load, and the fire risk at each load determined as the fraction of years in which the threshold of biomass known to carry fire (1000 kg ha^{-1}) was exceeded. When fire risk probability was plotted as a function of increasing N deposition, a sigmoidal response curve was obtained. The lower-bound CL was then defined as the N deposition load where fire risk began increasing exponentially above background levels. The amount of N deposition where fire risk no longer increased with added N was termed the fire risk stabilization load and was defined as the amount of N deposition resulting in 90% of the maximum fire risk. In regions with deposition above this load, fire risk is controlled by variation in annual precipitation and does not increase with increased N deposition, although annual biomass production will still increase with added N (Rao et al., 2010). These calculations were conducted for simulations performed under six precipitation regimes and six soil textures. The ranges of precipitation and soil textures included in the simulations bracketed observed mean annual precipitation and soil texture from the southern California desert region.

2.3. Critical load exceedance maps

Vegetation cover data from the California Gap Analysis Project (Davis et al., 1998) were overlain with statewide CMAQ total annual N deposition data to create maps showing the areas in which estimated N deposition is in excess of the CL values reported in this study. Urban and agricultural land use categories were excluded from this process of developing CL exceedance maps. Environmental Systems Research Institute (ESRI, Redlands, California) ArcGIS desktop version 9.3 software was used for spatial analysis and to produce CL exceedance maps. The CL exceedance map series are based on vegetation cover extant circa 1992 (Davis et al., 1998). These data include a classification using the California Wildlife Habitat Relationships (WHR) system (Mayer and Laudenslayer, 1988). Selected WHR classes were aggregated to match the CL vegetation types presented here.

Nitrogen deposition was converted from a raster to a polygon format then overlaid and intersected with vegetation cover. This produced a polygon dataset and table, including each type and area of vegetation with its associated N deposition. Vegetation polygons that included areas with varying annual N deposition values were partitioned into areas with the appropriate deposition value associated with each new area. Each vegetation type was categorized by N deposition to determine CL exceedance areas, which were then symbolized accordingly on the CL exceedance maps. The sum of all areas in exceedance of the CL was calculated for each vegetation cover. The N deposition and CL exceedance maps are displayed showing county boundaries and shaded relief for improved spatial recognition.

Simulated N deposition was calculated for the most polluted two-thirds of the state on a 4-km resolution grid (Tonnesen et al., 2007). The relatively unpolluted regions in northern California to the north of a line extending from Mendocino on the coast to Doyle on the California/Nevada border and in the far southeastern corner of the state (east of a line from Pahrump, Nevada to El Centro, California) were simulated on a 36-km grid resolution and merged with the 4-km simulation to produce a statewide N deposition map (Fig. 1) that was used to develop the CL exceedance maps. Previous results show that the 36 km grid does not estimate deposition in high pollution sites in California as well as the 4-km grid simulations, but performs well in less polluted regions (Fenn et al., 2003a; M.E. Fenn, unpublished data). The CL exceedance maps provide estimates of the areal extent for high potential of undesirable effects from excess nutrient N for each of the seven vegetation types.

3. Results and discussion

3.1. Mixed conifer forest critical loads

The N CL for incipient NO_3^- leaching was estimated at 17 kg N ha^{-1} yr^{-1} from regression analysis of peak concentrations of NO_3^- in streamwater runoff versus throughfall N deposition. A CL for a 26% reduction in fine root biomass was also estimated to be 17 kg N ha^{-1} yr^{-1} from regression analysis of previously published fine root biomass data (Grulke et al., 1998) and throughfall data (Fenn et al., 2008). Enhanced N accumulation in lichen material and shifts in lichen community functional groups were the most sensitive responders to atmospheric N deposition. An empirical CL of 3.1 kg N ha^{-1} yr^{-1} was calculated for enhanced lichen tissue N concentrations, which corresponded with the initiation of community changes (Fenn et al., 2008). At a throughfall N deposition level of 5.2 kg N ha^{-1} yr^{-1} the lichen community shifted from acidophyte dominance to neutrophyte dominance. Lichen species classified as acidophytes were extirpated at a CL of 10.2 kg N ha^{-1} yr^{-1} (Fenn et al., 2008).

3.2. Chaparral and oak woodlands critical loads

In chaparral ecosystems empirical CLs have been estimated for NO_3^- in streamwater of small catchments (4–10 ha) with rapid ephemeral runoff responses following precipitation. A higher CL is estimated as catchments increase in size because of greater capacity to retain and process atmospherically deposited N within the terrestrial and riparian portions of the catchment. Intermediate sized catchments (30–150 ha) commonly receive NO_3^- largely from groundwater exfiltration in addition to ephemeral NO_3^- inputs from surface runoff. Large catchments (>150 ha) have a greater N retention capacity due to in-stream N uptake processes and groundwater–surface water interactions at larger scales and thus have lower streamwater NO_3^- concentrations than intermediate sized catchments (Meixner and Fenn, 2004). Nonetheless, because of insufficient data to further differentiate the CL based on catchment characteristics, the estimated CL is the same for intermediate and large catchments considering that NO_3^- concentrations are above the critical threshold (0.2 mg NO_3-N L^{-1} or 14.3 μM) in both instances when N deposition exceeds the CL of 14 kg ha^{-1} yr^{-1}. The CL determined for small "flashy" catchments (4–10 ha) is set at 10 kg N ha^{-1} yr^{-1}, based on long-term streamwater NO_3^- data from Chamise Creek in Sequoia National Park (Fenn et al., 2003b,c) and throughfall data from Ash Mountain (Fenn et al., 2003a) located 4 km to the west of Chamise Creek. This low NO_3^- leaching CL is believed to be a result of leaching of N accumulated from deposition to soil and plant surfaces, or through stimulation of nitrification or both mechanisms (Fenn et al., 2003c). The estimated CL of 14 kg N ha^{-1} yr^{-1} for intermediate and large chaparral catchments is based on data from eight catchments in the Devil Canyon region of the western San Bernardino Mountains (Fenn and Poth, 1999; Meixner and Fenn, 2004). Based on the sparsity of N-saturated chaparral catchments in the SW Sierra Nevada where N deposition is often greater than 10 kg ha^{-1} yr^{-1} and a survey of chaparral catchments in southern California (Riggan et al., 1985), it appears that this higher N CL (14 kg ha^{-1} yr^{-1}) for NO_3^- leaching is more common and applicable over a greater geographic area than the small catchment CL of 10 kg ha^{-1} yr^{-1}.

The calculated CL for effects on epiphytic lichen communities in oak woodlands and chaparral regions of the Central Valley of California, the surrounding central Coast Ranges, and Sierra foothills (lichen data from Jovan and McCune, 2005) was highly similar to that of mixed conifer forests as described above. The CL for the shift to nitrophyte dominance in the lichen community was estimated to be 5.5 kg N ha^{-1} yr^{-1} (Fenn et al., in press).

3.3. Coastal sage scrub critical loads

Extractable soil N ($NO_3^- + NH_4^+$) ranged from 10 μg g^{-1} at the rural end of a N deposition gradient, to 39 μg g^{-1} at the urban end.

Percent cover of exotic grasses was positively correlated with soil N (Padgett et al., 1999) and atmospheric deposition, while cover of native shrubs and forbs was inversely correlated. Across sites spanning this gradient from low to high N deposition, total species richness ranged from 92 to 34 per 3 ha parcel surveyed, and, of these, 67 to 16, respectively, were native forb species (Choi et al., 2008; E. Allen, Unpubl.; Fenn et al., in press). Sites were chosen that had not burned for ten years so they would be in a similar successional stage. However, high deposition sites (13.4–19.6 kg N ha^{-1} yr^{-1} from CMAQ estimates; Tonnesen et al., 2007) have a history of two or more fires since the 1960s, while the moderately low deposition sites (8–11 kg N ha^{-1} yr^{-1}) burned only once since the 1960s. A rapid drop in native species cover and forb richness was observed between 9 and 11 kg N ha^{-1} yr^{-1}, so 10 kg N ha^{-1} yr^{-1} may be estimated as the CL for loss of native diversity and cover. Using N estimates from the inferential method (Fenn et al., in press), the rapid drop occurred between 6.6 and 8.9 kg N ha^{-1} yr^{-1}, making the intermediate value 7.8 kg N ha^{-1} yr^{-1} the CL for a decline in native species. Because of the uncertainty in the modeled vs. the values calculated with the inferential method, we use two CLs, 7.8 and 10, for CSS vegetation.

An analysis of mycorrhizal spores along the CSS gradient showed spore density and root colonization declined logarithmically, with 10 kg N ha^{-1} yr^{-1} as the CMAQ-determined CL (Egerton-Warburton and Allen, 2000; Allen, unpubl.) and thus 7.8 kg N ha^{-1} yr^{-1} from the inferential method. Spore density declined from 110 g^{-1} to 50 g^{-1} soil, while colonization ranged from 45 to 15% of root length from low (8.7 kg ha^{-1} yr^{-1}) to high (19.6 kg ha^{-1} yr^{-1}) N deposition, respectively. There was also a loss of species richness, declining from 19 to 12 spore morphotypes, although this was a monotonic decline and no CL could be determined. The spore density, richness, and percent colonization values from the sites with lowest N deposition (8 kg ha^{-1} yr^{-1}) were similar to values found in cleaner areas in the region (Sigüenza et al., 2006b). It is noteworthy that the CL for both CSS vegetation (exotic grass cover, native forb richness) and AMF (root colonization, spore density) were the same. The mechanism for this may be that as N increases, the highly mutualistic native species decline and are replaced by grasses that are less dependent on mycorrhizae (Sigüenza et al., 2006a).

3.4. Grassland critical loads

Within the grassland monitoring network in the San Francisco/San Jose area TH, KC1 and KC2 are south San Francisco Bay sites where grass invasions have consistently occurred and deposition exceeds 10 kg N ha^{-1} yr^{-1} (Figs. 2 and 4a,b). At the opposite end of the deposition spectrum, site JR receives 4 kg N ha^{-1} yr^{-1}, and grass invasions have been minimal compared with TH and KC. The three sites at Edgewood (EW1, 35 m west of Highway 280, EW2 35 m east of the road, and EW3 367 m east of EW2) provide a fine-scale N dry-deposition gradient from >15 kg N ha^{-1} yr^{-1} at EW2 to 5 kg N ha^{-1} yr^{-1} at EW3. EW3 is the site where the grass invasion is greatly diminished, and thus used to establish the CL for annual grass invasion of 5 kg N ha^{-1} yr^{-1} as dry deposition (Fig. 2). Including an upper bound of 1 kg N ha^{-1} yr^{-1} from wet and particulate deposition increases the critical load to 6 kg N ha^{-1} yr^{-1}. This CL is similar to the lower end of estimates for sensitive European grasslands (Bobbink and Roelofs, 1995) and for Minnesota prairie grasslands (Clark and Tilman, 2008).

Deposition across the localized EW gradient is dominated by NH_3 from 3-way catalytic converters that were introduced around 1990 (Baum et al., 2001; Durbin et al., 2002; Fraser and Cass, 1998; Kean et al., 2000). Deposition from HNO_3 is much lower than from NH_3 at the EW and JR sites because of clean oceanic air during the warm season when HNO_3 concentrations are highest. All urban and near urban sites have high levels of NH_3 deposition (Fig. 2).

The N CL for prairie grasslands in Minnesota, USA was established based on chronic low-level N additions (Clark and Tilman, 2008). The lowest N treatment level was 10 kg ha^{-1} yr^{-1} at a site with an estimated 6 kg ha^{-1} yr^{-1} of ambient N deposition. From a simple regression model the CL for significant reductions in species number was estimated to be 5.3 kg ha^{-1} yr^{-1}, virtually identical to our CL for serpentine grassland near San Jose, California. The time required to detect consistent reductions in species varied from three to nine years when N amendments ranged from 10 to 95 kg ha^{-1} yr^{-1} (Clark and Tilman, 2008). Thus, given sufficient time, relatively low N deposition inputs can impact species biodiversity. Clark and Tilman (2008) concluded that long-term studies using high rates of N addition may poorly predict, and even underestimate, the impact of chronic low rates of N deposition.

The only well-defined CL for California grasslands is that for serpentine grasslands as presented herein. Nitrogen addition studies in California grasslands have caused invasions by exotic species and other species diversity impacts, but N addition levels (50-100 kg N ha^{-1} yr^{-1}) were too high to determine the N CL (Huenneke et al., 1990; Maron and Jefferies, 1999; Zavaleta et al., 2003). Further studies using low levels of chronic N amendments and space for time studies are needed to evaluate the CL for California grasslands. However, we hypothesize that the CL for many California grasslands will likely fall within the 5–10 kg N ha^{-1} yr^{-1} range based on grassland CL studies elsewhere (Bobbink et al., 2010; Clark and Tilman, 2008), our serpentine grassland CL, and previous N fertilization studies in California grasslands.

3.5. Desert critical loads

In the N fertilization experiment in Joshua Tree National Park there were few vegetation biomass responses the first year, 2003; some responses the second year, 2004, which had moderate precipitation; and more responses in a record wet year, 2005. Invasive grasses increased under both 5 and 30 kg N ha^{-1} fertilizer additions at two of four sites in 2005. One of these was a pinyon-juniper woodland with the highest level of N deposition, and the other was creosote bush scrub with the lowest level of N deposition. In a drier year, only 30 kg ha^{-1} caused an increase in invasive grasses in two of the four sites. Thus 8 kg ha^{-1} yr^{-1} (5 kg ha^{-1} added + 3 kg ha^{-1} background deposition) can be considered the empirical CL for increased invasive grasses in a wet year. Native forbs decreased at sites with increased grass response to N, but at sites with naturally low grass invasion, native forbs responded positively to added N at 5 kg ha^{-1}. The surprisingly high response of plants to N in the low deposition creosote bush scrub site may be because it has the lowest rock cover of all the sites. The sandy soil is highly suitable for colonization by invasive grasses with fine roots. Even though the latter site is remote with good air quality, it has a high cover of exotic grasses in wet years. Thus N deposition will interact with soil texture to determine the N CL, and relatively small amounts of N input will promote invasive grass growth in soils with low rock and gravel content. A soil map of the desert will help in a mapping effort to determine which sites will be most susceptible to exotic annual grass invasion where N deposition exceeds 8 kg ha^{-1} yr^{-1}.

Exotic annual grass invasion is a concern in the desert because these grasses compete with native annuals leading to a loss of diversity and vegetation-type conversion. Another concern of vegetation-type conversion is the increase in fine fuel that promotes fire. Deserts seldom have sufficient fuel for fire, but fires have become more frequent in some areas of the California Mojave and Sonoran deserts (Brooks et al., 2004; Brooks and Matchett, 2006). Under N deposition and higher than average rainfall, some areas of

Fig. 4. (a) Site KC1 on the left side of the fence is ungrazed. Deposition at this site is estimated at 15 kg N ha^{-1} yr^{-1} as determined from the passive sampler data and 10 kg N ha^{-1} yr^{-1} from the 36-km grid CMAQ simulations (Weiss, 2006). (b) The effect of a May 2005 mowing (right side) in a grassland is seen in April 2006.

these deserts have been burning frequently (Brooks, 2003; Brooks and Matchett, 2006). The fuel level needed to carry a fire is about 1000 kg ha^{-1} of continuous dry grass cover (Scifres and Hamilton, 1993). This amount of fuel was produced in the fertilized shrub interspaces during the 2005 wet year, but also in the high N deposition range of the N gradient where fires have been occurring in the last two decades (Rao and Allen, 2010; Rao et al., 2010).

Using the biogeochemical model DayCent, the risk of exceeding the fire threshold was calculated for both pinyon-juniper woodland and creosote bush scrub. The model results indicate that many areas of CA deserts are above the CL, which was defined as the N load at which fire risk began to increase exponentially. Above the CLs of these ecosystems, small increases in N deposition result in large increases in fire risk, up to the fire risk stabilization load. Using the creosote bush scrub fire stabilization load, modeled for eight soil textures and four precipitation regimes representative of creosote bush habitat in the state (Rao et al., 2010), we calculated the average fire risk stabilization load at 8.15 kg ha^{-1} yr^{-1}. This value is very similar to the empirical CL for creosote bush determined from the fertilization experiment discussed at the beginning of this section, suggesting that this level of N deposition will be detrimental to both diversity and fire dynamics.

The pinyon-juniper woodland areas are more likely to burn than creosote bush scrub due to the greater abundance of woody biomass (Brooks and Minnich, 2006). In addition, most pinyon-juniper woodlands are in areas with greater average precipitation than creosote bush scrub (Rowlands, 1995), resulting in reduced water limitation for the winter annuals that are the fine fuel allowing fire to carry between trees and shrubs. Thus, the CL and the fire stabilization load for pinyon-juniper were lower than in creosote bush scrub. The low N deposition levels that result in increased fire risk in pinyon-juniper woodlands indicates that much of this ecosystem type in California is at high risk of fire due to the combination of increased fine fuel production from deposition and inherently high woody fuel abundance. In summary, the empirical CL for exotic grass invasion in desert ecosystems is 8 kg ha^{-1} yr^{-1}. The range including the lower and upper bounds of the CL for creosote bush scrub and pinyon-juniper woodlands are 3.2–9.3 and 3.0–6.3 kg ha^{-1} yr^{-1}, respectively based on fire risk probability from DayCent simulations (Table 1; Rao et al., 2010).

3.6. Comparison to critical loads in Europe and the rest of the U.S

Mediterranean systems are reportedly prone to N loss with chronic N deposition because of actively nitrifying soils and major precipitation and runoff in winter (Fenn et al., 1998). However, recent studies show only incipient low-level NO_3^- losses in streamwater in California forests at a CL of 17 kg N ha^{-1} yr^{-1} (Fenn et al., 2008). Similarly, in an oak forest in Spain no NO_3^- loss was observed with N deposition of 15 kg ha^{-1} yr^{-1} (Ávila et al., 2002, Rodà et al., 2002). By comparison, the CL for NO_3^- leaching in temperate forests in the NE United States is 8 kg ha^{-1} yr^{-1} (Aber et al., 2003). Stoddard et al. (2001) reported that for catchments within the ICP Waters network in Europe and North America at stage 2 of N saturation, (episodic elevated NO_3^- and high base-flow NO_3^- during the growing season), the average N deposition was only 14 kg ha^{-1} yr^{-1}. This is a much more advanced stage of NO_3^- loss than that observed in California forests at the CL of 17 kg ha^{-1} yr^{-1}.

These comparisons indicate that Mediterranean forests are actually less prone to NO_3^- leaching than temperate catchments. The comparatively low NO_3^- export in Mediterranean catchments when expressed as annual N mass loss (e.g., kg N ha^{-1}) is certainly due to the high evapotranspiration and low precipitation surplus in Mediterranean watersheds. However, NO_3^- concentrations in runoff can be as high as 300–400 μmolar during peak runoff events, and isotopic studies in southern California show that 20–40% of NO_3^- in runoff during storm events is direct throughput of unassimilated atmospheric NO_3^- (Michalski et al., 2004). In summary, forest and to a lesser extent, chaparral watersheds in California, and possibly other Mediterranean regions appear to have higher CLs for NO_3^- leaching loss compared to temperate forests. At the same time, catchments in California may be more prone to experience direct throughput of atmospheric N without biological assimilation when the CL is exceeded. Furthermore, small chaparral catchments (≤10 ha) at low elevation with low N retention capacity can have CLs as low as 10 kg ha^{-1} yr^{-1}, similar to that in other ecoregions.

In Europe the empirical CL range for lichen communities in temperate and boreal forests is 10–15 kg ha^{-1} yr^{-1} (Bobbink et al., 2003). However, this may be overestimated, presumably as a result of observations at sites already impacted by ambient N deposition; true low N deposition control sites no longer exist in much of Europe. Recent studies suggest that a more appropriate CL range for lichen community effects in Europe and North America is 3–10 kg ha^{-1} yr^{-1} (De Vries et al., 2007; Nordin et al., 2005; Van Dobben et al., 2006; Pardo et al., in press), with CLs tending toward the high end at sites with greater precipitation (Geiser et al., 2010). By comparison, the N CL at which epiphytic lichen communities in California forest and chaparral/oak woodland ecosystems shift from oligotrophic to eutrophic dominance is 5.2–5.5 kg ha^{-1} yr^{-1} (Fenn et al., 2008; Pardo et al., in press). Early declines in oligotrophic lichens can be detected at 3 kg ha^{-1} yr^{-1} in coniferous forests of the Sierras and northwestern CA (Pardo et al., in press).

No CLs are available for Mediterranean shrublands in other regions to compare to the CSS CLs in California. The N CL given for serpentine and other grasslands in California in this study (6 kg ha^{-1} yr^{-1}) is on the low end of the range of CLs proposed for grasslands in Europe and North America. Estimated CLs for tall-grass prairie is 5–15 kg ha^{-1} yr^{-1} and 10–25 kg ha^{-1} yr^{-1} for mixed- and short-grass prairie (Clark, in press). In Europe the CL range for three grassland vegetation classes including xeric, semi-arid and Mediterranean grasslands is given as 10–25 kg ha^{-1} yr^{-1} (Bobbink et al., 2003; R. Bobbink, personal communication). More research is needed in all these grassland types, but the available evidence suggests that California grasslands may be among the most sensitive to N deposition. This is presumably a result of the high invasive pressure from exotic grass species in California, which thrive under conditions of increased N availability.

We are not aware of studies in deserts to determine CL outside of the US, but tentative CLs can be estimated from studies in other US deserts. For instance, there was no productivity response by desert grassland in New Mexico to N deposition of 5.9 kg ha^{-1} yr^{-1}, but there was an increase with N fertilization of 20 kg ha^{-1} yr^{-1} (Baez et al., 2007). The researchers concluded that the CL lies between these two values. In Idaho cold desert, fertilization of 6 kg N ha^{-1} yr^{-1} caused a depletion in soil moisture, that was likely related to increased sagebrush production. Because there was no recharge of soil moisture in subsequent years, this has a potential for affecting future plant production negatively (Inouye, 2006). A higher level of fertilization of 12 kg N ha^{-1} yr^{-1} caused no greater response, so 6 kg N ha^{-1} yr^{-1} may be a CL, or nearly so. However, the site receives 1.4 kg N $ha^{-1}y^{-1}$ wet deposition as measured at a nearby NADP station, but total wet plus dry deposition is unknown. These values for biotic responses to N deposition (Baez et al., 2007; Inouye, 2006) are in the range of 3–9 kg N ha^{-1} yr^{-1} expected to cause increased productivity of herbaceous vegetation based on the DayCent model and N fertilization studies (Allen et al., 2009; Rao and Allen, 2010; Rao et al., 2010).

3.7. Critical load exceedances in California

For every vegetation type included in this study a large proportion of the land area is in excess of the CL, with values ranging from 29 to 54% of the land area exceeding the CL (Table 2). This is not surprising considering that the CL is 3–8 kg N ha^{-1} yr^{-1} for lichen community changes in forests, chaparral and oak woodlands and for plant community changes in desert and grasslands as a result of annual grass invasions. In descending order, the vegetation types with the highest percent land cover in exceedance of the CL are: coastal sage scrub > chaparral (lichen effects) > grassland > oak woodland > desert scrub > pinyon-juniper > mixed conifer forest (lichen effects) > chaparral (NO_3^- leaching) > mixed conifer forest (NO_3^- leaching) (Table 2). When comparing the vegetation types in terms of absolute area (km^2) in exceedance, the descending order of CL exceedance (using the lowest available CL values for each vegetation type) is: mixed conifer forest (lichen effects) > desert scrub > chaparral (lichen effects) > oak woodland > grassland > mixed conifer forest (NO_3^- leaching) > chaparral (NO_3^- leaching) > coastal sage scrub > pinyon-juniper. The spatial patterns and extent of CL exceedance for the seven vegetation types are shown in Figs. 5–11.

Coastal sage scrub and annual grasslands had high percent in exceedance (54 and 44%; Table 2) which may be attributed to the low estimated CLs of 6 and 7.8 kg ha^{-1} yr^{-1}, and also that these

Table 2
Areal extent (km^2) and percent land area in exceedance of the CL for seven vegetation types in California[a].

Vegetation cover and CL basis	Area of vegetation cover	Lowest CL value ($kg\,N\,ha^{-1}\,yr^{-1}$)	Low CL exceedance area	Percent exceedance	Highest CL value ($kg\,N\,ha^{-1}\,yr^{-1}$)	High CL exceedance area	Percent exceedance
Coastal sage scrub (invasives)	6328	7.8	3396	53.7	10.0	2098	33.2
Chaparral (lichen community effects)	27,045	5.5	14,315	52.9	5.5	14,315	52.9
Annual grassland (invasives)	28,634	6.0	12,496	43.6	7.5	8795	30.7
Oak woodland (lichen community effects)	32,659	5.5	13,454	41.2	5.5	13,454	41.2
Desert scrub (fire risk)	75,007	3.2	23,369	31.2	9.3	439	0.6
Pinyon-juniper (fire risk)	6602	3.0	2013	30.5	6.3	1386	21.0
Mixed conifer forest (lichen community effects)	106,663	3.1	30,596	28.7	5.2	24,998	23.4
Chaparral (nitrate leaching)[b]		10.0	3947	14.6	14.0	891	3.3
Mixed conifer forest (nitrate leaching)		17.0	4754	4.5			
Summary of 7 vegetation types	282,938		99,639[c]	35.2[c]		65,485[c]	23.1[c]

[a] For coastal sage scrub, annual grassland, desert scrub, pinyon-juniper, mixed conifer forests (lichen community effects), and chaparral (NO_3^- leaching) vegetation types a low and high CL value were used to determine the areal extent of CL exceedances for each of these vegetation types. Only one CL value was calculated for lichen community effects in chaparral and oak woodlands and for NO_3^- leaching in mixed conifer forest. See text for details.

[b] The lower CL for NO_3^- leaching in chaparral applies to small catchments (e.g., 4–10 ha) and the high CL for larger catchments. See text for details.

[c] In these summary CL exceedance calculations only the lichen CLs were used for the chaparral and forest vegetation types; the NO_3^- leaching CL data were not used for these summaries. In determining the high CL exceedance area and percent land area in exceedance for the summary of the seven combined vegetation types, the highest CL value was used when more than one CL was established. However, since only one CL was determined for lichen community effects in chaparral and oak woodland, the same CL and CL exceedance areas were used for the lowest and highest CL exceedance calculations.

vegetation types are concentrated at low elevation sites near population or agricultural centers (Figs. 2, 8 and 9). Likewise, 53% of the chaparral area (low to moderate elevation habitats) was in exceedance of the CL for lichen community changes, a sensitive responder to N deposition. Four additional vegetation types had exceedance areas of 29–41% (Table 2). These can be attributed to the relatively low CL values (3.0–5.5 $kg\,ha^{-1}\,yr^{-1}$) for lichen community shifts in oak woodlands and mixed conifer forests, and for fire risk to the low biomass desert scrub or pinyon-juniper systems. In contrast, we estimated that 5 and 15% of the forest and chaparral (low-end CL of 10 $kg\,ha^{-1}\,yr^{-1}$) areas are in exceedance of the NO_3^- leaching CL (Table 2). When the high-end CL for NO_3^- leaching in chaparral (14 $kg\,ha^{-1}\,yr^{-1}$) is considered only 3.3% of the chaparral area is in exceedance. The exceedance of the CL for NO_3^- leaching in forests and chaparral is a less widespread problem than the vegetation or lichen community changes observed.

Combining the exceedance areas of the seven vegetation types results in an estimated 99,639 km^2 in exceedance of the N CL in California, which equals 35% of the land area of the included vegetation types (Fig. 12a; Table 2). In these exceedance areas,

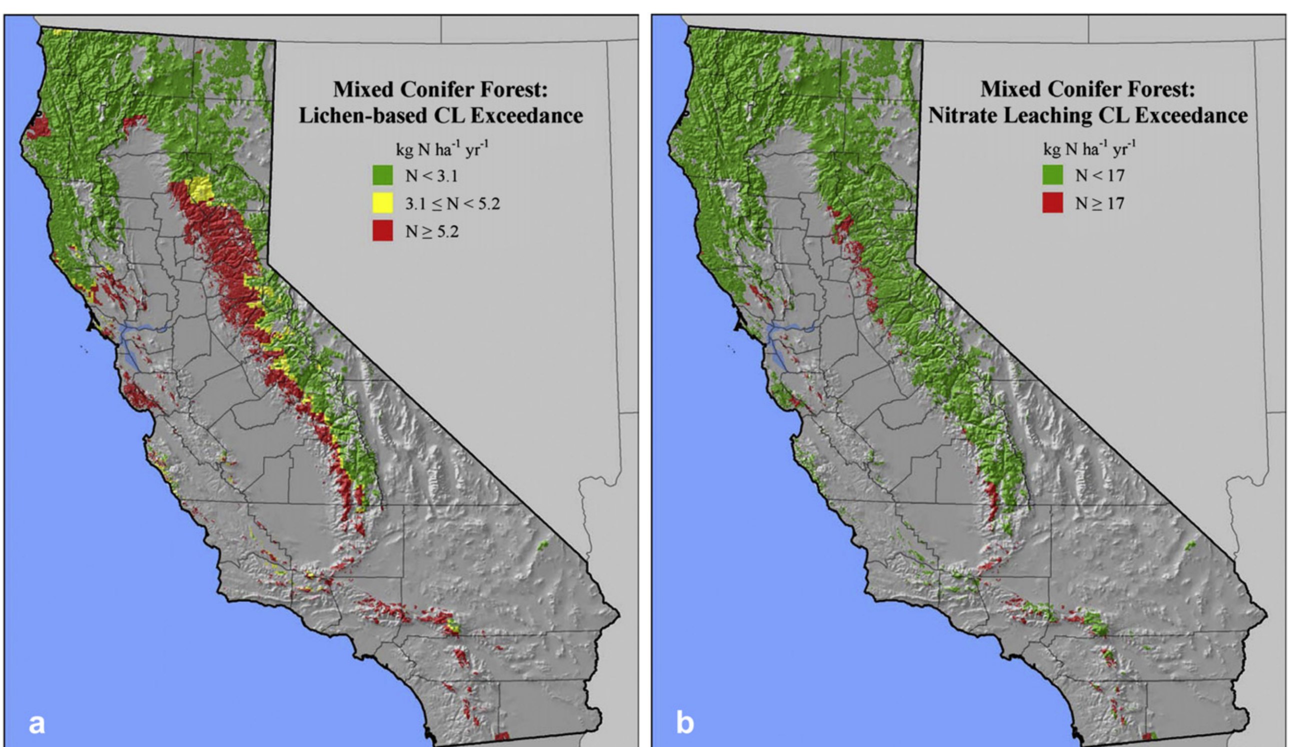

Fig. 5. Critical load exceedance map for mixed conifer forests based on (a) lichen community effects and (b) nitrate leaching.

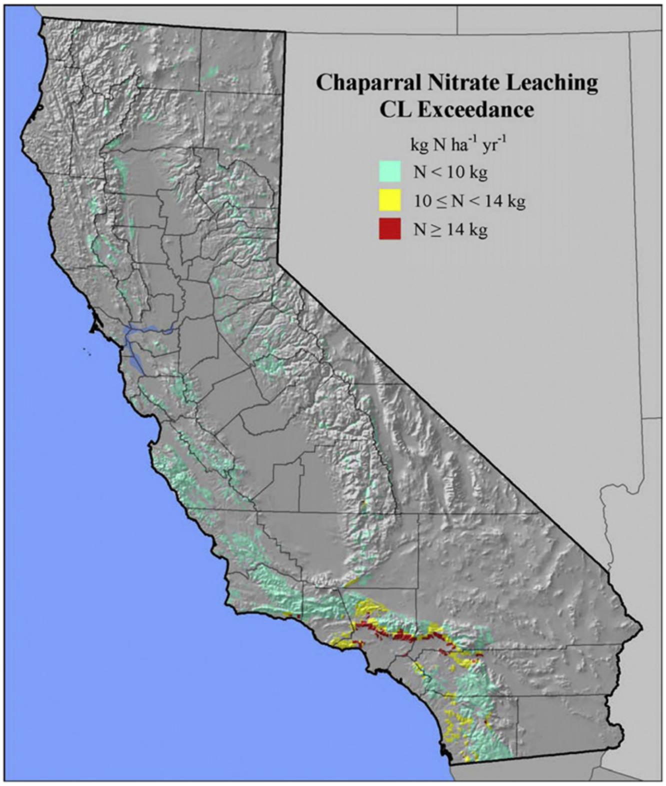

Fig. 6. Critical load exceedance map for chaparral ecosystems showing areas in exceedance of a low-end (yellow) and high-end (red) nitrate leaching critical load.

grasslands, desert and CSS ecosystems are at risk of type conversion as a result of invasion by exotic annual grasses, a dramatic effect and fundamental ecosystem change. In desert and CSS the increased fuel accumulation from invasive grasses greatly increases the risk of fire danger, and fire strongly favors vegetation-type conversion. This is particularly problematic in the desert where fires are normally rare and as a result native vegetation is threatened, particularly in wet years when biomass production potential is much greater (Rao et al., 2010; Rao and Allen, 2010). In forests, chaparral and oak woodlands lichen communities undergo dramatic community changes as a result of N deposition in exceedance of the CL. The lichen CL can serve as an early warning signal to identify areas where initial N effects are occurring and where additional impacts may be observed now or in the future (Fenn et al., 2008). In forests downwind of urban areas in southern California lichen community changes occurred decades ago (Nash and Sigal, 1999), many probably in the first half of the twentieth century (Fenn et al., 2008).

Fig. 12a,b shows the level of CL exceedance statewide, including all seven vegetation types, for the low- and high-end CL estimates. The low-end CLs are exceeded by at least 5 kg ha^{-1} yr^{-1} over approximately 27% of the exceedance area and by at least 10 kg ha^{-1} yr^{-1} in 10% of the exceedance area (Fig. 12a). When considering the high-end CL exceedance areas, regions that are no longer in exceedance include much of the desert in the southeast, the eastern Sierra Nevada, portions of the western edge of the Central Valley and western central California (Fig. 12b). These exceedance maps indicate that N deposition needs to be reduced by 5–15 kg ha^{-1} yr^{-1} or more over much of the western foothills of the Sierra Nevada, the mountains of the SW Sierra Nevada and the Transverse Ranges of southern California.

The exceedance areas do not necessarily represent areas where the effects upon which the CL is based have already occurred, although in many instances this is predominantly the case (e.g., lichen effects and NO_3^- leaching). Most conservatively, these can be considered areas where the estimated N deposition is at or above the CL at which these effects have been documented for this vegetation type. Exceedance areas represent sites at elevated risk of negative impacts from N excess. Factors that may influence whether undesirable impacts from N deposition actually occur within a site include site and land use and management history; soil, climatic and topographic conditions; species composition; and site disturbances. With the exception of clear lichen community effects from N deposition, critical loads based on plant physiological or plant community responses may be more uncertain than those based on chemical criterion (e.g., NO_3^- leaching), even though the latter are controlled by biological and nutrient cycling processes. For example, Vourlitis and Pasquini (2009) found that N fertilizer addition to CSS vegetation in plots characterized by a dense shrub canopy caused changes in the relative abundance of dominant shrubs, but not herbaceous plant species. This is in contrast to the effects of decades-long N deposition in CSS stands with a more open structure, resulting in exotic annual grass invasion as reported herein.

Preliminary data from the San Bernardino Mountains downwind from greater Los Angeles indicate that the CL for increased NO_3^- leaching in mixed conifer forests is also associated with a 26% reduction in root biomass in ponderosa pine (Fenn et al., 2008). Although this and other biological and ecophysiological N deposition effects are less well quantified, current information from mixed conifer forests in California suggests that NO_3^- leaching or N saturation symptoms in general are indicative of biological effects such as altered tree physiology, root:shoot ratios, and susceptibility to pests (Fenn et al., 2003c; Grulke et al., 1998; Jones et al., 2004). Nitrate leaching CL exceedance areas may also be areas where forest health and sustainability are at greater risk, but these quantitative relationships require further development. In Europe

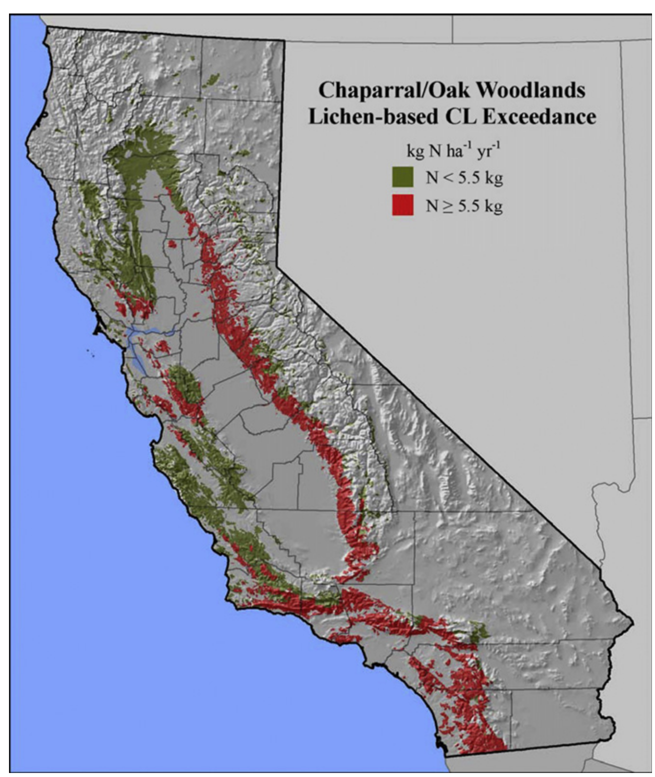

Fig. 7. Critical load exceedance map for chaparral and oak woodlands showing areas in exceedance of the critical load for effects on epiphytic lichen communities.

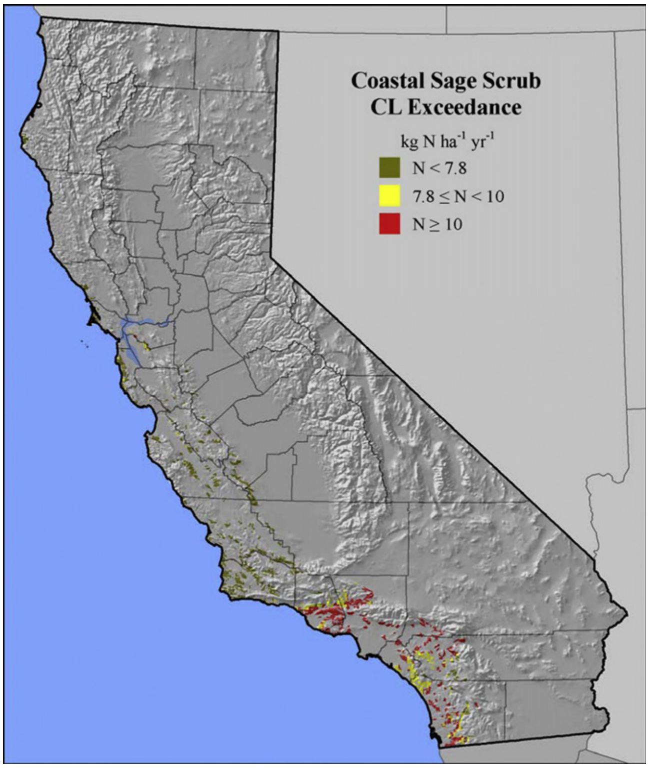

Fig. 8. Critical load exceedance map for coastal sage scrub showing exceedance of the critical load for plant and mycorrhizal community changes.

attempts have been made to relate NO_3^- concentrations in soil leachate to effects on forests and plant function in order to use these relationships to set empirical CLs (De Vries et al., 2007). The documented combined effects of ozone and N deposition in mixed conifer forests contribute to a syndrome of greater drought stress, susceptibility to bark beetle attack, tree mortality and increased fire occurrence (Grulke et al., 2009; Jones et al., 2004). Thus, in forests, as shown for CSS, desert and grasslands in California, N deposition at sufficient dose can contribute to dramatic changes in vegetation structure.

3.8. Uncertainty in critical loads and exceedance maps

The main sources of uncertainty associated with the CL exceedance maps are from the simulated estimates of N deposition and the extrapolation of the CL from the study sites where the empirical CL was determined to the statewide occurrence of the vegetation type. Thus, the CL exceedance maps are based on the assumption that the CL for a given vegetation is similar throughout the state. We consider that the empirical CL exceedance maps are likely to represent areas at risk for N excess effects more effectively than broad scale CL maps based on computed steady-state simple mass balance CLs, which are only tenuously related to actual observations of structural or functional changes in terrestrial ecosystems influenced by N deposition. Furthermore, the computed CLs are based on highly uncertain input parameters and outputs has been much discussed in the literature (Cresser, 2000; De Vries et al., 2007; Heywood et al., 2006; Rodriguez-Lado et al., 2007; UBA, 2004).

While the empirical CLs are expected to reflect biological responses to excess N more accurately than soil-based CL models for nutrient N (De Vries et al., 2007; Fenn et al., 2008), the CL exceedance maps also entail uncertainty associated with errors in simulating N deposition inputs with CMAQ. However on a statewide basis simulation modeling is the only way to estimate N deposition and it provides a uniform method for estimating deposition across vegetation types. We compared throughfall N deposition at 26 forested sites in the Sierra Nevada and San Bernardino Mountains with CMAQ estimates. There was reasonable agreement when throughfall deposition was $\leq$6–7 kg ha^{-1} yr^{-1} but as N deposition increased CMAQ underestimated N deposition. However a significant linear relationship was found between CMAQ deposition and throughfall N deposition ($y = -12.20 + 4.34x$; $r^2 = 0.80$). The CMAQ underestimates for forests may be due to inadequate capability to model orographic effects on pollutant transport and deposition in montane sites. Thus, in preparing the statewide N deposition map and the CL exceedance maps we adjusted CMAQ deposition for the forested sites based on the linear relationship with the empirical throughfall data.

The lichen-based CLs for forests and chaparral/oak woodlands and the forest NO_3^- leaching CL are considered robust because they are based on data from a large area representative of these vegetation types (Fenn et al., 2008, in press; Jovan, 2008; Jovan and McCune, 2005). The CSS CL is based on a regional N deposition gradient and fertilization experiments in southern California; however the CL could be overestimated because of the lack of a true low N control site within the study region (Fenn et al., in press). The chaparral NO_3^- leaching CL is primarily based on chaparral catchments in Sequoia National Park and the western San Bernardino Mountains.

The desert CL is based on fertilization experiments and biogeochemical modeling (Rao et al., 2010) in two desert types (Mojave and Colorado) within Joshua Tree National Park. The average CL for each vegetation type was determined as the break from low to intermediate fire risk, and was calculated as the average from the model runs for all soil types and the precipitation

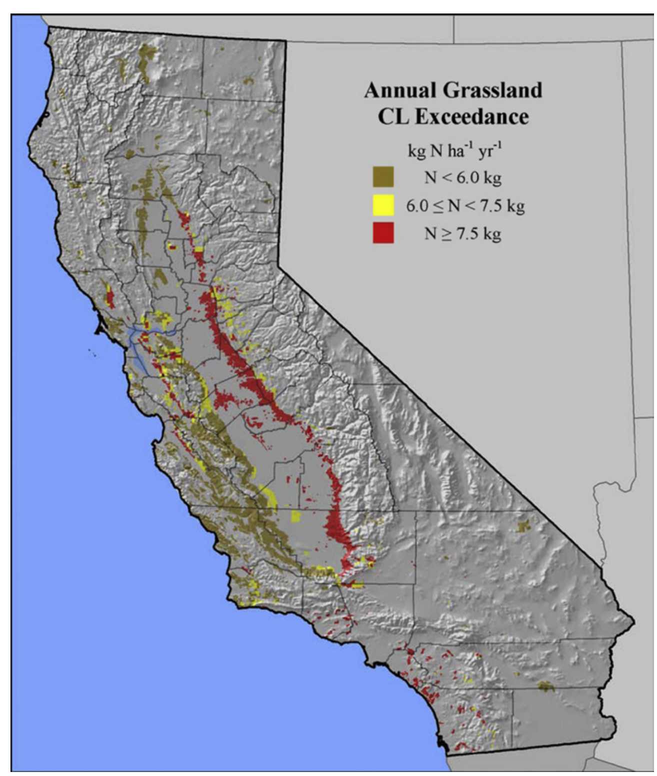

Fig. 9. Critical load exceedance map for annual grassland showing exceedance of the critical load for plant community changes. The CL for grassland (6.0 kg ha^{-1} yr^{-1}) is based on a roadside gradient study in serpentine grassland. Because of the uncertainty in extrapolating this CL to other grasslands, the CL exceedance for a CL of 7.5 kg ha^{-1} yr^{-1} is also presented.

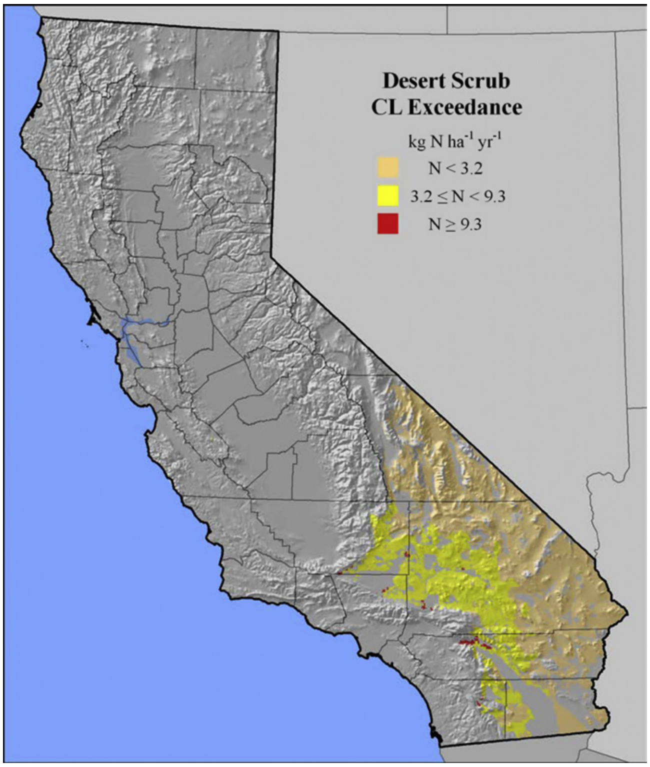

Fig. 10. Critical load exceedance map for desert scrub showing exceedance of the critical load for plant community changes.

regimes most common for that vegetation type (creosote bush scrub $n = 24$; pinyon-juniper $n = 12$). The break from intermediate to high fire risk was defined as the N deposition load where fire risk stabilized, and was similarly averaged across soil types and precipitation for each vegetation type.

The extrapolation for CL exceedances may be more uncertain for grassland because the CL is based only on serpentine grassland (Harrison and Viers, 2007; Weiss, 1999). However, the CL for serpentine grassland in California (6 kg N ha^{-1} yr^{-1}) is similar to that estimated for Minnesota prairie grassland (5.3 kg N ha^{-1} yr^{-1}; Clark and Tilman, 2008). We also consider the serpentine grassland CL as a reasonable, but possibly a conservative estimate for California grasslands, considering studies suggesting that serpentine grasslands are less responsive to added N than other California grasslands and are also less prone to exotic invasions (Harrison and Viers, 2007). Many N addition studies have shown the responsiveness of California grasslands to added N but the N treatments have been too high to determine the threshold response level or CL (Harpole et al., 2007; Huenneke et al., 1990; Zavaleta et al., 2003). Furthermore, grassland studies from other regions of North America and Europe also suggest that low levels of N deposition can cause significant biodiversity impacts as N accumulates in the ecosystem (Bobbink et al., 2010; Clark and Tilman, 2008; Stevens et al., 2004). Because of the lack of N response studies in California grasslands at N addition levels approximating the putative N CL, we will present the geographic distribution of potential exceedance by using the serpentine-based CL value of 6 as well as a more conservative value of 7.5 kg N ha^{-1} yr^{-1}.

3.9. Potential effects of climate change on critical loads in California

Another uncertainty in determining N CLs is the effect of climate change. Rockström et al. (2009) describe three earth-system processes that due to anthropogenic activities have already surpassed boundaries that are considered safe for the planet's continued ability to support human life; these are climate change, rate of biodiversity loss, and interference with the N cycle. Likewise, in California all three of these interrelated environmental threats are of concern. Temperatures in California are projected to increase by 1.5–4.5 °C by the end of the century under the various IPCC emissions scenarios (Cayan et al., 2008). Relatively small (less than approximately 10%) changes in overall precipitation are projected for California (Cayan et al., 2008), but climate models and trends project more frequent and longer lasting extreme storm events in North America (CCSP, 2008) and California (Bromirski and Flick, 2008). Climate warming is projected to reduce snow accumulation in California because more precipitation is expected to fall as rain and less as snow. A larger proportion of the streamflow volume will occur earlier in the year, and in snowmelt driven basins late winter snowpack accumulation is projected to decrease by 50% toward the end of this century (Miller et al., 2003). Low elevation catchments that are not dominated by snowmelt runoff but where runoff is largely controlled by vegetation water demand (e.g., chaparral), will likely experience decreased runoff as evapotranspiration rates increase (Tague et al., 2009).

If the future climate in California is characterized by more severe droughts interspersed with increased occurrence of extreme precipitation events, this is likely to have a strong influence on the dynamics of N accumulation and N fluxes, which in turn will affect CL values. In theory, such scenarios would result in lower N CLs because N is expected to accumulate in catchments during successive dry years followed by greater susceptibility to NO_3^- leaching and N volatilization losses in high precipitation years. It is unclear how these kinds of scenarios will affect plant N availability and the CL for effects on plants. In a warmer climate, the N CL for NO_3^- leaching in chaparral catchments may increase as runoff

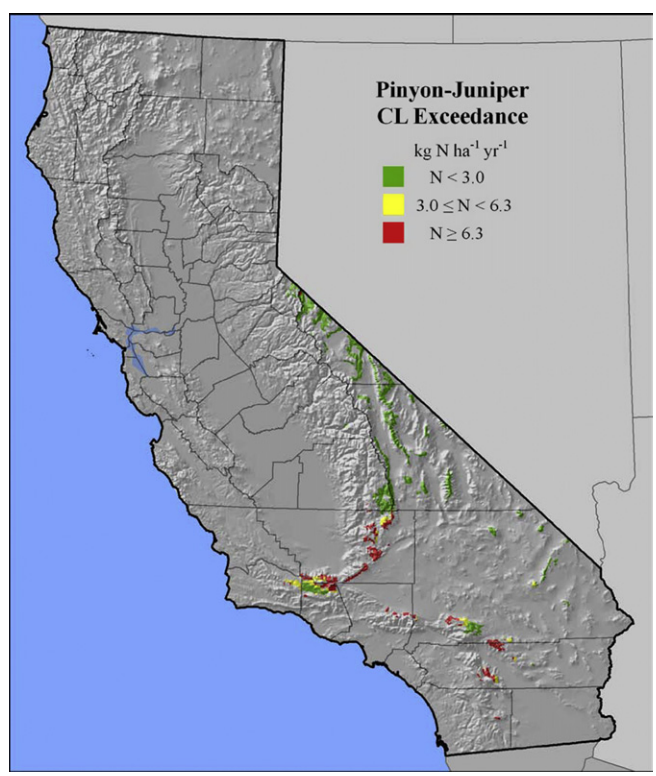

Fig. 11. Critical load exceedance map for pinyon-juniper vegetation showing exceedance of the critical load for plant community changes.

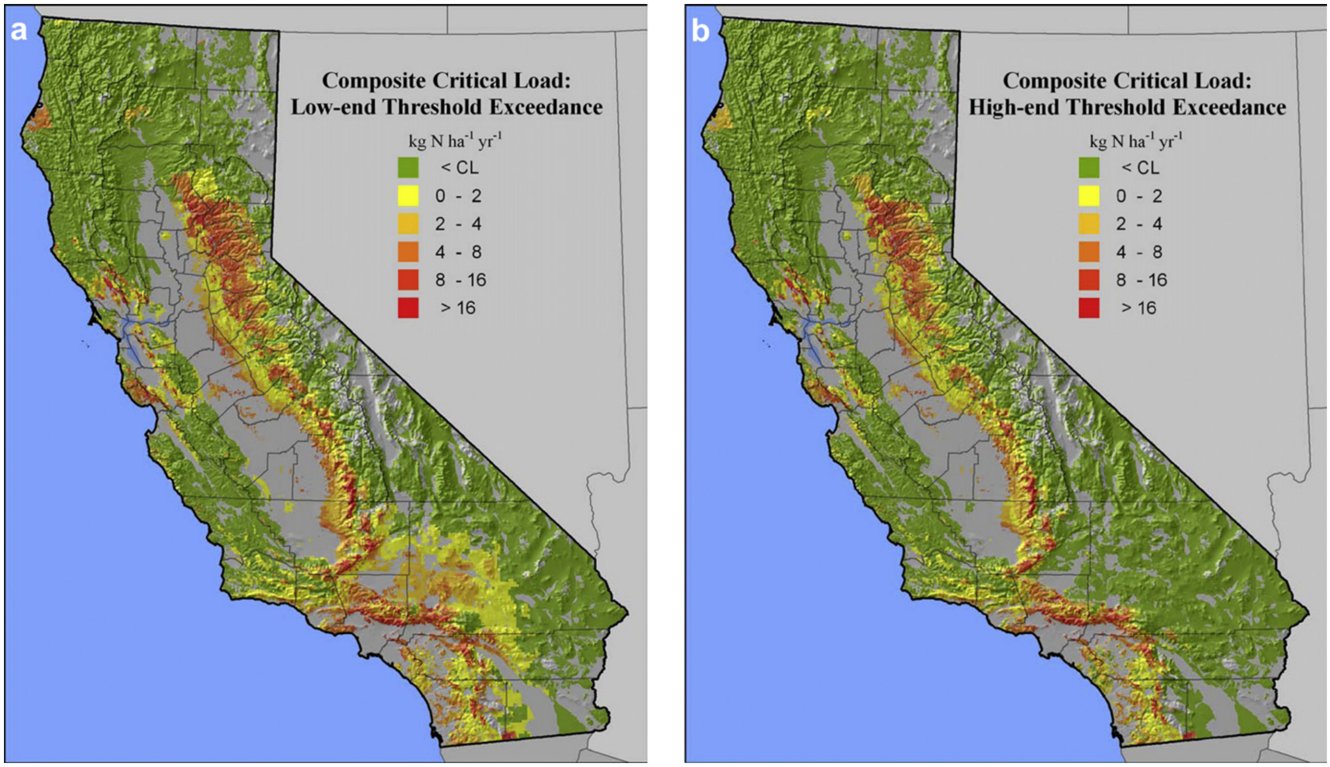

Fig. 12. Composite CL exceedance maps for all seven vegetation types included in this study showing the combined exceedance areas and the level of exceedance (kg N ha^{-1} yr^{-1}). When CLs based on two different N responders were used within a given vegetation type (e.g., lichen effects and nitrate leaching), only the more sensitive responder was used (lowest CL). (a) The lowest value of two CLs was used in the case of coastal sage scrub, mixed conifer forest (lichen community effects), desert scrub and pinyon-juniper, and the lichen effects CL was used for chaparral. (b) The higher CL values were used when more than two values were available for a given vegetation type.

declines, resulting in a lower tendency to leach NO_3^-. However, in some scenarios, vegetation may decrease resulting in lower evapotranspiration and greater runoff (Tague et al., 2009) and presumably lower CLs for NO_3^- leaching.

Climate change effects on the CLs for weedy invasives and associated accumulation of biomass sufficient to sustain fire spread in desert vegetation are expected to be similar to that described above for NO_3^- leaching. Enhanced N accumulation in dry years followed by irregularly occurring wet years or extreme precipitation events may stimulate biomass production as a result of increased availability of water and N. Of course, this scenario assumes that wet years are not characterized by extreme precipitation in which most of the moisture is rapidly lost as runoff with little effect on vegetative growth.

Lichen CL values are directly affected by precipitation amounts, with higher CLs with increasing precipitation (Geiser et al., 2010), presumably a result of leaching of N from lichen thalli. Thus, lichen communities may be more impacted by N in dry climates and less affected by N in wet climates or after large precipitation events. This also begs the question as to whether a larger fraction of precipitation falling as rain instead of snow will more effectively leach N from lichen tissue in montane areas and thus reduce N effects, resulting in a higher CL for effects on epiphytic lichens. Increasing nutrient availability allows mesotrophic and eutrophic species to tolerate colder climate zones (Table 6 in Geiser and Neitlich, 2007).

Other soil-mediated effects of excess N (e.g., changes in mycorrhizal communities, reduced fine root biomass production) are also expected to be similarly affected by the altered precipitation regime described above. However, we recognize that many complex interacting factors of ecological importance will be affected by future climate change and it is difficult to predict outcomes or which factors may ultimately be the most important in affecting ecosystem sensitivity to N deposition. If climate change alters fire frequency and intensity in some vegetation types, this could affect CLs in various ways, such as by reducing site N capital, altering plant N demand and succession, sometimes resulting in plant type conversion.

3.10. Management options for N-impacted ecosystems

Gundersen et al. (2006) listed five ways that management options may alleviate N saturation in temperate forest ecosystems: (1) reducing N input, (2) increasing N uptake, (3) increasing N export in harvests, (4) restoring soil N retention, and (5) improving catchment-scale N removal (e.g., in the riparian zone). In ecosystems detrimentally affected by N deposition, silvicultural treatments can often be applied to improve site condition, but invariably reductions in N deposition are also needed for sustainable improvements (Gimeno et al., 2009; Gundersen et al., 2006; Rothe and Mellert, 2004).

Management options for mitigating the effects of excess N vary widely among vegetation types because of differing resource impacts caused by N deposition. For instance, invasive species are highly responsive to N and have caused declines in native species and increased fire frequency in deserts and CSS (Allen et al., 1998, 2009; Brooks et al., 2004), prompting a focus on invasive species management. At the opposite end of the productivity spectrum, forest stands have not experienced major species shifts. But physiological changes in trees, such as reduced root:shoot ratios that may affect tree response to drought and bark beetle attack, are a concern in highly N-polluted ecosystems. Likewise, elevated N pollution in streams is a concern in N-saturated chaparral and forested catchments. Economic and resource values of ecosystems also dictate the type of management for elevated N. Most California ecosystems harbor endangered species (Skinner and Pavlik, 1997) and these are especially numerous in vegetation types with limited distributions such as serpentine grasslands and coastal sage scrub. Management to conserve endangered species threatened by N deposition focuses on invasive species control.

In many cases no management options can or will be implemented in ecosystems impacted by excess N. Treatment options may not be technically feasible or cost effective, and in many protected areas site manipulations are prohibited. Resources to carry out the treatments may not be available, and in many cases land managers aren't fully aware of the effects of N excess, or other management priorities and concerns take precedence. When prescribed fire seems an appropriate management tool, implementation of prescribed fire may be prohibited because of public opinion, issues with air quality impacts from fire emissions, risk of fire escape, or lack of resources to apply prescribed fire treatments. Frequently, management treatments for the effects of excess N will only be applied in local high-interest situations such as where threatened and endangered species habitat is impacted by N deposition or in areas heavily visited for recreation.

3.10.1. Management options for forests in exceedance of the critical load

Management options for mitigating the effects of excess N in mixed conifer forests are based on reducing N deposition inputs and treatments for reducing N pools in the ecosystem and to enhance plant and microbial N demand. Fire has a limited capacity to release N from the mineral soil where commonly 60–80% of ecosystem N capital is stored (Bauer et al., 2000; Kreutzer et al., 2009; Verburg and Johnson, 2001), with particularly high values in systems with low humus accumulation (Johnson et al., 2009). Volatilization losses of N during prescribed fires are believed to be lower in forests than in chaparral shrublands because of the lower temperatures in soil, litter and duff of forest fires (DeBano, 1982). Thus prescribed fire at repeated intervals, in combination with reduced N deposition is needed to eventually mitigate or reverse the symptoms of N excess. Simulated scenarios for highly-polluted mixed conifer forests in southern California indicate that the occurrence of prescribed fires every 15 years and 50–75% reductions in N deposition were the most effective treatments for N-saturated catchments. Nonetheless, even prescribed fire at longer intervals (30–60 years) and 25–50% decreases in N deposition still resulted in large decreases in ecosystem N, and could be considered as major progress in improving ecosystem condition (Gimeno et al., 2009).

The combined effects of ozone, N deposition and long-term fire suppression in southern California forests have resulted in large accumulations of C and N as necromass and woody fuels and in aboveground biomass. The latter effect is a result of the role of ozone and N enrichment in reducing C allocation belowground (Grulke et al., 2009). Thus, a larger fraction of the total ecosystem N may be allocated aboveground than in unpolluted forests, and particularly compared to unpolluted forests that also experience periodic burning. These factors support the usefulness of prescribed fire as a management option for mitigating N saturation conditions because a larger proportion of site N capital is aboveground where it can be burned, although excessive fuel and duff buildup can also make it difficult to implement an effective burn without causing excessive damage to roots or boles (Stephens and Finney, 2002). However, even in these polluted catchments we estimate that as much as 65–80% of site N capital may be stored belowground where fire is not effective at releasing the stored N (Johnson et al., 2009). In addition, prescribed fire can be difficult to implement in the urban–wildland interface that characterizes the most polluted forests in California.

Silvicultural options for increasing plant demand for N have not been tested, but could include such treatments as prescribed fire or mechanical stand thinning to encourage vigorous regrowth of understory and overstory vegetation. However, the only viable option for protecting sensitive native epiphytic lichen communities would seem to be much greater reductions in N emissions and deposition over large areas of the state of California. Applying wood chips to the soil in harvested areas of a northern hardwood forest with elevated N deposition immobilized N and was effective in reducing NO_3^- leaching (Homyak et al., 2008). Similar approaches could be tried in N-saturated stands in California to enhance N retention following disturbances such as fire or harvesting, although such methods are labor intensive, and prescribed fire can be difficult to implement in the urban–wildland interface characterizing the most polluted forests in California.

3.10.2. Management options for chaparral and oak woodlands in exceedance of the critical load

Few options are available for reversing the high N losses from N-saturated chaparral catchments. Post-fire streamwater monitoring in N-saturated chaparral catchments in the San Dimas Experimental Forest over a 15-year monitoring period indicated that prescribed fire was not an effective option for reducing N losses in streamwater in severely N-saturated catchments exposed to elevated N deposition for approximately 50 years (Fenn et al., 2008; Meixner et al., 2006). As discussed for forest ecosystems, fire has limited capacity to reduce N pools in the mineral soil. In three different chaparral fire studies 7–10% of total ecosystem N was lost during burns (Rundel and Vankat, 1989). However, volatilization of soil N in chaparral fires is minor because mineral soils even at a depth of 2.5 cm don't reach temperatures high enough (≥250 °C; DeBano, 1982) to volatilize significant amounts of N even in severe burns (Christensen, 1994; DeBano, 1982). However, post-fire erosion losses of N can be significant (Christensen, 1994). In areas with extensive fuel accumulation, smoldering fires can heat the soil to a depth of 10–20 cm (Christensen, 1994), but N volatilization is still expected to be small compared to the total N stored in the soil profile. Following fire, the soil has a high potential to mineralize N, followed by high nitrification rates (Fenn et al., 1993; Riggan et al., 1994), favoring NO_3^- export losses.

The significance of the above-mentioned factors for management of N-saturated chaparral catchments is that decreases in N deposition are ultimately required to more fully mitigate the symptoms of excess N. Although prescribed fire alone isn't enough to reverse the symptoms of N saturation, fire does result in release of N from the system, suggesting that if N deposition inputs are reduced sufficiently, over time periodic fire should help return chaparral vegetation to a condition of conservative N cycling. However, the time required for this would depend on site history and environmental conditions, the amount of N accumulated in the system and current and future rates of N deposition. As concluded for lichen community effects in forests, reducing N deposition to levels below the lichen-based CL is the only mechanism for reducing the impacts of N deposition on lichen communities in chaparral and oak woodlands. Because of the high sensitivity of lichens to N deposition, in many areas of southern and central California a 3–9 fold reduction from current inputs may be required to allow improvements in lichen community conditions.

3.10.3. Management options for coastal sage scrub in exceedance of the critical load

The two major problems facing CSS under high N deposition are increased exotic grass production and loss of native species diversity. A number of approaches have been used to manage exotic grasses and increase native plants. California is well known for a two-century history of vegetation-type conversion to exotic annual grassland (Minnich, 2008), but the conversion in CSS has occurred in the last 40–50 years (Allen et al., 1998; Minnich and Dezzani, 1998; Talluto and Suding, 2008). This poses a threat to the many rare species that are protected under the Endangered Species Act, and has resulted in a flurry of activity to restore CSS shrubs and understory forbs. Much of the effort is aimed at seedbank control for exotic annuals. The seedbank of exotics in remnant CSS sites with relatively low N deposition (8 kg ha^{-1} yr^{-1}) was up to 10,000 seeds m^{-2}, while that of native species was only 600 seeds m^{-2} (Cox and Allen, 2008a). In a site with higher N deposition (15 kg ha^{-1} yr^{-1} and perhaps historically higher), there was no native seedbank left at all, and the site was completely covered with exotic grasses and forbs (Cione et al., 2002).

The methods used for grass control in CSS include fire, herbicides, mowing, mulch to immobilize N, grazing, and solarization using plastic. The most effective large-scale method for controlling annual grasses is burning in the spring before seeds have shattered. This method is effective in perennial grasslands that resprout after fire (Gillespie and Allen, 2004), but fire has not been used in remnant CSS because managers are understandably reluctant to burn remnant stands of shrubs. Fire is, however, effective in CSS that has been type-converted to annual grassland, and is used in local preserves where permitted. The seedbank of exotics may be reduced by two orders of magnitude after fire, providing a window of opportunity to seed native species at a time when exotics are not so abundant (Cox and Allen, 2008a). Solarization, or soil heating using plastic, has been used effectively in small plots to control the weed seedbank in abandoned agricultural lands, and promoted greater establishment of native CSS species than mowing or herbicides (Marushia and Allen, 2010).

Mowing and other methods of mechanical control of exotics have proved effective where fire and other methods cannot be used for regulatory reasons. CSS has been reestablished using mechanical control plus seeding (DeSimone, 2007). Continuous annual mowing of exotic grasses in spring allowed gradual recolonization of native shrubs from a nearby seed source (Eliza Maher, Center for Natural Lands Management, pers. comm.). Grazing was effective for grass control in highly invaded CSS in a wet year when there was sufficient grass forage, but not in dry years. Furthermore, grazing would need to be applied at 5-year intervals as the grass recovers to pre-treatment cover within this time period (Allen et al., 2005.). Grazing is more effective in grasslands with more reliable annual precipitation (Weiss, 1999; See Section 3.7.4).

Grass-specific herbicides are effective for controlling annual grasses (Cione et al., 2002; Allen et al., 2005; Cox and Allen, 2008b; Steers and Allen, 2010). However, exotic forbs increased more than native plants in most of these studies, and shrubs established poorly in spite of seeding. This indicates that shrubs are part of a competitive hierarchy in order of decreasing aggressiveness from exotic annual grasses, exotic forbs, native forbs, and native shrub seedlings (Cox and Allen, 2008b). Current research focuses on control of exotic forbs to enable greater establishment of native species.

Mulch to immobilize N has been used for restoration of N-impacted CSS (Zink and Allen, 1998; Cione et al., 2002). The impacts of added carbon on N immobilization are short-term (Corbin and D'Antonio, 2004), so native species must establish quickly to take advantage of reduced soil N and reduced competition with nitrophilous exotic grasses. A more impractical aspect of mulching is that it can only be used for relatively small-scale restorations, and not for a landscape impacted by N deposition. Fire, herbicides, grazing, or mowing to reduce exotic grass cover will be more useful for large-scale mitigation of N deposition impacts on grass productivity.

3.10.4. Management options for grassland in exceedance of the critical load

In the face of continued deposition above the CL, management of grasslands to maintain native biodiversity is essential. Exotic annual grasses will never be completely eliminated from such systems. The key management goal is to reduce annual grass cover and thatch/litter accumulation enough that the native forbs can coexist at sufficient densities to provide habitat for species such as the Bay checkerspot butterfly.

In the south San Francisco Bay, invasions of annual grasses are effectively controlled by moderate grazing (Fig. 4a; 1 cow–calf pair per 4 ha). Removing cattle in high deposition areas is disastrous for the native biodiversity of the grassland, as high grass biomass leads to litter accumulation that effectively smothers the grassland with 1+ cm of thatch. Cattle selectively eat the nutritious annual grasses, reduce biomass accumulation, and mechanically break down litter leaving sufficient bare mineral soil and open canopy for the short annual forbs. Both winter–spring (wet season) and summer–fall (dry season) grazing are effective (Weiss, 1999), and a mosaic of different grazing regimes is advantageous in spreading risks across different weather years. The exact timing of grazing is determined by experienced ranchers based on range condition and cattle weight gains.

In N deposition affected grasslands, selective herbivory on N-rich grasses is an essential process in maintaining local diversity. Moderate grazing (defined by appropriate intensity and timing) can result in healthy ecosystems with high native biodiversity (Weiss, 1999; Marty, 2005). By consuming large amounts of (primarily) grass forage, grazers cycle and redistribute nutrients ("eat globally, deposit locally"; Weiss, 1999), physically disturb the soil surface, provide open germination sites for many native species, and export some N as animal biomass. But, the negative effects of overgrazing, including degraded riparian zones, soil compaction, increased erosion, and the spread of weeds, have been apparent over many poorly managed rangelands (Jackson and Bartolome, 2007).

At Edgewood, on the coastal San Francisco peninsula where the grassland CL was determined along a roadside gradient, the degraded areas are too small (~10 ha) for effective grazing. A rotational mowing regime has been implemented. In early May, when the *Lolium* seeds have not fully ripened but most annual herbs have set seed, mechanical mowing with a low cut (5 cm) takes off *Lolium* seed heads and little or no regrowth is observed. Later in the dry season (September) the thatch is broken up (if needed) with a harrow rake. Mowing has obvious positive effects (Fig. 4b), reducing grass cover and increasing native forb cover, including a three-fold increase in *Plantago* cover. The positive effects of mowing last for 3–5 years until regrowth of *Lolium* and thatch accumulation necessitate another mowing.

Prescribed fire can also reduce annual grass and thatch cover. Late-spring burns (May–June) are most effective because grass seeds have not dropped and are vulnerable to fire. Spring burns have been followed by a flush of high forb cover when sufficient seedbank was present, but habitats that have been overgrown by grasses for >3–4 years have lost much of the forb seedbank and do not show as strong of a post-fire increase in forb cover. Summer and fall burns have not been effective, except for reducing thatch cover, because grass seeds on the ground can survive and the post-fire germination and growth conditions are highly suitable for rapid grass growth. The positive effects of fire last only 2–3 years, so late-spring burns are considered an initial treatment for restoration and must be followed by grazing to control grass regrowth. Logistical and institutional barriers currently prohibit widespread use of prescribed fire in this ecosystem.

Because the Bay checkerspot butterfly is protected under the US Endangered Species Act as a Threatened Species, novel mitigation for new emissions sources in the South Bay has been implemented since 2001. The first mitigation project was the Metcalf Energy Center, a 600 MW natural gas-fired power plant. Agreements between the US Fish and Wildlife Service, California Energy Commission, and Calpine Corporation set a local precedent for addressing N deposition impacts. As of 2008, mitigation for new natural gas-fired power plants and road expansion includes permanent protection of >300 ha of prime serpentine grassland, along with endowments for monitoring and adaptive management that now exceed $2.5 million (Mayall, 2008). Acquisition includes fee-title and conservation easements on each mitigation property held by different entities. Monitoring includes surveys of Bay checkerspot butterfly populations, permanent transects measuring detailed composition of the grassland, rare plant surveys, weed control, and other activities that are presented in annual reports. On-going consultations with ranchers lead to fine-tuning of the grazing management.

Because the N deposition issue is regional in scale, the result of many point, line, and area sources that create a large pollution plume, a larger mitigation effort that avoids the pitfalls of project by project mitigation is underway. The remaining 1500+ ha of serpentine grassland on Coyote Ridge are being targeted by the Santa Clara County Habitat Conservation Plan/Natural Communities Conservation Plan, with N deposition impacts as one nexus for action. (www.scv-habitatplan.org). This habitat conservation plan will include rigorous standards for acquisition, monitoring, and adaptive management, using the initial mitigation projects as models.

3.10.5. Management options for desert in exceedance of the critical load

The problem of invasive annuals and frequent fire has only recently received attention in the desert, and restoration research has just begun on this problem. Past research and practice in the hot deserts have emphasized restoring disturbances such as pipelines and recreational vehicle tracks (Bainbridge, 2007). Methods of propagating and planting desert shrubs have been the focus, especially methods such as deep irrigation to assure survival of transplants. Hand control of invasive grasses and forbs is recommended where shrub seedlings are to be established, but relatively little large-scale control of exotic annuals has been done. The Weed Management Areas (http://www.cdfa.ca.gov/phpps/ipc/weedmgtareas/wma_index_hp.htm) have been designated in deserts (as well as other ecoregions) to help control invasive species, and N-responsive grasses such as *Bromus rubens* are considered high-priority for control in order to reduce fire frequency and competition with native flowers. To determine the biodiversity impacts of invasive species, removal studies have been done on *Brassica tournefortii* (Barrows et al., 2009), *S. barbatus* and *B. rubens* (Steers and Allen, 2010). These studies show losses in native plant and animal abundance and richness under exotic invasions, and recommend methods for control such as grass-specific herbicides and mowing. However, controlling invasive grasses over large expanses of N-eutrophied desert will be expensive, and the ultimate solution to preserve diversity and reduce fire frequency will be to reduce air pollution.

4. Conclusions

The ideal management option for reducing effects of N excess is improved air quality. Although NO_x emissions are declining in California (Cox et al., 2009), NH_x emissions are not decreasing to a similar extent if at all and N deposition in California is expected to remain high for the foreseeable future, thus pointing to the need for additional management options. However, improvement or protection of epiphytic lichen communities from the effects of atmospheric N can only be achieved by reducing their exposure to N pollution. In low biomass ecosystems such as CSS, desert or grasslands that are plagued by invasive annual grasses, removal or control of grasses or grass seeding can be achieved by treatments such as mowing, grazing, manual weeding, the use of grass-selective herbicides or burning. However, such treatments require periodic application to be effective, and may be limited in practice due to local concerns or restrictions related to protected lands, the use of fire or herbicides, or because methods are labor intensive.

In woody biomass dominated systems such as chaparral, woodlands or forests, management strategies focus on reduction of accumulated N as a result of chronic atmospheric inputs. Even with reductions in N deposition, if N has accumulated in the plant/soil system, management practices to reduce N stores will be needed to facilitate the return to more typical N accumulation and conservative N cycling. Possible methods for removing excess N include prescribed fire, thinning and various harvest techniques. The major problem with these methods is their limited capacity to liberate N stored in the mineral soil, where 65–80% of site N capital is stored in forest ecosystems in California (Johnson et al., 2009), compared to 80–95% in soils of California chaparral (Rundel and Parsons, 1980; Rundel and Vankat, 1989). A meta-analysis of fire effects on N pools in terrestrial ecosystems showed that the mean change in total soil N after fire was only 3% (Wan et al., 2001). The effectiveness of vegetation management treatments in reversing the effects of N deposition will depend partly on the size of the accumulated N pools, the on-going rate of N deposition, and the potential for treatments to enhance the release or removal of stored N.

We estimate that one-third of the land area of the seven major California vegetation types considered is in excess of the N CL. This result highlights the major ecological and environmental significance of N deposition in California. A key factor leading to such an extensive area in exceedance is the high N sensitivity of epiphytic lichen communities and plant communities within low biomass and N poor ecosystems. For example, coastal sage scrub and grasslands ecosystems have low CL values of 6–8 kg ha^{-1} yr^{-1}, and are at low elevation close to emissions sources, with 54 and 44% of these areas in exceedance of the CL. Similarly, 40–50% of the oak woodland and chaparral areas are in exceedance of the lichen-based CL. In contrast only about 5% of forest and 3–15% of chaparral coverage is in exceedance of the NO_3^- leaching CL, yet this encompasses an estimated six to eight thousand km^2 of land area. For grasslands, desert and CSS N deposition in exceedance of the CL represents risk of vegetation-type conversion, clearly a dramatic and undesirable effect. In the most polluted forests (e.g., estimated N deposition $\geq$ 25–35 kg ha^{-1} yr^{-1}) N deposition in conjunction with ozone threatens forest sustainability by contributing to multiple stress complexes, thus increasing forest mortality and fire risk (Grulke et al., 2009). However, the N CL for this effect is not well defined. In summary, this overview of the spatial extent and specific ecological effects of N deposition in California ecosystems highlights the difficulty in mitigating N excess effects by way of vegetation management options alone and the need for much greater reductions in N emissions in California.

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EXHIBIT D

Bay checkerspot butterfly
(*Euphydryas editha bayensis*)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Sacramento, California

August 2009

5-YEAR REVIEW

Bay checkerspot butterfly (*Euphydryas editha bayensis)*

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

The Bay checkerspot butterfly is a medium-sized butterfly in the family Nymphalidae, the brush-footed butterflies; its forewings have black bands along the veins in the upper wing with bright red, yellow, and white spots. Historically, the subspecies occurred in the vicinity of the San Francisco Bay area from San Bruno Mountain (west of the Bay), Mount Diablo (east of the Bay), to Coyote Reservoir (south of the Bay) (Murphy and Ehrlich 1980, p. 318). The current range of the subspecies is greatly reduced and is patchily distributed in serpentine grasslands or grasslands occurring on similar soil types. Aside from an attempt to reintroduce the subspecies to Edgewood Park (San Mateo County) in early 2007, the butterfly is currently restricted to Santa Clara County, California. The subspecies is described as having a metapopulation dynamic (Ehrlich *et al*. 1975, pp. 221-228), which is a group of spatially distinct populations that occasionally exchange individuals (Service 1998, p. II-177; 2007, p. 48179) and sites that are unoccupied one year may be occupied the next, and vice versa (Wilcox and Murphy 1985, p. 882; Harrison 1994, p. 114). The primary larval host plant for the butterfly is a small, annual, native plantain (*Plantago erecta*). The butterfly also frequently requires the presence of a secondary host plant, either purple owl's-clover (*Castilleja densiflora*) or exserted paintbrush (*Castilleja exserta*) (Singer 1972, p. 76; Murphy and Ehrlich 1980, p. 316; Weiss 1999, p. 1478) since owl's clover and the paintbrush remain edible longer than the plantain. Once reaching their fourth instar (larval development stage/molt), larvae enter diapause (dormancy) and spend the summer in cracks and crevices or under rocks.

Methodology Used to Complete This Review:

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO) of the U.S. Fish and Wildlife Service (Service) using information from the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (Recovery Plan) (Service 1998), survey information from experts who have been monitoring various localities of this subspecies, the California Natural Diversity Database (CNDDB) (CNDDB 2006, 2008), maintained by the California Department of Fish and Game (CDFG), Geographic information system (GIS) data provided by Jones and Stokes and Associates (JSA 2007), the 2007 proposed revised critical habitat for the Bay checkerspot butterfly (Service 2007), and the 2008 final revised critical habitat for the Bay checkerspot butterfly (Service 2008a).

Contact Information:

Lead Regional Office: Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist, Region 8, California and Nevada; (916) 414-6464.

Lead Field Office: Kirsten Tarp, Recovery Branch, Sacramento Fish and Wildlife Office, 916-414-6600.

Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on March 5, 2008 (Service 2008b). We received two letters from the public in response to our Federal notice initiating this 5-year review.

Listing History:

<u>Original Listing</u>
FR Notice: 52 FR 35366
Date of Final Listing Rule: September 18, 1987
Entity Listed: *Euphydryas editha bayensis*, an insect subspecies
Classification: Threatened

Associated Rulemakings: Critical habitat for the Bay checkerspot butterfly was first finalized on April 30, 2001 (Service 2001). A proposed revised designation of critical habitat was published on August 22, 2007 (Service 2007) and a final revised critical habitat was published on August 26, 2008 (Service 2008a).

Review History: We have not conducted any status reviews for this subspecies since the time of listing. Updated information on its status and threats was included in the 1998 Recovery Plan, 2001 designation of critical habitat, and the 2008 final revised designation of critical habitat; however, these documents did not include a five-factor analysis of threats or make recommendations on the subspecies' classification under the Act.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for *Euphydryas editha bayensis* is 3C according to the Service's 2008 Recovery Data Call for the Sacramento Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a subspecies that faces a high degree of threat, but has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline

Name of Plan or Outline: *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area*
Date Issued: September 20, 1998

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is an invertebrate, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status

Species Biology and Life History

Spatial Distribution: Historically, the Bay checkerspot butterfly occurred in several locations around the San Francisco Bay. West of the Bay the checkerspot occurred at San Bruno Mountain (San Mateo County), and Twin Peaks and Mount Davidson (San Francisco County). East of the Bay the checkerspot occurred at Franklin Canyon and Mount Diablo (Contra Costa County), and the Oakland Hills (Alameda County). South of the Bay the checkerspot occurred in several locations in Santa Clara County (Murphy and Ehrlich 1980, p. 318). At the time of listing in 1987, the butterfly was known from two primary areas (core populations) (serpentine grasslands generally larger than 800 acres that support persistent populations), Edgewood Park (San Mateo County) and along the eastern ridgeline in Santa Clara County stretching from San Jose south to Morgan Hill (here on referred to as Coyote Ridge) (CNDDB 2008; Service 1998, p. 35376). The listing rule also stated that three secondary (satellite) areas (serpentine grasslands generally less than 800 acres) were likely occupied and three other areas were known to be occupied (Service 1998, p. 35366). Satellite areas that supported the butterfly at listing included Jasper and Pulgas Ridges (San Mateo County) as well as several areas in Santa Clara County (near Calero Reservoir, 2.5 miles west of San Martin, Tulare Hill, and one site near Kalana Avenue) (Harrison 1989, p. 1237; Service 1998, p. 35376). According to the listing rule, there were approximately 15 other sites in Santa Clara County that probably supported satellite colonies at one time or another and included: a site south of the City of Saratoga, one site east of Lexington Reservoir, four sites between Guadalupe Reservoir and the City of New Almaden, three sites in the vicinity of Chesbro Reservoir, two sites in Santa Teresa County Park, and four sites near the City of Gilroy (Service 1998, p. 35376); although the listing rule stated that these areas likely supported populations the rule notes that many of the areas had been surveyed in 1985 without documenting the presence of the butterfly. San Bruno Mountain (San Mateo County) was noted as the only tertiary habitat (area of non-serpentine grassland) that still supported the butterfly.

The Bay checkerspot butterfly is patchily distributed and because it occurs as a metapopulation, the exact distribution of the butterfly varies through time: sites that are unoccupied one year may be occupied the next, and vice versa (Wilcox and Murphy 1985, p. 882; Harrison 1994, p. 114). The Coyote Ridge core population has historically been referred to as four separate populations (Silver Creek Hills, San Felipe, Metcalf, and Kirby Canyon), but what constitutes a population has not been defined and Coyote Ridge may be comprised of many populations. Aside from Metcalf Road, a two-lane road that divides the ridge line in half, Coyote Ridge is primarily contiguous grassland.

At the time the Recovery Plan was finalized in 1998, the butterfly's range had become more restricted. The range at that time still included two core areas (Edgewood Park in San Mateo County and Coyote Ridge in Santa Clara County) (Hellman *et al.* 2003, p. 75; Weiss, pers. comm. 2006; Weiss 2006a, p. 2; CNDDB 2008) as well as a number of smaller satellite areas. Only one satellite area was believed to still occur in San Mateo County at Stanford University's Jasper Ridge Biological Preserve (Jasper Ridge), but only 6 adults were observed in 1997 (McCabe 1997, p. A-18; CNDDB 2008) and none were observed in 1998 (CNDDB 2008). Satellite areas in Santa Clara County that were believed to be occupied were Santa Teresa County Park (H.T. Harvey & Associates, 1998 p. 13; Arnold, pers. comm. 2007), Calero County Park (CNDDB 2008), and Coyote Lake-Harvey Bear Ranch County Park (CNDDB 2008).

The current range of the Bay checkerspot butterfly is even further reduced. Only one core area remains (Coyote Ridge), and all known extant occurrences of the Bay checkerspot butterfly are within a 9-mile radius of Coyote Ridge (Service 2008a, p. 50422) and all are located in Santa Clara County. Prior to an attempted reintroduction at Edgewood Park in 2007, the butterfly had not been observed in San Mateo County since 1997-1998 (Stanford 2006, p. 8; CNDDB 2008). Of all potentially remaining satellite areas in Santa Clara County, butterflies have only recently (since 1998) been observed at Tulare Hill, although not all potential satellite areas are surveyed annually.

Since listing, the number of sites with extant Bay checkerspot butterfly populations has decreased considerably and there are no populations in Alameda, Contra Costa, San Mateo, or San Francisco Counties. The number of individuals in currently occupied sites has also declined in recent years. Fluctuation in the number of populations and the number of individuals within a population varies dramatically from one year to the next based on the population dynamics and life history of the Bay checkerspot butterfly. However, a number of factors have and continue to contribute to the loss of both populations and the number of individuals within a population and are discussed below.

Abundance: Population size of the Bay checkerspot butterfly is primarily determined by the survival rate of prediapause larvae (see Table 1 below for life cycle table) (Singer 1972, p. 77; Weiss *et al*. 1988, p. 1486). Prediapause larval survivorship is dependent upon the timing of host plant senescence, which in turn is dependent on environmental conditions such as temperature and rainfall. Prediapause larvae experience mortality rates upwards of 95 percent (Murphy 1988, p. 46; Weiss *et al*. 1988, p. 1487; Cushman *et al*. 1994, p. 198; Murphy *et al*. 2004, p. 26), with rates of 98-99 percent common (White 1974, p. 310).

In Santa Clara County, population trends for the Bay checkerspot butterfly are only available for Coyote Ridge (its four historical populations noted above), Tulare Hill, and Coyote Lake-Harvey Bear Ranch County Park. On Coyote Ridge, south of Metcalf Road (Kirby Canyon population), Bay checkerspot butterfly numbers increased from approximately 20,000 postdiapause larvae (see Table 1 below for life cycle table) in 1997 to 700,000 in 2004, but fell to approximately 100,000 in 2005 (Weiss 2006a, p. 1). Between 2006 and 2007 the number of postdiapause larvae in the Kirby Canyon population was down "often by a factor of three or more" (CH2MHILL 2008, p. 8-8). Results from the 2008 survey period are not yet available.

On Coyote Ridge, north of Metcalf Road (Metcalf population), Bay checkerspot butterfly postdiapause larvae increased from approximately 200,000 in 2000 to 400,000 in 2004, but then declined to 45,000 in 2006 (Weiss 2006a, p. 1). Adult surveys were conducted in March and April 2008. WRA (2008, p. 16) observed 636 adults, but no larvae. The Service is not aware of any more recent survey information in this area.

Postdiapause larval estimates from the northern end of Coyote Ridge (Silver Creek Hills population) increased from 75,000 in 1992 to 128,000 in 1993, and then fell to an estimated 58,000 in 1994 following the removal of grazing from portions of the area (Weiss 1996, p. 93; Weiss 1999, p. 1480). No larvae or adults were observed in 1998 (Weiss 1999, p. 1480). Annual surveys at Silver Creek Hills since the construction of a residential subdivision and reintroduction of grazing over portions of the area in 2000-2001 have not detected any larvae. However, surveys have showed an increase in adult butterflies from a low of 11 in 2001 to a high of 53 in 2007 (WRA 2007, p. 8). Results from the 2009 survey period are expected in fall 2009.

On Tulare Hill approximately 2,000 postdiapause larvae were observed in 2002. The Tulare Hill population declined significantly in 2003, when only one postdiapause larva was observed (CH2M Hill 2005, p. 8-6). Five adults were observed on Tulare Hill in 2004 (CH2MHill 2005, p. 8-2). Seven adults were observed in 2005, but no larva (CH2MHILL 2006, p. 8-2). One adult and one postdiapause larva were observed in 2006 (CH2MHILL 2007, p. 1-7-9). One adult was observed in 2007, but no larvae (CH2MHILL 2008, p. 8-8). Results from the 2008 surveys are not yet available.

According to the California Natural Diversity Database (CNDDB 2006, 2008), thousands of adult Bay checkerspot butterflies were observed at Coyote Lake-Harvey Bear Ranch County Park in 1994, 6 adults observed in 1997, and 1 adult observed in 1999. According to Santa Clara

County Parks (D. Rocha, pers. comm. 2008) no Bay checkerspot butterflies have been seen at Coyote Lake-Harvey Bear Ranch County Park since 1999 despite annual monitoring.

In spring 2007, an effort was made to reintroduce the Bay checkerspot butterfly to Edgewood Park (San Mateo County) by relocating approximately 1,000 postdiapause larvae collected from Coyote Ridge. However, the reintroduction appears not to have been successful; no larvae and only one adult butterfly were observed at Edgewood Park in 2008 (Weiss, pers. comm. 2008).

Life History: The Bay checkerspot butterfly is univoltine (one generation reaches sexual maturity each year) and generally reproduces and dies within a single year, although some larvae may be capable of diapausing more than once (Singer and Ehrlich 1979, p. 54; White and Levin 1981, p. 355; Harrison 1989, p. 1242; Mattoni *et al*. 1997, p. 106; Kuussaari *et al*. 2004, pp. 139-140). Adults emerge from pupae in early spring (late February to April) and have an average life span of about 10 days with some individuals living up to three weeks (Ehrlich, unpublished data, cited in Baughman 1991, p. 537; Cushman *et al*. 1994, p. 196). Eggs are laid during the 4 to 6 week flight season and hatch within 10 days. Larvae feed for approximately two weeks until they reach their fourth instar and then enter diapause, which lasts through the summer dry season. Larvae break diapause once their host plants germinate with the onset of the rainy season in the fall.

Table 1. Bay checkerspot butterfly generalized life cycle (Murphy *et al*. 2004, p. 25).

	Rainy Season >---------->						Summer Dry Period >---------->						
Life Cycle Stage													
Diapause							xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
Prediapause Larvae					xxxxx	xxxxx	xxxxx						
Eggs					xxxxx	xxxxx	xxxxx						
Adults				xxxxx	xxxxx	xxxxx	xxxxx						
Pupae			xxxxx	xxxxx	xxxxx	xxxxx							
Postdiapause Larvae	xxxxx	xxxxx	xxxxx	xxxxx									
	November	December	January	February	March	April	May	June	July	August	September	October	November

Murphy *et al*. (1983, p. 261) observed increased longevity and reduced weight loss in adult Bay checkerspot butterflies fed sugar. Increased nectar intake results in longer adult life span and improved adult condition (females produce more and larger egg masses). Females that eclose (emerge as adults from pupae) early in the flight season will contribute more eggs, since nectar availability can be limited later in the flight season. Longer survival is important during wet years for females that lay eggs on cool slopes since larvae from these eggs develop more slowly. Slow-developing larvae may not reach diapause before the larval host plants senesce. The flight season extends from late February to early May (Weiss *et al*. 1988, p. 1487) depending on weather.

Females typically only mate once, but males may mate multiple times (Labine 1964, p. 335; Baughman 1991, p. 538). After mating, females lay 1 to 5 egg masses (Murphy *et al*. 1983, p. 259). Egg masses may contain anywhere from 5 to 350 eggs (Singer 1972, p. 75;Weiss *et al*. 1988, p. 1487; Weiss 1996, p. 6; Murphy *et al*. 2004, p. 25). Eggs hatch in 13-15 days (Singer and Ehrlich 1979, p. 54; Murphy *et al*. 2004, p. 25) and larvae begin feeding. Murphy *et al*. (1983, p. 259) reported average lifetime egg production of 401 to 805; the study also stated an average lifetime egg production of 426 by females without food. Egg production (both size and number of eggs) significantly increased with the intake of nutrients (Murphy *et al.* 1983, p. 261; Boggs 1997, pp.181, 184). Murphy *et al*. (1983, p. 261) observed that a mixture of amino acids and sugar intake by females produced heavier eggs, which resulted in an increased likelihood of survival. Intake of amino acids and sugar in the lab simulated varying degrees of nectar availability in the wild. Greater availability of nearby adult nectar sources likely results in higher larval survivorship since heavier eggs result in larger larvae. Since the ability to enter diapause is size dependent, large larvae are able to enter diapause sooner after hatching than small larvae. Since population size is most influenced by the number of postdiapause larvae, abundant nectar sources likely results in an increase in the number of individuals at a particular location. However, in dry years when flowers produce less nectar or in areas where there are no mature nectar plants, populations of the Bay checkerspot butterfly may still persist because females are capable of producing eggs even without food.

Larvae feed until they have grown sufficiently to reach their fourth instar and enter diapause. Larvae that are not able to enter diapause prior to host plant senescence starve (Singer and Ehrlich 1979, p. 54; White 1987, p. 209; Weiss 1996, p. 6). Larvae are able to enter diapause when they reach 4 to 20 milligrams (White 1987, p. 209). Larvae break summer diapause and resume feeding with the onset of the rainy season and host plant germination, generally between November–January (Weiss 1996, p. 6). Postdiapause larvae then feed until reaching a mass of 250 to 500 milligrams (Weiss *et al*. 1988, p. 1489) at which time they pupate.

The Bay checkerspot butterfly requires areas with topographic diversity (warm south and west slopes as well as cool north and east slopes), because some slopes become unfavorable depending on annual weather conditions and time of year. Fleishman *et al*. (2000, p. 34) defined warm and very warm slopes as south- and west-facing slopes with a tilt greater than 11 and 17 degrees, respectively, with cool and very cool slopes defined as those facing north or east with a tilt greater than 11 and 17 degrees, respectively. Harrison *et al*. (1988, p. 365) defined warm slopes as those facing south, southwest, and southeast with a tilt greater than 7 degrees and cool slopes as those facing north or northeast with a tilt greater than 7 and 12 degrees, respectively. In hot, dry years, north- and east-facing slopes remain cool and moist longer and larval host plants tend to senesce (reach later maturity, grow old) later than those on other slopes (Weiss *et al*. 1988, p. 1493; Fleishman *et al*. 2000, p. 33). The delayed senescence of plants on cool, moist slopes allows larvae to reach their fourth instar (larval development stage or molt) and enter diapause (dormancy) before host plants become inedible. Larvae that are not able to enter diapause prior to host plant senescence starve and die (Singer and Ehrlich 1979, p. 54; White 1987, p. 209; Weiss 1996, p. 6). Because host plants on cool slopes can flower and senesce 3 or more weeks after those on warmer slopes (Weiss *et al*. 1988, p. 1493), cool slopes are especially important during extremely dry years (i.e., droughts). However, larval feeding and growth tends to increase on warm slopes because they receive more solar exposure than other slopes; this allows postdiapause larvae to grow quickly and pupate earlier than those on cool slopes. Individuals that pupate earlier have a much greater chance of reproductive success (Weiss *et al*. 1988, pp. 1493-1494).

In addition to weather, slope is important relative to the timing of egg lying. As the adult mating season (flight season) progresses, females tend to lay more eggs on cool slopes than on warm slopes (Weiss *et al*. 1988, p. 1493). The timing of the flight season varies with weather, but can generally be described as occurring from late February to early May (Murphy *et al*. 2004, p. 25). Larvae that hatch late in the flight season on cooler slopes have a greater chance of reaching diapause than those laid at the same time on warm slopes, because host plants remain edible longer on cool slopes. The pattern of larval survivorship across different slopes changes from one year to the next as well as within years; therefore, it becomes important that a variety of slopes and aspects are present to support the butterfly and its host plants.

While varying topography is important to provide the microclimate conditions necessary to ensure some larvae survive each year, elevation does not appear to be an important physical characteristic. The Bay checkerspot butterfly has been observed over a wide range of elevations. In San Mateo County, Bay checkerspot butterflies historically occurred on San Bruno Mountain at elevations of approximately 1,000 feet, at Pulgas Ridge at approximately 550 feet, and at Edgewood Park and Jasper Ridge at approximately 600 feet. In Santa Clara County Bay checkerspot butterflies have been observed at elevations between 300 to 1,100 feet. Portions of Coyote Ridge are as high as 1,100 feet. Tulare Hill ranges from about 300 to 550 feet and the area around Calero Reservoir where Bay checkerspot butterflies have been observed varies from approximately 500 to 800 feet.

The population size of the bay checkerspot butterfly is primarily determined by the survival rate of prediapause larvae (Singer 1972, p. 77; Weiss *et al*. 1988, p. 1486). Prediapause larvae experience mortality rates upwards of 95 percent (Murphy 1988, p. 46; Weiss *et al*. 1988, p. 1487; Cushman *et al*. 1994, p. 198; Murphy *et al*. 2004, p. 26). Larval survivorship is dependent upon the timing of host plant senescence, which in turn is dependent on environmental conditions such as rainfall.

White (1986, p. 58) observed that pupal mortality rates, as well as cause of mortality (predation, parasitism, crushing, or disease), varied significantly depending on location (i.e., microhabitat types). For example, crushing was most likely in areas of bare ground, whereas pupae in areas with dense vegetation had a higher rate of mortality due to mold and viruses. Since prediapause larval mortality is the most significant factor influencing population size, a variety of diapause sites are necessary to ensure adequate numbers of larvae survive diapause. Pupal mortality rates of 26-89 percent have been observed (White 1986, p. 58-59; Weiss *et al*. 1988, p. 1492). Adults eclose in 10-43 days (White 1986, p. 60; Weiss *et al.* 1988, p. 1492), with timing strongly affected by weather.

Sex ratios in the Bay checkerspot butterfly have been reported several times in the scientific literature (Ehrlich 1965; Ehrlich *et al.*, 1984; Launer *et al*. 1993; Hellman *et al*. 2003; Boggs and Nieminen 2004). Ehrlich (1965, p. 330-331) noted sex ratios in the field of 2.73:1 (sex ratios in this review are male:female), while laboratory ratios were closer to 1:1. Ehrlich *et al*. (1984, p. 530) noted an observed sex ratio (sex ratio of captured individuals) in adults of 1.95:1; however, the same study observed that butterflies captured in the field are typically males due to differences in catchability and that sex ratios of butterflies in the lab are closer to 1:1 (Ehrlich *et al.* 1984, p. 527). Ehrlich *et al.* (1984, p. 527-528) discussed differences in the realized sex ratios (the actual sex ratio) and the operational sex ratio (sex ratio of individuals available to mate) and speculated that the bias towards males was due to greater pre-adult mortality of females, higher rate of emigration of females, and possibly a greater adult mortality of females (Ehrlich *et al*. 1984, p. 537). Ehrlich *et al*. (1984, p. 534) hypothesized that higher female mortality was the result of the longer period of time (approximately 6 days in the study) females spend as pre-adults (likely occurring during the postdiapause stage as a result of longer exposure to predators). Emigration in Ehrlich *et al*. (1984) was between areas 'C', 'G', and 'H' at Jasper Ridge that are separated by only a few thousand feet (Ehrlich *et al*. 1965, p. 328). Launer *et al*. (1993 p. 47) reported variable sex ratios depending on location and time of year. Sex ratios at a creek ranged from 1:25 to 1.3:1 and at a ridge site ranging from 1.6:1 to as high as 11:1 (Launer *et al*. 1993, p. 47). Hellman *et al*. (2003, p. 79) examined historical data and reported average sex ratios at Jasper Ridge of 1.59:1 where the number of males exceeded the number of females in 12 out of 19 years in area 'C' and 24 out of 28 years in area 'H' (Hellman *et al.* 2003, p. 78). Boggs and Nieminen (2004, p. 94) reexamined data from Ehrlich *et al*. (1984) and estimated an operational sex ratio of approximately 0.85:1, which maybe due to differences in adult eclosure (in the study year males were collected 6 days prior to the first female).

The Bay checkerspot butterfly is considered relatively sedentary (Ehrlich 1965, p. 333; Harrison 1989, pp. 50-51; Singer and Hanski 2004, p. 187). McKechnie *et al*. (1975, p. 561) observed that, out of several years of mark recapture studies, only 1.7 percent of males and 4.8 percent of females moved a distance of approximately 1,600 feet. These figures are consistent with observations made by Weiss (1996, p. 93), who reported that adult movement declined with increasing distance with only about 5 percent moving between 656 to 984 feet. Harrison (1989, p. 1239) observed movements of 3.5 miles for one male and 2 miles for one female. Murphy (Service 2001, p. 21451) reported movement of Bay checkerspot butterflies of 4.7 miles. Harrison *et al*. (1988, p. 371) hypothesized that habitats greater than 4.3 to 5.0 miles from a source population (Coyote Ridge in the study) were unlikely to ever sustain populations of the Bay checkerspot butterfly. This hypothesis was based on the presence or absence of adult Bay checkerspot butterflies in Santa Clara County in apparently suitable habitat and their relative distance from Coyote Ridge. The study was not designed to predict the Bay checkerspot butterfly's upper limit of dispersal.

<u>Habitat or Ecosystem:</u> The Bay checkerspot butterfly inhabits areas around the San Francisco Bay with soils derived from serpentinite ultramafic rock (Montara, Climara, Henneke, Hentine, and Obispo soil series) or similar non-serpentine soils (such as Inks, Candlestick, Los Gatos, Fagan, and Barnabe soil series) in areas ranging from a few acres to thousands of acres. Serpentine or serpentine-like soils are characterized as shallow, nutrient poor (typically lacking in nitrogen, phosphorous, and calcium), containing high magnesium (and other heavy metals), and with low water holding capacity. All currently occupied habitats of the Bay checkerspot butterfly occur on serpentine or serpentine-like grasslands that support at least two of the subspecies' larval host plants, although the range of all the host plants is greater than that of the Bay checkerspot butterfly. Due to poor nutrient availability, as well as the other characteristics noted above, serpentine and serpentine-like grasslands are, for the most part, inhospitable to the non-native grasses and forbs that dominate other California grassland ecosystems; these areas are essentially isolated patches where native grassland vegetation is capable of persisting in a landscape that is otherwise dominated by non-native and invasive plant species. A number of researchers believe that the Bay checkerspot butterfly likely occurred more widely in non-serpentine grasslands in the San Francisco Bay area prior to the invasion of non-native invasive

grasses and forbs (Murphy and Weiss 1988, p. 197; McLaughlin *et al*. 2002, p. 6074; Murphy *et al*. 2004, p. 26), but have subsequently been relegated to these fragmented habitats due to plant competition. Some researchers have noted that the Bay checkerspot butterfly does not feed on its larval host plants when those plants occur off serpentine soils (Johnson *et al*. 1967, p. 423). Johnson *et al*. (1967, p. 423) observed a patch of larval host plants spanning both serpentine and non-serpentine soils and noted larvae feeding on host plants only on plants within the serpentine area, even though the patch was contiguous. However, anecdotal evidence indicates that in laboratory conditions, larval Bay checkerspot butterflies will feed on host plants grown on non-serpentine soils (Murphy *et al*. 1983, p. 258; Boggs 1997, p. 185).

<u>Changes in Taxonomic Classification or Nomenclature:</u> Some authors have advocated renaming the Bay checkerspot butterfly from *Euphydryas editha bayensis* to *Euphydryas editha editha* for reasons of historical precedence (Mattoni *et al*. 1997; Emmel *et al*. 1998, p. 17)); however, this name has not been adopted in any subsequently published literature on the subspecies, nor in the majority of the published literature prior to this article. Occasionally the butterfly is placed in the genus *Occidryas*, but this is viewed as taxonomically incorrect (Zimmerman *et al*. 2000, p. 352). Mattoni *et al*. (1997, p. 100) suggested that *Euphydryas editha editha* ranges from the San Francisco Bay area south to Santa Barbara County in California, and includes the populations known as the Bay checkerspot butterfly and several populations south of Santa Clara County whose subspecific status has been uncertain, and which if recognized would be a range extension for the Bay checkerspot butterfly. The listing rule discussed the taxonomic status of the butterfly extensively, including butterflies in Santa Barbara County (Service 1987, p. 35370). A review panel assembled by the Service to address the taxonomic status of the butterfly concluded that *Euphydryas editha bayensis* is a valid subspecies and that it has been continuously recognized as such in the scientific literature (Service 1987, p. 35370). Aside from the two studies above (Mattoni *et al*. 1997; Zimmerman *et al*. 2000) and one non-peer reviewed book (Emmel *et al*. 1998), all subsequent literature on the Bay checkerspot butterfly published since it was listed recognizes the name *Euphydryas editha bayensis* as correct and no other published literature extends the subspecies' range south of Santa Clara County; this corresponds to the vast majority of published literature on the butterfly, spanning more than six decades.

<u>Genetics:</u> A number of genetic studies (McKechnie *et al*. 1975; Mueller *et al*. 1985; Slatkin 1987; Baughman *et al*. 1990) have been conducted on *Euphydryas editha*, and some specifically on the Bay checkerspot butterfly. However, well-resolved phylogenies for many butterfly species do not exist despite their well-studied biology (Wahlberg *et al*. 2004, p. 221), including the Bay checkerspot butterfly. In addition, what constitutes a population of Bay checkerspot butterflies was not defined in any of the genetic studies identified below. McKechnie *et al*. (1975, p. 571) studied 21 *Euphydryas editha* populations (including the Bay checkerspot butterfly) for differences at eight polymorphic enzyme loci and found that some loci were highly variable between populations, while other loci were almost identical; they concluded that strong selection pressures were in operation despite obvious migration between populations at Jasper Ridge. Historically the Bay checkerspot butterflies at Jasper Ridge were grouped into three separate populations, 'C', 'G', and 'H'. Mueller *et al*. (1985, p. 495) examined allele frequencies at six polymorphic loci in two of the populations at Jasper Ridge and found substantial variations between observed values and those predicted by computer modeling, which indicated fluctuating selection pressures from one year to the next. Slatkin (1987, p. 791) reexamined the data from

McKechnie *et al*. (1975) and concluded that there was genetic similarity at seven of eight loci. Baughman *et al*. (1990, p. 1967) examined the genetic structure of 41 populations of *Euphydryas editha* (including the Bay checkerspot butterfly) at 19 loci; the study divided the 41 populations into groups based on similar alleles, but found that the genetic groupings did not associate with observed morphological differences such as size, color pattern, flight season, or host plant. One possible explanation is that the various subspecies were recently interconnected, as early as the last ice age (8,000-10,000 years ago) and that gene frequency distributions are more reflective of historical gene flow rather than current gene flow (Baughman *et al*. 1990, p. 1973). Baughman *et al*. (1990, p. 1973) notes that this hypothesis may be speculative but is supported by historical factors including changes in habitat over the last 10,000 years (areas that were previously mesic woodland and grasslands are now arid basins); the current disjunction between patches of suitable habitat may not have existed 5,000 years ago, since fragmentation of much of the habitat by agriculture, urbanization, and non-native vegetation has occurred in the last 100 years. Baughman *et al.* (1990, p. 1973) stated that the current distribution of *Euphydryas* butterflies are small discrete populations and the distribution of many of these butterfly populations may have been different as recently as 300 butterfly generations ago. The majority of genetic studies on the Bay checkerspot butterfly occurred in the 1970s and 1980s prior to the advent of more advanced molecular techniques. Additional genetic studies are necessary to characterize the relationships between and among different populations of Bay checkerspot butterflies.

Species-specific Research and/or Grant-supported Activities:

As noted above, the Bay checkerspot butterfly is one of the most well-studied insects in biology (Murphy and Ehrlich 1980, p. 319). Dr. Paul Ehrlich of Stanford University and his laboratory have been studying the Bay checkerspot butterfly since 1959 and the study of the butterfly's population dynamics was influential in developing the metapopulation concept. Research regarding the genetics of the Bay checkerspot butterfly was noted in the previous section. McLaughlin *et al*. (2002a) examined how climate change hastened the extinction of the Bay checkerspot butterfly at Jasper Ridge; this study is detailed below under Factor E. The following is a summary of recent research.

Microclimate: Weiss *et al*. (1988) examined thermal environments on topographically diverse serpentine grasslands and observed that larvae and pupae developed faster on warm slopes than on cooler slopes. In the same study microclimate was observed to affect the phenology of host plants and adult nectar plants. The relationship between larval and pupal development and host plant phenology was used to determine prediapause mortality rates of larvae; females that pupated earlier in the season could have offspring that survived on almost all slopes; however, larval survivorship from females that pupated in the middle of the flight season was restricted to cooler slopes and larvae from females that pupated late did not survive on any slope.

Weiss *et al*. (1993) developed models that examined patterns of adult emergence in relation to topography and microclimate from 1985-1989. The model used slope-specific insolation as the rate-controlling variable and accounted for solar exposure and cloud cover (Weiss *et al*. 1993, p. 261). The model accurately predicted postdiapause larval mass and observed mass to within 4-6 days in most microclimates (Weiss *et al*. 1993, p. 265).

Fleishman *et al*. (2000, p. 36) examined the effects of microclimate on oviposition of Bay checkerspot butterflies and observed that senescence of larval host plants (*Plantago erecta*) varied significantly with microclimate. The study did not find a significant effect on larval survival (Fleishman *et al*. 2000, p. 40); however, the authors note that this may have been an artifact of their study design because they were not able to track survival of individual larvae and their estimates were based on survival of any individual from the same egg mass (Fleishman *et al*. 2000, p. 41).

McLaughlin *et al*. (2002b) examined variation in population size between two subpopulations ('C' and 'H') at Jasper Ridge. The Jasper Ridge 'C' population occupied in a largely flat homogeneous area, while the 'H' population included areas of topographic diversity. The 'C' population varied more widely than 'H' and became extirpated earlier than 'H' (McLaughlin *et al.* (2002b, p. 545). McLaughlin *et al.* (2002b, 538) concluded that extirpation of the Bay checkerspot butterfly in areas protected from disturbance was driven by climate variability and that topographic diversity buffered the population from some of the effects of climate.

<u>Nitrogen deposition and invasive species:</u> The process of combustion of fossil fuels (from vehicles, power plants, etc.) results in the production of a number of emissions, including various nitrogen based substances such as nitrous oxides (N_2O), ammonia (NH_3), nitrogen oxides (NO_x), nitric acid (HNO_3), nitrate (NO_3-), and ammonium (NH_4). Nitrogen is the primary limiting factor in plant growth. Weiss (1999, p. 1476) investigated the role of atmospheric nitrogen deposition on butterfly and plant populations across different grazing regimes, and found that populations of the Bay checkerspot butterfly in south San Jose declined dramatically after removal of cattle grazing at several locations, while other nearby populations under continued grazing did not suffer the same decline in butterfly numbers. Weiss (1999, p. 1476) determined that while the initial cause of the butterfly declines were the result of rapid invasion by non-native annual grasses that crowded out the butterfly's larval host plants, the evidence indicated that dry nitrogen deposition from smog was responsible for creating soil conditions that allowed the observed grass invasion. Weiss (1999, p. 1482) estimated nitrogen deposition rates south of San Jose to be 10-15 kg of nitrogen per hectare per year (kg-N/ha/yr). Weiss (2002, p. 31) further demonstrated these effects by analyzing the pattern of non-native grass invasion resulting from nitrogen deposition at Edgewood Park, and observed that the cover of non-native Italian ryegrass (*Lolium multiflorum*) decreased with distance from Interstate Highway 280 (I-280), while *Plantago erecta* cover increased with distance. *Plantago erecta* cover was also higher upwind of I-280 than downwind.

<u>Vegetation management:</u> Weiss (2002, p. 36) examined the effect of mowing, goat grazing, raking, and fall seeding of *Plantago erecta* at Edgewood Park and found that species richness increased in mowed plots and *P. erecta* cover increased from 3 to 9 percent in mowed plots vs. no change in control plots, while non-native grass (*Lolium multiflorum)* decreased from 50 to 15 percent. Percent of *Castilleja densiflorus* (secondary host plant) cover was unaffected by mowing, but *Lasthenia californica* (adult nectar plant) increased from 4 to 8 percent cover in mowed vs. control plots. Mowing was the only factor that had a significant effect on cover.

In 2004, the Service provided funding for a 3 year study to examine the effect of various vegetation management scenarios (ambient grazed (1 cow and calf per 10 acres), partial grazed, ungrazed/untrimmed, and ungrazed/trimmed) on the food plants of the Bay checkerspot butterfly and several other plant species on portions of Tulare Hill and Coyote Ridge (Weiss *et al*. 2007, p. 4). Non-native vegetation was tallest in both 2006 and 2007 in ungrazed/untrimmed plots and shortest in the ambient grazing plots, and annual forbs (such as native host plants) declined in all treatments except ambient grazing (Weiss *et al*. 2007, p. 10).

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

When the butterfly was listed as threatened in 1987 (Service 1987), we identified urban development (i.e., residential development), highway construction (and its associated habitat fragmentation), and overgrazing as threats to the subspecies. Additional threats were noted in the Recovery Plan (Service 1998, pp. II-191-197) and included habitat degradation caused by non-native vegetation as a result of nitrogen deposition.

<u>Non-native plant species:</u> Invasion of native grasslands by non-native plants is widely seen as one of the major causes of decline of a number of native species including the Bay checkerspot butterfly. Serpentine habitats are not immune to invasion by non-natives. For example, non-native grass growth in the Silver Creek Hills area was observed to choke out the host plants of the Bay checkerspot butterfly (Service 1998), and yellow star thistle (*Centaurea solstitialis*) invaded some serpentine areas at Edgewood Park Natural Preserve. Some eucalyptus species (*Eucalyptus* spp.) can grow in serpentine areas, and destroy butterfly habitat due to leaf litter and shading. New invasive plants continue to be introduced to northern California through gardens, landscaping, and accidental means.

Coupled with the threat from invasive and non-native species is nitrogen deposition (including NOx and NH_3) that enriches serpentine and serpentine-like soils that are usually nutrient poor. Increased nitrogen (typically a limiting factor in plant growth) in these areas has resulted in the accumulation of a thick carpet of vegetative material, commonly referred to as thatch. Dense thatch inhibits the growth of native forbs (Huenneke *et al*. 1990, p. 488). Italian ryegrass is the major invasive grass in degraded sites in Santa Clara County (Weiss 2002, p. 6). The increased density of non-native vegetation negatively affects the Bay checkerspot butterfly's host plant due to competition and crowding (Weiss 1999, p. 1481). Huenneke *et al.* (1990, p. 489) found that areas that were fenced to prevent grazing resulted in an increase in native perennial and non-native annual grasses, but in grazed areas, forbs continued to represent an important component. Low and moderate grazing regimes (approximately one cow per 10 acres) have been implemented on portions of Tulare Hill and Coyote Ridge. Because cattle tend to select non-native grasses over native forbs (Weiss 1999, p. 1484), the result of these grazing regimes has been local increases of the Bay checkerspot butterfly's larval host plants.

Nitrogen deposition rates in portions of Bay checkerspot butterfly habitat in Santa Clara County have been estimated to be between 10 and 15 kg-N/ha/yr (Weiss 1999, p. 1482-1483). On Tulare Hill, nitrogen deposition rates have been estimated at 17 kg-N/ha/yr (CH2MHILL 2008, p. 4-2). Although there is no empirical threshold for effects associated with nitrogen deposition, the U.S. Department of Agriculture estimates the threshold of annual nitrogen deposition rates that can potentially impact sensitive plant communities is 3-10 kg-N/ha/yr (USDA 1992, p. 10). Although these are vague guidelines and should not be interpreted as a critical load, it is consistent with estimates for the threshold for effects to serpentine ecosystem structure and diversity at Edgewood Park, which was 5 kg-N/ha/yr (Weiss, pers. comm. 2007).

In summary, annual grasses that have dominated native grassland habitat in California since European settlement have displaced numerous species, and now due to increased nitrogen deposition annual grasses are able to colonize the otherwise nutrient poor, native serpentine bunchgrass communities. Continued spread of non-native vegetation threatens to degrade and eliminate areas that are occupied by the Bay checkerspot butterfly by reducing or eliminating both larval and adult host plants as well as increasing the distance of unsuitable habitat between extant occurrences of the butterfly.

<u>Development:</u> Development pressure in Santa Clara County is likely to increase. The City of San Jose has developed a General Plan to guide development into the year 2020. Portions of the general plan share boundaries with Bay checkerspot butterfly critical habitat units, including Units 5, 6, 7, and 9. In 1997, the California Court of Appeals found that the City of San Jose's zoning did not have to be consistent with the City's General Plan (*Juarez et al*. v. *City of San Jose et al*. (6^{th} District, Case No. CV736436 H014755)); this may result in areas not currently within the urban growth boundary still being proposed for development, including those areas that are environmentally sensitive such as serpentine grasslands. In 1977 the Calero Lake Estates, a 270-acre (27 lots) residential development, was authorized in the hills south of Santa Teresa County Park and north of Calero Reservoir. In 1998, H.T. Harvey and Associates (H.T. Harvey & Associates 1998, p. 11-12) documented larval and adult Bay checkerspot butterflies within the Calero Lake Estates. To date, only one residence has been constructed; however, the Service is currently reviewing a low-effect habitat conservation plan (HCP) for development of a second lot that will result in the loss of 1.3 acres and protection and management of 6.8 acres of serpentine grassland.

Activities at United Technologies Corporation's (UTC) San Jose site were discussed in the listing rule, but activities at UTC were not identified has posing a significant threat. In addition, at the time of listing no urban or commercial development had been proposed on lands owned by UTC that would "seriously alter" Bay checkerspot butterfly habitat (Service 1987, p. 35371). All work conducted at UTC (aside from grazing to control hazardous fuels) was outside Bay checkerspot butterfly habitat. Since grazing is one of the primary tools for managing Bay checkerspot butterfly habitat, UTC's actions within butterfly habitat have been beneficial. UTC is currently in the process of closing their San Jose plant (i.e., removing structures, soil remediation, etc.) and no work is currently planned in Bay checkerspot butterfly habitat aside from continued grazing. There has been no change in the status of the habitat owned by UTC.

Historically development of serpentine grasslands, and the resulting fragmentation, was a significant threat to the Bay checkerspot butterfly. Several sites with documented Bay checkerspot butterfly occurrences were lost as a result of development activities in San Mateo County. The population of Bay checkerspot butterflies near Hillsborough (San Mateo County), where the type locality was described, was lost in 1977 due to habitat loss (Service 1987, p. 35376). The Bay checkerspot butterflies at Woodside (San Mateo County) were lost after a housing development reduced the amount of habitat to approximately 26 acres (Service 1987, p. 35376) in the early 1980s. Several other populations in San Mateo County were splintered into smaller populations after construction of Interstate 280 and eventually became extirpated. Approximately 334 acres of habitat on the northern portion of Coyote Ridge in Santa Clara County was developed for a housing development (Ranch on Silver Creek) in the early 2000s and the population of Bay checkerspot butterflies at this site nearly disappeared. Establishment of a 473-acre on-site butterfly preserve and implementation of a grazing regime has improved the size of the population in recent years (53 adults, but no larvae in 2007), but the population is still not as robust as it was prior to the housing development (approximately 128,000 larvae in 1993). No larvae have been observed within the 473-acre on-site preserve since 1998 despite annual monitoring. It is uncertain whether the adults observed on the preserve are emigrants from other occupied areas on Coyote Ridge or if annual monitoring is simply not effective at locating larvae.

The distance between extant populations has increased due to loss of populations resulting from habitat modification (from development and conversion of native grasslands to non-native annual grasslands) that in turn reduces the likelihood that individuals from core populations can recolonize extirpated sites. Harrison *et al*. (1988, p. 371) hypothesized that habitats greater than 4.3 to 5.0 miles from a source population (Coyote Ridge in that study) were unlikely to ever sustain populations of the Bay checkerspot butterfly because the rate of extinction at small distant sites was more frequent than the rate of recolonization. Small populations at distances of more than 5 miles from core populations are unlikely to persist over time. As noted in the "Abundance" section above, the majority of historical populations are extirpated. The remaining populations have continued to decline in recent years, and Coyote Ridge is the only remaining core population. The population on the southern half of Tulare Hill, where habitat quality is higher than on the north side, has decreased to only one adult during the last two years of surveys and no observed larvae.

The Santa Clara Valley Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP) is expected to be completed and submitted for Service approval and permit issuance in 2010. According to the second Administrative Draft, the HCP/NCCP includes 519,506 acres (JSA 2009, p. 1-7) in Santa Clara County and encompasses all remaining populations of the Bay checkerspot butterfly. Development activities associated with the HCP/NCCP are expected to result in permanent impacts of no more than 550 acres of serpentine bunchgrass and 28 acres of serpentine rock outcrop (JSA 2009, Table 4-2). Development activities are also expected to result in no more than 67 acres of temporary impacts to serpentine bunchgrass and 1 acre of serpentine rock outcrop (JSA 2009, Table 4-3). A draft analysis of nitrogen deposition resulting from activities covered under the HCP/NCCP has been prepared, and once finalized and incorporated into the draft HCP/NCCP the above estimate of impacts is expected to increase. However, while impacts from nitrogen deposition are currently the most significant threat to the Bay checkerspot butterfly due to the resulting increase in non-native plant cover, they are indirect impacts and do not typically result in the permanent loss of habitat. For example, at existing nitrogen deposition rates, appropriate cattle grazing is an effective method of restoring and maintaining serpentine grasslands. Once fully implemented, the HCP/NCCP is expected to preserve approximately 6,742 acres of Bay checkerspot butterfly habitat as a Conservation Reserve, including the purchase of approximately 4,400 acres of currently unprotected Bay checkerspot butterfly habitat (JSA 2009, Table 5-20). While some impacts to Bay checkerspot butterfly habitat will occur under the HCP/NCCP, implementation of the HCP/NCCP is expected to contribute to the conservation of the Bay checkerspot butterfly in Santa Clara County because much of the habitat will be protected and managed (including implementation of grazing, invasive species control, and population monitoring) for the butterfly as well as other serpentine species, including the federally endangered Santa Clara Valley dudleya (*Dudleya setchellii*) and Metcalf Canyon jewelflower (*Streptanthus albidus* ssp. *albidus*). Permanent and temporary impacts are also expected from implementation of management and monitoring actions associated with the HCP/NCCP's Conservation Reserve area. Although these actions may result in some small amount of take of Bay checkerspot butterflies, overall the actions are expected to benefit the butterfly, as well as other species covered under the HCP/NCCP, by protecting, enhancing, and restoring Bay checkerspot butterfly habitat.

County Park improvements are proposed for coverage under the HCP/NCCP and are likely to occur in Santa Teresa Hills, Calero, and Coyote Lake-Harvey Bear Ranch County Parks, all of which have habitat for the Bay checkerspot butterfly and include historical occurrences. Potential effects to the Bay checkerspot butterfly in County Parks will primarily be related to new trail development and vegetation management, although specific plans identifying where these actions will occur have not yet been prepared. Expansion of the Kirby Canyon Landfill, located on Coyote Ridge south of Metcalf Road, is also proposed for coverage under the HCP/NCCP. The impact of the proposed landfill expansion on the Bay checkerspot butterfly was previously consulted on under section 7 of the Endangered Species Act (Service 1985; 1993; 1997; 2003); however, the applicants are seeking coverage under the HCP/NCCP to include species that may be listed in the future.

Today, development and fragmentation are less of a threat to the Bay checkerspot butterfly because much of the remaining habitat is protected in one form or another (conservation easements, State and County Parks, etc.) or will be protected. Much of the remaining occupied habitat in Santa Clara County is expected to be preserved and managed for the Bay checkerspot butterfly and other serpentine species under the Santa Clara Valley HCP/NCCP. However, a relatively small amount of habitat in Santa Clara County will be lost to development under the HCP/NCCP. If habitat that is impacted under the HCP/NCCP is located between two large populations or in the middle of a single large population, movement between or among the populations may be reduced. However, the Service is not aware of any specific plans for development that would fragment the remaining populations in Santa Clara County.

Vegetation Management: Overgrazing has previously been identified as a threat; however, a more common threat today is lack of or undergrazing. Grazing is frequently used as a management tool to reduce standing biomass of non-native vegetation; however, overgrazing can be a potential threat if grazing densities are not appropriately managed. Huenneke *et al*. (1990, p. 489) and Weiss (1999, p. 1480) found areas fenced to prevent grazing or where grazing had been removed, resulted in an increase in annual grasses, which crowd out forbs including those essential to the Bay checkerspot butterfly. Forbs continued to be an important component in areas that included limited grazing. Therefore, we consider a limited amount of grazing to be beneficial to Bay checkerspot butterfly habitat.

<u>Gopher control</u>: Gopher control may also be a threat, since larval host plants have been observed to stay green and edible longer when located on or near soils recently tilled by gophers (*Thomomys bottae*) (Singer 1972, p. 75; Murphy *et al*. 2004, p. 26). Huenneke *et al*. (1990, p. 490) hypothesized that soil disturbance by gophers may limit the growth of grasses similar to results of grazers reducing the standing grass biomass in a system, which allowed the persistence of small forbs. Larval host plants that stay green longer into the dry season may allow more prediapause larvae to reach their fourth instar and enter diapause. However, gopher control measures are not widely implemented in areas currently occupied by Bay checkerspot butterfly and the potential threat is low.

<u>Summary of Factor A:</u> In summary, the threat from invasion of non-native plant species (associated in part from nitrogen deposition) is one of the most significant current threats to the Bay checkerspot butterfly. The listing rule noted habitat loss from urban development (i.e., road construction, subdivisions, etc.) was a threat to the Bay checkerspot butterfly. The threat from development still exists, but is not as significant as it was historically, since a number of historical butterfly locations are currently under some form of protection (i.e., all historical occurrences in San Mateo County). In addition, completion of the Santa Clara Valley HCP/NCCP is expected to protect and manage several thousand acres of Bay checkerspot butterfly habitat, including areas on Coyote Ridge. Management of conserved lands under the Santa Clara Valley HCP/NCCP will include grazing and invasive species management programs to minimize the impacts of nitrogen deposition. The HCP/NCCP will also include an adaptive management plan that will allow for adjustments to grazing and invasive species programs to account for changes in these threats (such as new invasive species, or increased/decreased nitrogen deposition). See the discussion of "Recovery Criteria" below for information on conservation areas for the Bay checkerspot butterfly.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial, recreational, scientific, or educational purposes was noted in the listing rule. Overcollection was noted, but was described as not being a threat to any population. However, the Recovery Plan identified overcollection as likely having a significant negative impact on the subspecies. Collection of Bay checkerspot butterflies on San Bruno Mountain in the early 1980s, when collectors captured and kept all individuals encountered, in conjunction with the wildfire in 1986 likely contributed to the extirpation of the butterfly at this location (C.D. Nagano, Service, pers. comm. 2008). Adult specimens of rare butterflies are highly valued by private collectors, and an international market exists for illegally collected specimens, as well as other listed and rare butterflies (Ehrlich 1984). Butterflies in small populations are vulnerable to harm from collection of adult butterflies (Gall 1984a, 1984b). A population may be reduced to below sustainable numbers by removal of females, thereby reducing the probability that new populations will be founded. Collectors pose a threat because they may be unable to recognize when they are depleting colonies below the threshold of survival or recovery (Collins and Morris 1985; Hayes 1981). While the Service is not aware of recent instances of illegal collection, we still consider illegal collection a threat to Bay checkerspot butterfly populations because of the small size of many of the remaining populations.

Ehrlich and Murphy (1987, p. 128) reported that foot-traffic associated with intensive study of one Jasper Ridge population had a significant impact on the area's vegetation, and suggested that butterfly eggs, larvae, and pupae also may have been destroyed by the trampling. We do not have any additional information regarding the impact of foot-traffic on the Bay checkerspot butterfly.

Harrison *et al*. (1991, p. 227) examined the effects of scientific collection of the Bay checkerspot butterfly in two populations on Jasper Ridge. Harrison *et al*. (1991, p. 241) concluded that the effects of sampling are small (statistically undetectable) in comparison to variation in population size due to environmental factors; however, they did note that sampling appears to have increased the chances of extinction (as high as 15 percent) of two of the three populations at Jasper Ridge. Orive and Baughman (1989, p. 246) studied the effects of a mark-and-recapture study on the Bay checkerspot on Jasper Ridge, and found that handling by experienced researchers did not significantly increase observable wing-wear. However, Singer and Wedlake (1981, pp. 216-217) found that butterfly recapture rates were higher (21 percent) for the common bluebottle swallowtail (*Graphium sarpedon*) if they were marked without being handled, while handled butterflies were recaptured at a rate of only 2 percent. Currently the Service is not aware of any mark-and-recapture studies being conducted on the Bay checkerspot butterfly, as such mark-recapture studies are not currently viewed as a significant threat.

FACTOR C: Disease or Predation

At the time of the listing, parasitism by three species of parasitoids was not a major factor in determining the size of any Bay checkerspot butterfly population (Service 1987, p. 35376). The Service does not have any additional information on disease, predation, or parasitism in Bay checkerspot butterflies.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

Federal Protections:

At the time of listing, there were no regulatory mechanisms thought to adequately protect the butterfly from habitat loss, illegal collection, or harm resulting from other threats. Below is a summary of those Federal mechanisms that afford some protection to the Bay checkerspot butterfly.

Endangered Species Act of 1973, as amended (ESA): The ESA is the primary Federal law providing protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 CFR 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that result from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California's related Natural Community Conservation Planning program (such as the Santa Clara Valley HCP/NCCP in preparation).

National Environmental Policy Act (NEPA): NEPA (42 U.S.C. 4371 *et seq.*) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

The Lacey Act**:** The Lacey Act (P.L. 97-79), as amended in 16 U.S.C. 3371, makes unlawful the import, export, or transport of any wild animals whether alive or dead taken in violation of any United States or Indian tribal law, treaty, or regulation, as well as the trade of any of these items acquired through violations of foreign law. The Lacey Act further makes unlawful the selling, receiving, acquisition or purchasing of any wild animal, alive or dead. The designation of "wild animal" includes parts, products, eggs, or offspring. Since populations of the Bay checkerspot butterfly are known to have been impacted by illegal collection in the past (before listing), the Lacy Act affords some protection to the butterfly.

<u>The Clean Air Act (CAA)</u>: The CAA (P.L 101-549) relates to the reduction of smog and air pollution and is under the authority of the Environmental Protection Agency (EPA), although individual States generally implement the CAA. Vehicle emissions are regulated under the CAA and in the mid 1970s catalytic converters began to be installed in vehicles to reduce harmful emissions such as hydrocarbons. However, installation of catalytic converters resulted in an increase in the emission of nitrous oxides and ammonia. Other substances produced from internal combustion of fossil fuels include nitrogen oxides, nitric acid, nitrate, and ammonium. According to a report prepared for the California Energy Commission nitric acid and ammonia "have the highest deposition velocities, because they are highly soluble in water" (Weiss 2006b, p. 11). Ammonia is currently an unregulated emission (Weiss 2006b, p. 55). The current emission standards still result in the deposition of 10-15 kg N/ha/yr along portions of Coyote Ridge (Weiss 1999, p. 1482). Serpentine grasslands are believed to experience adverse impacts as a result of nitrogen deposition at rates of 5 kg N/ha/yr. Therefore, the existing air quality standards are inadequate to protect the butterfly from habitat degradation resulting from invasion by non-native vegetation due to excessive nitrogen.

<u>State Protections:</u>

The State's authority to conserve rare wildlife and plants is comprised of four major pieces of legislation: the California Endangered Species Act, the Native Plant Protection Act (NPPA), the California Environmental Quality Act, and the Natural Community Conservation Planning Act. Adult and larval host plants for the Bay checkerspot butterfly are not considered rare and therefore are not protected by the NPPA.

<u>California Endangered Species Act (CESA):</u> The CESA (California Fish and Game Code, section 2080 *et seq.*) does not provide protection to insects (sections 2062, 2067, and 2068, California Fish and Game Code).

<u>California Environmental Quality Act (CEQA)</u>: The CEQA requires full public disclosure of the potential environmental impact of proposed projects. The public agency with primary authority or jurisdiction over the project is designated as the lead agency and is responsible for conducting a review of the project and consulting with other agencies concerned with resources affected by the project. Section 15065 of CEQA guidelines requires a finding of significance if a project has the potential to reduce the number or restrict the range of a rare or endangered plant or animal (including insects). Species that are eligible for listing as rare, threatened, or endangered but are not so listed are given the same protection as those species that are officially listed with the State. Once significant impacts are identified, the lead agency has the option to require mitigation for effects through changes in the project or to decide that overriding considerations make mitigation infeasible. In the latter case, projects may be approved that cause significant environmental damage, such as destruction of endangered species. Protection of listed species through CEQA is, therefore, at the discretion of the lead agency. CEQA provides that, when overriding social and economic considerations can be demonstrated, project proposals may go forward, even in cases where the continued existence of the species may be jeopardized, or where adverse impacts are not mitigated to the point of insignificance.

Natural Community Conservation Planning Act (NCCP): The NCCP is a cooperative effort to protect regional habitats and species. The program helps identify and provide for area wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity. Many NCCPs are developed in conjunction with HCPs prepared pursuant to the Federal ESA. If included as a covered species, a NCCP would afford the butterfly considerable benefits, since the Act requires NCCPs contribute to the recovery of covered species.

Summary of Factor D: In summary, the Endangered Species Act is the primary Federal law that provides protection for this species since its listing as threatened in 1987. Other Federal or State regulatory mechanisms provide some discretionary protections for the butterfly; however, we believe other laws and regulations have limited ability to protect the Bay checkerspot butterfly in absence of the Endangered Species Act.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

At the time of listing habitat damage resulting from drought and overgrazing was noted as having caused the disappearance of four populations of Bay checkerspot butterfly (Murphy and Erlich 1980, p. 319). The listing rule also noted natural climatic changes in association with habitat that has been impaired. An additional threat noted in the Recovery Plan (Service 1998, pp. II-191-197) included pesticide use. Today, wildfire and small population size coupled with pesticides, extreme weather, and anthropogenic climate change are also threats under Factor E.

Pesticides: According to the California Department of Pesticide Regulation (CDPR), 1,388,327 pounds of pesticides were applied in Santa Clara County and 365,491 pounds were applied in San Mateo County in 2006. Use of pesticides (i.e., insecticides and herbicides) in or adjacent to areas with Bay checkerspot butterflies may negatively affect populations. Populations adjacent to areas where there is intensive use of pesticides may be at risk due to pesticide drift and runoff. In 1990 and 1992, De Snoo *et al*. (1998, p. 157) found that the number of butterfly species and number of individuals was significantly greater in the unsprayed margins of a field than in areas adjacent to treated fields. Longley *et al*. (1997, p. 165) observed increased larval mortality of cabbage white butterfly (*Pieris brassicae*) in hedge rows adjacent to conventionally sprayed headlands compared to those with a 6-meter buffer. In at least one instance, Bay checkerspot butterfly larvae appeared to have survived a direct application of malathion by the California Department of Food and Agriculture (to control Mediterranean fruit fly (*Ceratitis capitata*)); however, the application was conducted in the fall of 1981 when larvae were still in diapause. Malathion is a broad spectrum organophosphate insecticide used on a wide variety of agricultural crops. Malathion also has residential uses on ornamental plants, including lawns. Other uses for malathion include outdoor garbage dumps, mosquito control programs, as well as pasture and rangelands (EPA 2006, p. 5). Application of malathion may be by aircraft, irrigation systems, ground fogging, or hand sprayers and spreaders (EPA 2006, p. 5). According to the CDPR, in 2006, 1,626 pounds of malathion was applied in Santa Clara County and 205 pounds were applied in San Mateo County (CDPR 2006). There are more than 89,000 acres of agricultural land on the Santa Clara Valley floor west of Coyote Ridge and south of Tulare Hill. The exposure risk for Bay checkerspot butterflies on Coyote Ridge and Tulare Hill to malathion is likely low, but is dependent on the type of application. Applications that result in drift, such as that associated with aerial spraying or ground fogging, are the most likely type of application that could result in exposure of Bay checkerspot butterflies. The CDPR has no information regarding the application of malathion in areas currently occupied Bay checkerspot butterfly (CDPR 2006).

Homeowners, businesses, and public agencies make widespread use of organophosphates and *Bacillus thuringiensis* (Bt) (a bacteria) to eradicate pests (lepidopterans, coleopterans, and dipterans) such as the California oakworm (*Phryganidia californica*), light brown apple moth (*Epiphyas postvittana*), and other moth larvae that sometimes defoliate trees and crops. Other uses for Bt include mosquito control programs, maintenance of rights of way, landscape maintenance, and residential use (EPA 1998, p. 54-55). Application of Bt may be by aircraft, irrigation systems, and hand sprayers and spreaders (EPA 1998, p. 5). In 2006, 6,027 pounds of Bt was applied in Santa Clara County and 414 pounds in San Mateo County (CDPR 2006). Since Bt is widely used by State and County officials to control a number of invasive lepidopterans in order to protect agricultural resources, the exposure risk to Bay checkerspot butterflies may be high in occupied areas that are adjacent to application sites, especially if applied by aircraft over large areas (i.e., county-wide spraying). The CDPR has no information regarding application of Bt in areas currently occupied Bay checkerspot butterfly (CDPR 2006).

The following 12 pesticides have been identified as having or potentially having adverse effects on Bay checkerspot butterflies: acephate, azinphos-methyl, bendiocarb, chlorpyrifos, fenthion, naled, permethrin, S-fenvalerate, endosulfan, parathion, phorate, and trifluralin (Service, *in litt.* 1999, p. 3). These pesticides target a wide range of species including, but not limited to: white flies, black flies, beetles, roaches, ants, wasps, termites, grasshoppers, crickets, moths, leafhoppers, aphids, mosquitoes, lice, fleas, ticks, spiders, mites, and nematodes. Trifluralin is an herbicide and targets a range of vegetation including grasses, morning glory, millet, foxtail, nettles, thistles, and wild oats and barley. The majority of these 12 pesticides are used in agricultural operations (fruit, vegetables, nuts, orchards, sod farms, and nurseries to name a few), but they are also frequently used in residential and commercial areas. All 12 pesticides are applied by a variety of methods including by aerial spraying, backpack spraying, ground fogging, dusting, and granular application. Because the 12 pesticides are used to control a wide variety of organisms (including lepidopterans) and application methods include aerial spraying, the exposure risk to Bay checkerspot butterflies is potentially high in certain areas. Given that the majority of these 12 pesticides are used to treat agricultural crops, the risk of direct exposure from application within occupied habitat is relatively low since agricultural operations in Santa Clara County occur on the valley floor, while the Bay checkerspot butterflies occur primarily in the hills. However, the risk may be high in occupied areas that are adjacent to application sites, especially if applied by aircraft over large areas or ground fogging in residential areas adjacent to Bay checkerspot populations (such as the Ranch on Silver Creek).

According to the California Department of Pesticide Regulation (CDPR 2006), a combined total of 16,157 pounds of acephate, azinphos-methyl, chlorpyrifos, naled, and permethrin were applied in Santa Clara County in 2006 and 1,066 pounds of endosulfan and trifluralin were applied in Santa Clara County in 2006. In San Mateo County, approximately 3,292 pounds of acephate, chlorpyrifos, naled, and parmethrin were applied in 2006 and 65 pounds of endosulfan and trifluralin (CDPR 2006). The use of pesticides could result in adverse effects to the listed butterflies if their use occurs within or in close proximity to occupied habitat. Herbicides pose a threat to these animals if they kill the larval food plants or the adult nectar plants. Larvae of some species of lepidopterans are extremely sensitive to pesticides, and even soil around host plants may remain contaminated after the plant is safe (Mattoon *et al.* 1971, p. 254).

In summary, a variety of pesticides are used within the range of the Bay checkerspot butterfly, but the Service does not have specific information regarding pesticide use within occupied habitat. However, pesticides are known to affect a wide range of organisms and some target lepidoptera in particular. Given the general nature of pesticides the Service considers them to be a current threat to the Bay checkerspot butterfly. However, the Service does not have specific information regarding the use of the individual pesticides mentioned above or their possible adverse affects on the Bay checkerspot butterfly beyond a general understanding that pesticides are harmful to a variety of species, including butterflies.

<u>Wildfire:</u> No Bay checkerspot butterflies were observed on San Bruno Mountain after a wildfire burned portions of the mountain in 1986. However, only about 50 adult Bay checkerspot butterflies were observed on the mountain in 1984 (CNDDB 2006), so their subsequent disappearance may not have been solely related to the fire (overcollection and drought likely contributed to the extirpation at this site). Wildfire may pose a greater risk now than at listing, due to small population size and the current narrow distribution of the butterfly. Wildfires can burn large tracts of grassland habitats and the only remaining core population is on Coyote Ridge in primarily contiguous grassland. A large wildfire at this location could eliminate or result in substantial declines in the core population.

While wildfire poses a significant threat, prescribed fire can be an effective management tool in restoring native grassland ecosystems. The use of fire as a management regime in serpentine grasslands has not been well studied; however, use of prescribed burns may be an effective management tool depending on timing, intensity, and size of the area burned. An experimental prescribed burn was conducted over a small portion of Coyote Ridge in 2006, but the results have not yet been submitted to the Service. A wildfire on the northwest portion of Tulare Hill in 2004 resulted in higher densities of both larval host and adult nectar plants; however, population surveys have not been conducted on that portion of Tulare Hill.

<u>Small population size:</u> Small population size coupled with climate change was noted in the listing rule as a threat. The population size of the Bay checkerspot butterfly is heavily dependent on survival of prediapause larval, which in turn is tied to timing of host plant senescence. Host plant senescence, as discussed in the life history section above, is tied to the annual variation in precipitation and temperature as well as slope aspect (i.e., solar exposure). Populations that are reduced to a small size are less resilient to extreme weather and are prone to local extirpation. Given the Bay checkerspot butterfly's metapopulation dynamic, population fluctuations, local extirpations, and recolonization are normal occurrences for the subspecies (Ehrlich *et al*. 1975, pp. 221-228; 1980; Harrison 1994, pp. 111-128). However, small population size combined with the species' metapopulation dynamics, climate change, nitrogen deposition, development, and habitat fragmentation is likely a significant threat.

<u>Climate change:</u> Climate change is a threat to the Bay checkerspot butterfly as noted in both the listing rule and the Recovery Plan. At the time of listing, natural climate change was identified

in conjunction with habitat damage as reducing carrying capacity. However, since listing the threat from extreme weather (i.e., periods of prolonged drought or excessive rain) has been expanded to include anthropogenic climate change. One of the three populations at Jasper Ridge became extirpated in 1964 and then another in the late 1970s after severe droughts. Several populations of Bay checkerspot butterflies were known to disappear following the droughts in the late 1970s, including two in Alameda County, one on Pulgas Ridge, a site west of Uvus Reservoir (Service 1987, p. 35376; CNDDB 2008), west of Calero Reservoir (CNDDB 2008), near San Martin (CNDDB 2008), portions of the population in the Silver Creek Hills, and near Coyote Reservoir (Murphy and Ehrlich 1980, p. 319). Murphy and Weiss (1992, p. 6) stated that the droughts in the mid to late 1970s and 1980s resulted in extreme population declines including all populations (known at that time) in Santa Clara County except for the largest population on Coyote Ridge. Murphy and Weiss (1992, p. 6) also note in 1981-1983 (El Niño years) prolonged rains resulted in declines due to extended periods of pupal development. Murphy and Weiss (1992) postulated that the Kirby Canyon population (Coyote Ridge south of Metcalf Road) of Bay checkerspot butterflies may not adequately be able to withstand climate changes. The populations in southern Santa Clara County receive the least amount of rainfall in the range of the butterfly. McLaughlin *et al*. (2002a) analyzed precipitation records in the vicinity of San Jose from 1932-1998, which showed an increased variability in precipitation; the study indicated that increased variability in precipitation caused the local extinction of Bay checkerspot butterflies at the Jasper Ridge Biological Preserve (McLaughlin *et al*. 2002a, p. 547).

The Recovery Plan notes that the Bay checkerspot butterfly is very susceptible to climate change (Service 1998, p. II-197), since the butterfly's development (and mortality) is tied to its host plant's development, which in turn is temperature and rainfall dependent. Murphy and Weiss (1992) modeled the impact of four broad climate change scenarios on the Bay checkerspot butterfly in the San Francisco Bay area. According to Murphy and Weiss (1992, pp. 8-9), three out of the four scenarios modeled (warmer/drier, cooler/drier, and colder/wetter) would have negative impacts on the Bay checkerspot butterfly, as well as changes in the timing of rainfall. Seasonal rains that are too early or too late result in larval development being out of phase with their host plants (i.e., host plants senesced prior to larvae entering diapause). In addition, changes in temperature could shift the development period of the butterfly so that it is out of sync with its host plants. Hayhoe *et al*. (2004, p. 12423) estimated temperatures in California would increase by 1.35-1.6 degrees Celsius by midcentury and 2.3-3.3 degrees Celsius by the end of the century under low emission scenarios, and by 1.5-2.0 degrees Celsius by midcentury and 3.8-5.8 degrees Celsius by the end of century under high emission scenarios.

Forister and Shapiro (2003, p. 1131) observed that the mean date of first flight for 16 out of 23 butterfly species in northern California had moved towards an earlier date over 31 years. In four species the shift was significant and in two species the shift was approximately a month earlier (Forister and Shapiro 2003, p. 1132). As summarized by Parmesan (2006), climate variables explained 85 percent of the variation in flight date, with warmer, drier winters driving early flight. While none of the species in the study were in the genus *Euphydrys*, seven of the species were in the Nymphalidae family. The date of first flight was also observed to have increased in 26 out of 35 butterfly species in the United Kingdom (Roy and Sparks 2000 as cited in Parmesan 2006, p. 7). Stefanescu *et al*. (2003, p. 1498) found that 17 species of butterflies examined in their study had advanced first flight dates and eight with significant advances in mean flight dates. Visser and Holleman (2003, p. 292) observed decreased synchronization between hatching of winter moth (*Operophtera brumata*) eggs and oak bud burst (food plant for the moth) resulting from increased spring temperatures. Visser and Holleman (2003, p. 292) hypothesized that since larvae can only survive 2-3 days without food this mis-timing would lead to mortality or dispersal. Since prediapause larval Bay checkerspot butterflies are small and do not travel far, this would likely result in increased larval mortality.

A second concern with climate change is amount and frequency of rain events, drought, and heat waves. Bell *et al*. (2004, pp. 85-86) noted the frequency, number, and length of heat events would increase and the amount of rainfall would decrease through out most of California (including locations with Bay checkerspot butterflies). Hayhoe *et al* (2004, p. 12426) notes that by the end of the century, the length, frequency, and severity of extreme droughts increases in three out of four scenarios. Murphy and Weiss (1988, p. 189) stated that synchronicity of larvae and host plant senescence was poor in drought years. Increased frequency and duration of drought would likely result in higher larval mortality.

<u>Summary of Factor E:</u> The threats from climate change and wildfire are significant threats especially in conjunction with the current narrow distribution and small population size of the subspecies. Climate change and wildfire in conjunction with other impairment of habitat due to invasive and non-native vegetation, nitrogen deposition, and fragmentation and loss of habitat resulting from development, represent major threats to the Bay checkerspot butterfly. Pesticides were noted as a threat in the Recovery Plan. The Service has no information regarding the impact of pesticides on the Bay checkerspot butterfly beyond a general understanding that pesticides are harmful to a variety of species, including lepidopterans, and that pesticides are being applied in areas adjacent to extant occurrences of Bay checkerspot butterflies and may be applied within areas currently occupied by the butterfly.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough to downlist, or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

Delisting: The Bay checkerspot butterfly will be recommended for delisting with the completion of the following criteria (*Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* issued September 20, 1998):

1. *Core population – Adult populations of at least 8,000 butterflies, or populations of at least 20,000 postdiapause larvae, in 12 of 15 consecutive years, at each of the following areas: Kirby, Metcalf, San Felipe, Silver Creek Hills, Santa Teresa Hills, and Edgewood Park. Total population across all core areas should be at least 100,000 adults or 300,000 post-diapause larvae in each of the 12 years, with no recent severe decline.*

   Is criterion still valid: Yes.

   Listing factors addressed: Present or threatened destruction, modification or curtailment of its habitat or range (Factor A). Other natural or manmade factors affecting its continued existence (i.e., small population size, climate change) (Factor E).

   Has criterion been met: Criterion 1 has not been met; in fact, populations have continued to decline since listing. For specific information regarding size of populations in core areas, see the Abundance section above. This criterion is up-to-date and still relevant to the subspecies.

2. *Satellite populations – Adult populations of at least 1,000 butterflies, or populations of at least 3,000 postdiapause larvae, in 10 of 15 consecutive years, at each of at least nine distinct areas: three in San Mateo County, five in Santa Clara County, and one in Contra Costa County. Adult populations of at least 300 butterflies, or populations of at least 1,000 postdiapause larvae, in 8 of 15 consecutive years, at each of at least 18 additional distinct areas: 5 in San Mateo County, 10 in Santa Clara County, 1 in Alameda County, and 2 in Contra Costa County. To be "distinct," populations should be separated by at least 1 kilometer (3,000 feet) of unsuitable, unrestorable habitat.*

   Is criterion still valid: No. Satellite populations in Alameda and Contra Costa Counties are unlikely to be established naturally due to the distance between them and extant populations being several times greater than the known dispersal capabilities of the butterfly. Even if all recently occupied core and secondary habitats in San Mateo and Santa Clara Counties were occupied, the likelihood of recolonization and persistence in sites at distances greater than 5 miles from occupied core areas would be low (Harrison *et al*. 1988, p. 371). One peer reviewer on the proposed revised Critical Habitat designation for the Bay checkerspot butterfly commented that San Bruno Mountain was not within easy dispersal distance for the Bay checkerspot butterfly (Launer, *in litt.* 2008). A second peer reviewer stated that dispersal between San Bruno Mountain and Pulgas Ridge (approximately 10 miles south) is unlikely and should not be counted on as part of the metapopulation dynamics for the butterfly (Weiss, *in litt.* 2008). The historical sites in Alameda County are greater than 15 miles from San Bruno Mountain, 20 miles from Pulgas Ridge, and 40 miles from the nearest recent occurrence of Bay checkerspot butterflies (in Santa Clara County). The historical sites in Contra Costa Counties are further still. If butterflies were reintroduced to sites in Alameda and/or Contra Costa Counties, given the population dynamics of the butterfly coupled with the distance between potential reintroduction sites and extant populations, it is unlikely they would persist in the long term. Some species with metapopulation dynamics whose habitat has been fragmented due to anthropogenic causes are hardly ever likely to recolonize distant patches (Harrison 1994, p. 114).

Listing factors addressed: Present or threatened destruction, modification or curtailment of its habitat or range (Factor A). Other natural or manmade factors affecting its continued existence (i.e., small population size, climate change) (Factor E).

Has criterion been met: Criterion 2 has not been met. There are no remaining populations in Alameda, San Mateo, or Contra Costa Counties. The Service is only aware of recent survey data for one satellite population in Santa Clara County, Tulare Hill, where only one adult was observed in 2006 and 2007 (the last years for which population data are available). The butterfly has not been observed in Santa Teresa Hills since 1998, when one adult and two larvae were observed (H.T Harvey and Associates 1998, p. 11). The subspecies was last observed near Calero Reservoir in 1994 (CNDDB 2008), near San Martin in 1985 (CNDDB 2008), near Hale Avenue, west of the City of Morgan Hill, in 1997 (two adults) (CNDDB 2008), in the Kalana Hills in 1997 (one adult) (CNDDB 2008), and a site 2.5 miles west of the City of San Martin since 1985 (CNDDB 2008). Historically the butterfly may have occurred on Communications Hill, but the site has since been developed to a large degree for residential housing.

3. *Protection and management of habitat – Permanent protection of adequate primary (core population), secondary (moderate-sized satellite), and tertiary habitat (small-sized satellite) to support long-term persistence of the metapopulations detailed under criteria 1 and 2 above. For satellite populations, because of their natural tendency to wink in and out of existence at various sites, this will mean protecting more habitat areas than the minimum 9 moderate-sized and 18 small-sized populations. It is estimated that nearly all known suitable habitats in San Mateo, central and western Santa Clara, western Alameda, and Contra Costa Counties will be needed to support an adequate constellation of Bay checkerspot butterfly satellite populations. Appropriate adaptive management in perpetuity of the Bay checkerspot butterfly's native ecosystem should be guaranteed in all protected habitat, including secure funding for ongoing management.*

Is criterion still valid: This criterion only partially reflects the most up-to-date scientific data on the butterfly. As noted above for criterion 2, establishment and sustainability of populations in Alameda and Contra Costa Counties is unlikely due to the distance between them and extant populations. However, protection and management of habitat in Santa Clara County has restored some areas of degraded habitat (i.e., Silver Creek Hills) and allowed recolonization. Along the southern portion of Coyote Ridge (Kirby Canyon), protection and management of habitat has maintained large populations of the butterfly from 1997 to 2006 (Weiss 2006a, p. 1). In the absence of appropriate grazing regimes, the larval host plants would likely be outcompeted by non-native invasive grasses and the butterfly would be unlikely to persist (Huenneke *et al.* 1990, p. 489;

Weiss 1999, p. 1480). However, protecting habitat from development alone does not appear to be sufficient to maintain populations of Bay checkerspot butterflies. Many State and County parks are considered "protected" (i.e., not subject to development), but in the absence of appropriate grazing regimes, the larval host plants have been outcompeted by non-native invasive grasses and the butterfly has disappeared from most historical areas, even those areas that have not been developed and are largely undisturbed. In addition, many parks do not have conservation easements or deed restrictions, and portions of these lands could be subject to transfers to other owners, which could result in their being developed. Finally, the primary mission of many State and County Parks is recreation (trail development, hiking, horse back riding, etc.) and may not afford the same level of protection as areas that are conserved specifically for threatened and endangered species.

Listing factors addressed: Present or threatened destruction, modification or curtailment of its habitat or range (Factor A). Overutilization for commercial, recreational, scientific, or educational purposes (Factor B). Other natural or manmade factors affecting its continued existence (i.e., small population size, climate change) (Factor E).

Has criterion been met: Criterion 3 has been partially met. All known core and satellite areas in San Mateo County are under some form of protection (park open space, conservation easement, natural area, etc.). Approximately 577 acres of Bay checkerspot butterfly habitat is part of the San Bruno Mountain State and County Park and is protected and managed in accordance with the San Bruno Mountain Habitat Conservation Plan (HCP); however, management actions have been underfunded and many have not been carried out. Approximately 467 acres of the Edgewood Park core area is included in the Edgewood Park Natural Preserve; a management plan for the park has not yet been developed. All 179 acres of the Pulgas Ridge satellite area is managed as open space by the San Francisco Public Utilities Commission and may be included under a proposed HCP. All 329 acres of the Jasper Ridge satellite area is contained within Stanford University's Jasper Ridge Biological Preserve; however, the area is not managed for any species and is utilized by Stanford University primarily as a research facility. This area is currently part of a proposed HCP, but the HCP will not include the Bay checkerspot butterfly as a covered species. In total, approximately 1,552 acres of Bay checkerspot butterfly core and satellite habitats have been protected in San Mateo County, but most of these lands are not permanently protected under deed restrictions or conservation easements.

Approximately 308 acres of the Kirby Canyon area (southern portion of the Coyote Ridge core area) in Santa Clara County has been permanently protected and is being managed to benefit listed species, including the Bay checkerspot butterfly. Approximately 473 acres of the Silver Creek Hills area (extreme northern portion of the Coyote Ridge core area) has been permanently protected and is being managed to benefit listed species, including the Bay checkerspot butterfly. The Service is not aware of any areas within the Metcalf or San Felipe areas (northern portions of the Coyote Ridge core area) that are permanently protected or managed for the butterfly. Although the recovery criterion indicates the Santa Teresa Hills area is a core area, it has not been referred to as such in the literature. In the Santa Teresa Hills, approximately 420 acres are currently owned by Santa Clara County Parks and Recreation; however, the majority of habitat is not managed to benefit the butterfly. Approximately 1,201 acres of Bay checkerspot butterfly core habitat has been permanently protected and is managed for the butterfly in Santa Clara County.

Approximately 298 acres satellite area in Santa Clara County, in the City of San Martin adjacent to the Cordevalle golf club, has been permanently protected and is currently managed for listed species, including the Bay checkerspot butterfly. Approximately 116 acres are permanently protected and managed for the butterfly on Tulare Hill. In total approximately 414 acres of satellite areas in Santa Clara County have been permanently protected and are managed for the Bay checkerspot butterfly.

A third satellite area at Coyote Lake-Harvey Bear Ranch County Park in Santa Clara County is managed, but not permanently protect, for the butterfly and includes approximately 283 acres of Bay checkerspot butterfly critical habitat (Service 2008a). A portion of a fourth satellite area near Calero Reservoir is within the Calero County Park and is managed, but not permanently protected, for the butterfly and includes 875 acres of critical habitat Unit 8.

4. *Investigation and removal of existing or reasonably foreseeable threats to bay checkerspot butterfly populations and habitat.*

   Is criterion still valid: Yes.

   Listing factors addressed: Present or threatened destruction, modification or curtailment of its habitat or range (Factor A). Overutilization for commercial, recreational, scientific, or educational purposes (Factor B). Disease and predation (Factor C). Disease and predation (Factor D). Other natural or manmade factors affecting its continued existence (i.e., small population size, climate change) (Factor E).

   Has criterion been met: Criterion 4 has not been met. Several studies have examined threats to the butterfly or its habitat from invasion of non-native vegetation (Murphy and Weiss 1988; Huenneke *et al*. 1990; Weiss 1999; Weiss 2002; Malmstrom *et al.* 2005), over and under grazing (Weiss 2002; Weiss *et al*. 2007), overcollection (Harrison *et al*. 1991), disease and predation (White 1986), wildfires (CH2M Hill 2006), and climate change (Harrison *et al*. 1988; Murphy and Weiss 1992; McLaughlin *et al*. 2002; Zavaleta *et al*. 2003; Levine and Reese 2004). While none of the studies has resulted in the removal of these threats range wide, they have resulted in more effective vegetation management over portions of Tulare Hill and Coyote Ridge.

The recovery criteria implicitly address all four of the listing factors noted in the final rule to list the subspecies. Factor B, overutilization for commercial, recreational, scientific, or education purposes, was mentioned in the listing rule, but had not been identified as a threat to any population (Service 1987, p. 35376); however, Factor B is mentioned in the Recovery Plan as a threat (Service 1998, p. II-196) and is implicitly addressed in the recovery criteria.

IV. SYNTHESIS

The status of *Euphydryas editha bayensis*, which historically occurred in five San Francisco Bay Counties, has declined dramatically since it was listed as threatened in 1987. At the time the Recovery Plan was finalized in 1998, the butterfly was restricted to San Mateo and Santa Clara Counties, with each county having one core population and a few satellite populations. Since 1998, populations of the butterfly have continued to be lost, including the core population as well as all satellite populations in San Mateo County. Loss of all populations in Alameda, Contra Costa, and San Mateo Counties, despite most being largely protected from development in City, County, and State Parks, and inclusion of some of the areas within existing or proposed HCPs, indicates that habitat protection alone is not sufficient to protect the subspecies. The Bay checkerspot butterfly is now restricted to one core population (Coyote Ridge) and a few satellite populations within an approximate 9-mile radius of Coyote Ridge. None of the threats identified in the listing rule or the Recovery Plan have been reduced or eliminated. The butterfly is still at great risk from invasion of non-native vegetation, exacerbated by nitrogen deposition from air pollution. Despite the use of prescribed burns to control non-native vegetation, wildfires may pose a greater threat now than at the time of listing due to the extremely narrow distribution of the butterfly; a single wildlife across Coyote Ridge could eliminate a large percentage of the remaining individuals. Given the butterfly's much reduced distribution and a life history closely tied to timing of annual rainfall, the butterfly may not be capable of withstanding natural fluctuations in annual weather patterns (periodic droughts) let alone larger variations due to climate change. Finally, the majority of habitat in Santa Clara County is in private ownership and ongoing development pressure will result in additional fragmentation, including fragmentation of the only remaining core population. Considering the continued decline of the butterfly (including loss of all but one core population), continuation of most of the listing threats, and reduced range, we conclude the Bay checkerspot butterfly is at greater risk of extinction now than at the time of listing and warrants reclassification to endangered status.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
_X__ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
____ No Change

New Recovery Priority Number and Brief Rationale: No change is recommended. The recovery priority number for the Bay checkerspot butterfly is 3C, indicating a high threat level and a high recovery potential.

Listing and Reclassification Priority Number and Brief Rationale: The recommendation to uplist of the Bay checkerspot butterfly to endangered is given a reclassification number of 3, indicating it is a subspecies with a high magnitude and imminent threat (Service 1983).

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

Many of the recovery tasks identified in the Recovery Plan focus on securing and protecting serpentine habitats. All historical Bay checkerspot butterfly populations in San Mateo County are now extirpated despite the majority of these sites being protected from development. Protection of historical and existing sites alone appears to be insufficient to recover the butterfly. Management of many of the San Mateo sites is lacking and may have contributed to the loss of the butterfly in these areas. The development and implementation of appropriate management actions at multiple sites (Recovery task 3.1) maybe the most important step in protecting the Bay checkerspot butterfly. Once historical sites have management plans that are being implemented and habitat quality improves (i.e., through the establishment of grazing), initiation of introductions (Recovery task 6.2) should proceed in order to establish core and satellite populations outside of Santa Clara County. A third important task should be the establishment of artificial rearing techniques (Recovery task 5.41). Multiple reintroductions to the same site are likely to be necessary to establish populations (Weiss, pers. comm. 2008). Establishment of artificial rearing techniques for this subspecies including captive populations would allow multiple reintroductions of the butterfly without depleting the only remaining core population.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

Bay checkerspot butterfly (*Euphydryas editha bayensis*)

Current Classification: Threatened

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
_X_ Uplist to Endangered
____ Delist
____ No change needed

Appropriate Listing/Reclassification Priority Number: 6

Review Conducted By: __SFWO staff____________________

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve [signature] Date 7.16.09

REGIONAL OFFICE APPROVAL:

Lead Regional Director, U.S. Fish and Wildlife Service, Region 8

Approve [signature] Date 8/17/09

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

COMPETITIVE ENTERPRISE INSTITUTE, *et al.*, *Petitioners*, v. NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, *et al.*, *Respondents*.	No. 20-1145

DECLARATION OF ROBERT WEISSMAN

1. My name is Robert Weissman. I am President of Public Citizen, Inc.

2. Public Citizen is a non-profit consumer advocacy group that represents the interests of its members on a wide range of issues before administrative agencies, courts and legislatures. Public Citizen has long been involved in regulatory issues involving the automobile industry, including issues related to emissions standards regulated by the Environmental Protection Agency (EPA), as well as matters falling within the regulatory authority of the National Highway Traffic Safety Administration (NHTSA), such as fuel economy and motor vehicle safety.

Public Citizen's organizational mission includes advocating for the interests of its members in the availability of clean, safe, and economical motor vehicles.

3. Public Citizen has tens of thousands of members nationwide, and a great many of them purchase new automobiles in any given year.

4. Until recently, EPA emissions standards required substantial year-over-year decreases in greenhouse gas emissions for automobiles produced in model years 2021 to 2025 and thus would require automakers to provide a wider range of lower-emission vehicles than they would without those standards in place. Those standards protected the interests of consumers, including thousands of Public Citizen members, in the availability of a broad selection of low-emission vehicles during those model years. Such vehicles are important to consumers, including Public Citizen members, who believe in choosing vehicles that will contribute less to global warming than higher-emission vehicles. Such low-emission vehicles are also beneficial to consumers because they often achieve emissions reductions in part through increased fuel efficiency, and they are therefore less expensive to operate.

5. For its part, NHTSA had promulgated relatively stringent fuel-economy standards through model year 2021 and had issued a set of "augural" standards it expected to issue for model years 2022 through 2025 that would require substantial year-over-year increases in fuel economy during those years.

5. EPA's issuance of a new set of greenhouse gas emissions standards for model years 2021 through 2026, and NHTSA's promulgation of fuel efficiency standards covering those years, which call for (respectively) substantially smaller year-over-year decreases in greenhouse gas emissions and substantially smaller year-over-year increases in fuel economy than did EPA's prior standards and NHTSA's former 2021 fuel economy standard and its "augural" 2022 through 2025 standards, threaten the protection of consumer interests, including the interests of Public Citizen's members, provided by the former standards. EPA's and NHTSA's actions allow automakers to produce a mix of vehicles including more higher-emission and lower-fuel-economy vehicles, and correspondingly fewer lower-emission and higher-fuel-economy vehicles. That directly affects interests of Public Citizen members and other consumers, and causes them injury, by reducing their

ability to choose from among a broad range of low-emission and high-fuel-economy vehicles when purchasing a new car.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 28, 2020.

Robert Weissman

Declaration of Ann Wiley

I, Ann Wiley, declare as follows:

1. The facts set forth in this declaration are based on my personal knowledge and if called as a witness, I could and would competently testify thereto under oath. As to those matters which reflect a matter of opinion, they reflect my personal opinion and judgment upon the matter.
2. I have been a member of the Center for Biological Diversity since 2009. I participate in action alerts, read the online newsletters, and follow all of the Center's current issues. As a member, I rely in part on the Center to represent my interest in conserving endangered species and their habitats.
3. I am deeply concerned about the impacts of climate change and sea-level rise on nesting sea turtles.
4. Growing up in the Pacific Northwest, I had a tremendous appreciation and love for the outdoors and spent much time hiking, biking, skiing, sailing, and learning about the flora and fauna. I moved to south Florida in 1984 and had to learn a new world – new plants, animals, birds, trees, soils, and ecosystems. Through volunteering, studying, taking courses, and working and spending time in the different ecosystems, I learned a lot about the uniqueness, wild places, and wildlife of south Florida.

5. I live approximately five miles west of loggerhead and green sea turtle nesting habitat in Fort Lauderdale, Florida. I began volunteering with loggerhead sea turtles in 1986 with the Key Biscayne sea turtle program in Miami, Florida. I relocated nests to hatcheries, released hatchlings, excavated hatched nests, and collected data. I also volunteered with the Nova Southeastern University sea turtle program in Fort Lauderdale in the early 1990s. My responsibilities there were similar to those on Key Biscayne.

6. In 2007, I began volunteering with Sea Turtle Oversight Protection ("STOP") in Broward County, Florida. STOP is permitted under the Fish and Wildlife Commission to document disorientation events of sea turtle hatchlings, collect the disoriented hatchlings, and release them in the sea or take them to a rehabilitation facility if needed. (Hatchlings disorient, or move away from the ocean, when they hatch at night near artificial light, moving toward the source of the artificial light instead of the ocean.) That data is given to the code department, the Fish and Wildlife Conservation Commission, and the U.S. Fish and Wildlife Service, with whom STOP works closely. We also work with condos and oceanfront properties regarding coastal lighting ordinances. From 2010-2013, I was out on the beach 5 to 7 nights a week from 8 p.m. to 4 a.m. from mid-June through

mid-November. Over the years, I have seen hundreds of sea turtle mothers nest, and I have released thousands of hatchlings.

7. I have also worked as an ecological tour guide in south Florida for fourteen years. Our clients are from around the world. I conduct full-day tours for corporate clients and offer a turtle tour, taking them to three separate areas that relate to turtles and their nesting habitat. Our turtle tour is very much in demand. Each tour benefits local non-profits such as: Gumbo Limbo Environmental Center, Loggerhead Marine Life Center, and Nature Conservancy's Blowing Rock Preserve. We then lunch at a local restaurant. I also have private clients who join me for a day to a week to learn about sea turtles and the coastal and near shore habitats. I also give lectures to Road Scholar groups regarding sea turtles and coastal ecosystems. During my busiest season with Road Scholar, I gave about 15 talks in 5 months. Before COVID and in our very busy season, I also led about 5-6 ecological tours a week. That has slowed down some because of the coronavirus health crisis. However, I continue to lead some tours and give talks to conservation groups for free.

8. I will continue volunteering with STOP monitoring hatch-outs and working as a guide teaching visitors and locals about sea turtles and their habitat and life cycles into the foreseeable future, and will continue visiting sea turtle

nesting beaches during nesting season 5–7 nights per week. There are few things more wondrous to see on a hot steaming night in south Florida than a mama sea turtle at the end of her thousand-mile journey, cautiously pulling herself ashore, on her natal beach, returning to be a mom. As her dark round form emerges from the white curl of the surf, children's eyes fly open and adults gasp. I have had many a tourist tell me that no matter what they had done on their vacation, where they had eaten, shopped or traveled, seeing this sight was the highest point of their entire vacation. Many return year after year to join STOP on the beach to see and protect the nesting mothers and their hatchlings. From all corners of the earth – they have fallen in love with the sea turtle. Each hatchling I release is with joy and deep sorrow. I know what lies ahead for them and that much of that hardship, injury, and death will be caused by humankind.

9. Over the years that I have lived in south Florida, we have begun to experience more storms, stronger storms, hotter summers, hotter winters, and very different rain cycles. Sea-level rise became apparent here at least 10 years ago. Streets east of downtown Fort Lauderdale flood seasonally with each high tide, pump stations have been planned and are being built, and sea walls and streets are being raised. I live on the North Fork of the

New River, and each October, for the past three years, my dock has been under water at each high tide. This is a new phenomenon.

10. The coastal areas are most impacted by these storm systems. Repeatedly over the past several years, we have seen strong storms, more frequent and more powerful, break away from the coastline and carry hundreds of yet unhatched sea turtle nests out to sea. These are generally the green and loggerhead nests that suffer this loss.

11. The loggerhead sea turtle and green sea turtle are listed species under the Endangered Species Act. They are being harmed by the loss of safe coastal habitat, sea-level rise, and increased storms and storm surges that inundate their nests. I live 8 feet above sea level.

12. I am aware that this spring, the U.S. Environmental Protection Agency ("EPA") and the National Highway Traffic Safety Administration ("NHTSA") issued emission standards for cars and light trucks, rolling back previous standards. I have learned that this rule will increase carbon dioxide emissions by roughly a billion tons over the next decade and beyond. I am also aware that the rule acknowledges that the massive CO_2 emissions will increase the harmful effects of climate change, including worsening sea-level rise, and increasing heavy precipitation events and temperatures.

13. That the Federal Government, especially under the Trump administration, has not only not decreased, but has actually *increased* the amount of allowable emissions is of serious concern to me, not only for myself but for the many listed and native species who are losing the habit they need to procreate and survive.

14. My profession, my volunteer work, and my free-time enjoyment would all be damaged, hurt, and injured by the decline in sea turtle populations.

15. I became a certified scuba diver shortly after moving to Florida in 1984, where recreational diving is a huge industry. To watch a sea turtle glide by is a beautiful and memorable site for any diver.

16. My family has been quite connected with the Burke Museum of Natural History at the University of Washington in Seattle, one of the leading natural history museums in the country. Every summer they have a very successful fundraiser. Last spring, the fundraiser dinner raised over $500,000 in one night. I was asked if I would donate a four-day sea turtle tour. I lined up everything: hotels, meals, tours, travel, etc. A few weeks before the dinner auction, the Burke called and asked if I would be willing to do it twice, as they felt many people would bid on it. They were right. Each trip, valued at about $3,000, sold for $8,500, bringing in $17,000 for the Burke. People

went nuts over the concept. The first group came last September, and it was a smash hit.

17. The economy of south Florida is driven by the beauty and uniqueness of its gorgeous and diverse ecosystems. It is why people come here. From the miraculous Everglades, Big Cypress, and Ten Thousand Islands, to the coastal beaches, the world-class bird watching, and the coral reefs, money pours in so that people can see these natural jewels. The loss of nesting habitat due to sea-level rise and climate-crisis-fueled storms could affect my income, decrease my number of tours and talks, and effectively decrease the number of tourists who visit the turtle-related locations that we visit on our tours.

18. I believe that the earth and its ecosystems, and the native animals who live in them, have inherent, intrinsic value, completely unrelated to man. I believe that biodiversity is what makes life, and what makes life worthwhile. I believe that sea turtles have the inherent right to live a safe and healthy life in their oceans and their beaches. Man has evolved such that he has the power to aid or destroy all other species. No other single species can do this. It is our duty and obligation to preserve and protect the wondrous world we

are each visiting. In the moment that the tiny newborn sea turtle enters his solo journey into the unknown, dark, endless expanse of a danger filled sea, if God is not there with him, where is He?

19. I believe, and am afraid, that the vehicle emissions rule EPA and NHTSA issued in 2020 will worsen the climate crisis, increase sea-level rise, worsen storms and will directly cause injury and loss to nesting sea turtles, including by inundating nests.

I declare under penalty of perjury that the foregoing is true and correct and was executed on December 15, 2020 in Fort Lauderdale, Florida.

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DECLARATION OF SHAYE WOLF
FOR THE CENTER FOR BIOLOGICAL DIVERSITY

I, Shaye Wolf, declare as follows:

1. The facts set forth in this declaration are based on my personal knowledge and if called as a witness, I could and would testify competently thereto under oath. I reside in the city of Kensington, California.

2. I am the Climate Science Director in the Climate Law Institute at the Center for Biological Diversity ("Center"), where I have worked since 2007. I received my Bachelor of Science degree in Biology at Yale University, my Master of Science degree in Ocean Sciences at the University of California, Santa Cruz, and my Ph.D. in Ecology and Evolutionary Biology from the University of California, Santa Cruz. My doctoral work, focused on forecasting the effects of climate change on seabird populations along the west coast of the United States, was published in *Global Change Biology* and *Ecology*.[1] (Please see Exhibit A for a full list of references).

[1] Shaye G. Wolf et al., *Predicting population consequences of ocean climate change for an ecosystem sentinel, the seabird Cassin's auklet*, 16 GLOBAL CHANGE BIOLOGY 1923 (2010)*;* Shaye G. Wolf et al., *Range-wide reproductive consequences of marine climate variability for the seabird Cassin's auklet*, 90 ECOLOGY 742 (2009).

3. In my role as Climate Science Director for the Center's Climate Law Institute, I have developed expertise in the identification and mitigation of the harms from anthropogenic climate change to human communities, species, and ecosystems. In my role, I regularly review scientific studies and reports on climate change; communicate with scientists and the public about climate change; attend scientific conferences on climate change; author technical comments, reports, and other publications on the harms of climate change to human communities, species, and ecosystems; contribute to climate change mitigation and adaptation plans; and support the Center for Biological Diversity's work fighting the climate crisis by urging and compelling all levels of government to implement urgent, large-scale cuts in greenhouse gas pollution—focused on phasing out fossil fuel production and combustion—to avoid devastating harms from climate change.

The SAFE Rule Will Significantly Increase Greenhouse Gas and Criteria Pollutant Emissions

4. The Trump administration's Safer Affordable Fuel Efficient (SAFE) Vehicles Rule for Model Years 2021-2026, paired with the National Highway Traffic Safety Administration's (NHTSA) Preemption Rule and the Environmental Protection Agency's (EPA) Waiver Withdrawal under the One National Program Rule, will result in significant increases in greenhouse gas pollution and criteria

pollutant emissions, including nitrogen oxide (NOx) and sulfur dioxide (SO_2), as compared to the standards finalized under the Obama administration. According to the analysis by EPA and NHTSA, the SAFE Rule would result in substantial additional carbon emissions: approximately 867 to 923 million metric tons of additional CO_2 emissions over the lifetimes of vehicles through Model Year (MY) 2029[2] and an additional 7.8 billion metric tons of CO_2 emissions between 2021 to 2100, compared to the No Action Alternative.[3] In addition, according to EPA and NHTSA, the Rule would result in increased emissions of two other potent greenhouse gases: 1.116 to 1.182 million metric tons of additional methane, a super-pollutant 87 times more powerful than CO_2 at warming the climate over a 20-year timeframe, and 19,500 to 24,300 metric tons of additional nitrous oxide emissions over the lifetimes of vehicles through MY 2029, compared with the No Action Alternative.[4]

5. The SAFE Rule will also increase emissions of criteria pollutants including NOx, and SO_2.[5] EPA and NHTSA estimated that the SAFE Rule would result in a cumulative increase in NOx of 20,500 to 25,500 metric tons over the

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[2] Nat'l Highway Traffic Safety Admin., The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Year 2021–2026 Passenger Cars and Light Trucks, Final Rule, 85 Fed. Reg. 24174, at 24176, Tables I-5, I-6, VII-116, VII-117, VII-118, VII-119 (Apr. 30, 2020) (to be codified at 40 C.F.R. pts. 86 & 600) ("Final Rule").
[3] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE SAFER AFFORDABLE FUEL-EFFICIENT (SAFE) VEHICLES RULE FOR MODEL YEAR 2021–2026 PASSENGER CARS AND LIGHT TRUCKS, at Table 5.4.1-1 (Mar. 2020) ("FEIS").
[4] FEIS at 5-36; Final Rule at Tables VII-117, VII-119.
[5] Final Rule at Tables VII-120 to VII-127.

lifetime of vehicles through MY 2029, compared to the No Action Alternative.[6] EPA and NHTSA also estimated that the SAFE Rule would result in a cumulative increase in SO_2 of 22,400 metric tons over the lifetimes of vehicles through MY 2029, although the agencies alternately estimated the potential for a much smaller cumulative decrease in SO_2 of 7.2 thousand metric tons from the Rule.[7]

6. However, the greenhouse gas and criteria pollutant emissions from the Rule are likely to be much higher than estimated by these agencies. An independent analysis estimated that the SAFE Rule would result in an additional 1.5 billion metric tons of climate pollution by 2040—an amount equivalent to the total pollution from 68 coal plants operating for five years.[8]

7. Furthermore, the agencies' Final Regulatory Impacts Analysis (FRIA) indicates that NOx and SO_2 pollution are likely to be much higher than estimated under the Rule. Specifically, the agencies assume that only half of the increased gasoline consumption under the Rule would come from U.S. refineries with the other half coming from imported gasoline refined in other countries. However, given that the U.S. is the world's biggest crude oil producer with abundant refining capacity, the increase in gasoline consumption is likely to be met by domestic refining of crude oil produced in the U.S. Under this more likely scenario, the

[6] Final Rule at Tables VII-120, VII-121, VII-122, VII-123.
[7] Final Rule at Tables VII-120, VII-121, VII-122, VII-123.
[8] ENVTL. DEFENSE FUND, TRUMP ADMINISTRATION MOVES AHEAD WITH HARMFUL CLEAN CARS ROLLBACK, https://www.edf.org/sites/default/files/Cars_Final_Rollback_Factsheet.pdf.

SAFE Rule would result in much more upstream NOx and SO_2 pollution from U.S. refineries. The FRIA includes a sensitivity run reflecting this scenario, in which 100 percent of incremental refining will be domestic (the "Maximum Impact on Domestic Refining" scenario). In this scenario, cumulative NOx emissions increase three to fourfold, from 20.5 thousand metric tons to 80.6 thousand metric tons under the CAFE program and from 25.5 thousand metric tons to 78.6 thousand metric tons under the CO_2 program.[9] Similarly, cumulative SO_2 emissions increase substantially from -7.2 thousand metric tons to 36.1 thousand metric tons under the CAFE program and from 22.4 thousand metric tons to 60.9 thousand metric tons under the CO_2 program.[10]

Scientific Evidence Connects the Dots Between Greenhouse Gas and Criteria Pollutant Emissions and the Harms to Threatened and Endangered Species

8. Importantly, overwhelming scientific evidence shows that greenhouse gases, NOx, and SO_2, as well as other gaseous sulfur oxides (SOx), harm endangered animal and plant species in ways that are causally understood and measurable. As detailed below, an extensive body of scientific research has established the causal relationships between greenhouse gas and criteria pollutant

[9] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN. & U.S. ENVTL. PROTECTION AGENCY, FINAL REGULATORY IMPACT ANALYSIS: THE SAFER AFFORDABLE FUEL-EFFICIENT (SAFE) VEHICLES RULE FOR MODEL YEAR 2021 – 2026 PASSENGER CARS AND LIGHT TRUCKS, at 1797, 1800 (July 1, 2020) ("FRIA").
[10] *Id.*

emissions and impacts to listed species, connecting the dots between the emissions of these pollutants and their resulting species-specific effects.

Greenhouse Gas Pollution Harms Listed Species

9. The U.S. National Climate Assessments, scientific syntheses prepared by hundreds of scientific experts and reviewed by the National Academy of Sciences and federal agencies, including the EPA and Department of Transportation, have repeatedly recognized that human-caused climate change is causing widespread and intensifying harms to natural systems, including to species and ecosystems. Most recently, the Fourth National Climate Assessment, comprised of the 2017 *Climate Science Special Report* (Volume I)[11] and the 2018 *Impacts, Risks, and Adaptation in the United States* (Volume II),[12] concluded that greenhouse gas emissions—primarily from the burning of fossil fuels—are driving rising temperatures, the increasing frequency of heat waves and other extreme weather events, sea level rise and increasing storm surge, the rapid loss of Arctic sea ice and the collapse of Antarctic ice shelves, decreasing snowpack, and ocean

[11] U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, VOL. I (2017) ("USGCRP Vol. I 2017"), https://science2017.globalchange.gov/.
[12] U.S. GLOBAL CHANGE RESEARCH PROGRAM, IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES, FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II (2018) ("USGCRP Vol II 2018"), https://nca2018.globalchange.gov/.

warming and ocean acidification, among other climate impacts that "continue to impact species and populations in significant and observable ways."[13]

10. Greenhouse gas emissions and resulting climate disruption are increasing stress on species and ecosystems—causing changes in species' distribution, phenology, physiology, survival and reproductive rates, genetics, ecosystem structure and processes—and increasing extinction risk.[14] As greenhouse gases continue to rise, many species are losing their habitats and being forced to move upward and poleward to try to keep pace with suitable climate conditions, physical features such as body size are changing, species are shifting their timing of breeding and migration, and entire ecosystems are under stress.[15] Climate change-related local extinctions are already widespread, with one study finding that almost half of the 976 species surveyed have already suffered local extinctions related to climate change.[16]

[13] *Id*. at 269, 281.
[14] Rachel Warren et al., *Increasing impacts of climate change upon ecosystems with increasing global mean temperature rise*, 106 CLIMATIC CHANGE 141 (2011) ("Warren et al. 2011").
[15] Camille Parmesan & Gary Yohe, *A globally coherent fingerprint of climate change impacts across natural systems*, 421 NATURE 37 (2003); Terry L. Root et al., *Fingerprints of global warming on wild animals and plants*, 421 NATURE 57 (2003); Camille Parmesan, *Ecological and evolutionary responses to recent climate change*, 37 ANN. REV. OF ECOLOGY, EVOLUTION, AND SYSTEMATICS 637 (2006); I-Ching Chen et al., *Rapid range shifts of species associated with high levels of climate warming*, 333 SCIENCE 1024 (2011); Ilya M. D. Maclean & Robert J. Wilson, *Recent ecological responses to climate change support predictions of high extinction risk*, 108 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. OF THE U.S. 12337 (2011) ("Maclean and Wilson 2011"); Warren et al. 2011; Abigail E. Cahill et al., *How does climate change cause extinction?*, 280 PROC. OF THE ROYAL SOC'Y B 20121890 (2012).
[16] John J. Wiens, *Climate-related local extinctions are already widespread among plant and animal species*, 14 PLOS BIOLOGY e2001104 (2016).

11. Scientific studies have projected catastrophic species extinction during this century if greenhouse gases continue to rise unabated.[17] One 2020 analysis projected the extinction of up to a third or more of animal and plant species in the next 50 years.[18] As the Third National Climate Assessment warned, "landscapes and seascapes are changing rapidly, and species, including many iconic species, may disappear from regions where they have been prevalent or become extinct, altering some regions so much that their mix of plant and animal life will become almost unrecognizable."[19]

12. As a result of these well-documented impacts, many federally listed species face intensifying harms and rising extinction risk from increasing greenhouse gas pollution.

The Polar Bear Will Be Harmed by the SAFE Rule

13. The polar bear (*Ursus maritimus*) is a clear example of one of the many threatened and endangered species that will be harmed by the significant increase in greenhouse gases caused by the SAFE Rule. In 2008, the Fish and

[17] Chris. D. Thomas et al., *Extinction risk from climate change*, 427 NATURE 145 (2004); Maclean and Wilson 2011; Mark C. Urban, *Accelerating extinction risk from climate change*, 348 SCIENCE 571 (2015).
[18] Cristian Román-Palacios & John J. Wiens, *Recent responses to climate change reveal the drivers of species extinction and survival*, 117 PROC. OF THE NAT'L ACAD. OF SCI. OF THE U.S. 4211 (2020).
[19] Peter M. Groffman et al., *Ecosystems, Biodiversity, and Ecosystem Services in* CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT, U.S. Global Change Research Program, at 196 (Melillo, Jerry M. et al. eds., 2014), https://www.globalchange.gov/browse/reports/climate-change-impacts-united-states-third-national-climate-assessment-0.

Wildlife Service listed the polar bear as a threatened species due to rising greenhouse gas emissions which are causing the warming of the Arctic and the resulting loss of the polar bear's sea ice habitat.[20]

14. Rapid Arctic warming and disappearance of sea ice are some of the most striking harms from greenhouse gas pollution. As highlighted by the Fourth National Climate Assessment, Alaska and the Arctic have experienced some of the most severe and rapid temperature rise associated with climate change.[21] Alaska has warmed twice as fast as the global average since the mid-20th century, and this trend is expected to continue.[22] In parallel, Arctic summer sea ice extent and thickness have decreased by a shocking 40 percent during the past several decades,[23] with the Bering, Chukchi, and Beaufort Sea off Alaska suffering some of the fastest losses.[24] The length of the sea ice season is getting shorter as ice melts earlier in spring and forms later in autumn.[25] Along Alaska's northern and western coasts, the sea ice season has contracted by more than 90 days.[26] As greenhouse gas emissions continue to rise, the Arctic is projected to be virtually

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[20] U.S. Fish and Wildlife Serv., Determination of Threatened Status for the Polar Bear (*Ursus maritimus*) Throughout Its Range, 73 Fed. Reg.28212, 28293 (May 15, 2008) (to be codified 50 C.F.R. pt. 17).
[21] USGCRP Vol II 2018 at 91-92.
[22] USGCRP Vol II 2018 at 43.
[23] Walter N. Meier et al., *Arctic sea ice in transformation: A review of recent observed changes and impacts on biology and human activity*, 51 REV. OF GEOPHYSICS 185 (2014); USGCRP Vol I 2017 at 29, 57, 303.
[24] USGCRP Vol. I 2017 at 305; Karen E. Frey et al., *Divergent patterns of recent sea ice cover across the Bering, Chukchi and Beaufort seas of the Pacific Arctic Region*, 136 PROGRESS IN OCEANOGRAPHY 32 (2015); G. Carleton Ray et al., *Decadal Bering Sea seascape change: consequences for Pacific walruses and indigenous hunters*, 26 ECOLOGICAL APPLICATIONS 24 (2016).
[25] Claire L. Parkinson, *Spatially mapped reductions in the length of the Arctic sea ice season*, 41 GEOPHYSICAL RES. LETTERS 4316 (2014); USGCRP Vol I 2017 at 307.
[26] USGCRP Vol I 2017 at 307.

ice-free in summer by 2040,[27] which would be a shocking loss given that minimum summer sea ice averaged 2.64 million square miles during 1979 to 1992.[28]

15. It is precisely this rapid sea ice loss that led the U.S. Fish and Wildlife Service (FWS) to list the polar bear as a threatened species.[29] The polar bear relies on sea ice for all its essential activities, including hunting seals, finding mates, and building dens to rear cubs.[30] Recognizing the critical importance of sea ice for polar bear survival, FWS designated 179,508 square miles of sea ice habitat off Alaska as critical habitat for the polar bear in 2010.[31]

16. Federal documents acknowledge that shrinkage and premature breakup of sea ice due to climate change is the primary threat to the species, leaving bears with vastly diminished hunting grounds, less time to hunt, and a shortage of sea ice for other essential activities such as finding mates and resting.[32]

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[27] James E. Overland & Muyin Wang, *When will the summer Arctic be nearly sea ice free?*, 40 GEOPHYSICAL RES. LETTERS 2097 (2013); Muyin Wang & James E. Overland, *Projected future duration of the sea ice-free season in the Alaskan Arctic*, 136 PROGRESS IN OCEANOGRAPHY 50 (2015); USGCRP Vol I 2017 at 29, 303.

[28] Nat'l Oceanic and Atmospheric Admin., Climate Change: Arctic Sea Ice Summer Minimum, Climate.gov, Sept. 8, 2020, https://www.climate.gov/news-features/understanding-climate/climate-change-minimum-arctic-sea-ice-extent.

[29] Determination of Threatened Status for the Polar Bear (*Ursus maritimus*) Throughout Its Range, 73 Fed. Reg. 28212 at 28293, "On the basis of our thorough evaluation of the best available scientific and commercial information regarding present and future threats to the polar bear posed by the five listing factors under the Act, we have determined that the polar bear is threatened throughout its range by habitat loss (i.e., sea ice recession). We have determined that there are no known regulatory mechanisms in place at the national or international level that directly and effectively address the primary threat to polar bears—the rangewide loss of sea ice habitat."

[30] *Id.*

[31] U.S. Fish and Wildlife Serv., Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Polar Bear (*Ursus maritimus*) in the United States, 75 Fed. Reg. 76086 (Dec. 7, 2010) (to be codified at 50 C.F.R pt. 17).

[32] Determination of Threatened Status for the Polar Bear (*Ursus maritimus*) Throughout Its Range, 73 Fed. Reg. 28212 at 28212-28303; U.S. FISH AND WILDLIFE SERV., REGION 7, POLAR BEAR (*URSUS MARITIMUS*) CONSERVATION MANAGEMENT PLAN, FINAL (2016) ("Polar Bear Conservation Management Plan 2016"); U.S. FISH AND WILDLIFE SERV., MARINE MAMMALS MANAGEMENT, POLAR BEAR (*URSUS MARITIMUS*) 5-YEAR REVIEW: SUMMARY AND EVALUATION (Feb. 3, 2017) ("Polar Bear 5-Year Review 2017").

As summarized in FWS's 2017 5-year Review, sea ice loss and a shorter sea ice season make hunting calorie-rich seals more difficult for polar bears, leading to nutritional stress, reduced body mass, and significant declines in some populations.[33]

17. In the southern Beaufort Sea of Alaska, polar bears declined by 40 percent over a recent 10-year period,[34] and this decrease has been attributed to sea ice loss that limited access to prey over multiple years.[35] For the bears in this population, research has linked sea ice loss to decreases in survival,[36] lower success in rearing cubs,[37] shrinking body size,[38] and increases in fasting and nutritional stress.[39] The loss of sea ice also jeopardizes the polar bear's sea-ice dependent prey species—the ringed seal and bearded seal—which were federally listed as threatened in 2012 due to sea ice loss from climate change.[40]

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[33] Polar Bear 5-Year Review 2017 at 16.

[34] Jeffrey F. Bromaghin et al., *Polar Bear Population Dynamics in the Southern Beaufort Sea during a Period of Sea Ice Decline*, 25 ECOLOGICAL APPLICATIONS 634 (2015) ("Bromaghin 2015").

[35] Polar Bears: Proceedings of the 15th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, Copenhagen, Denmark, 29 June–3 July 2009, at 52 (Martyn E. Obbard et al. eds., 2010) ("Thus, the SB subpopulation is currently considered to be declining due to sea ice loss"); Bromaghin 2015.

[36] Eric V. Regehr et al., *Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice*, 79 J. OF ANIMAL ECOLOGY 117 (2010); Bromaghin 2015.

[37] *Id.*

[38] Karyn D. Rode et al., *Reduced body size and cub recruitment in polar bears associated with sea ice decline*, 768 ECOLOGICAL APPLICATIONS 20 (2010).

[39] Seth G. Cherry et al., *Fasting physiology of polar bears in relation to environmental change and breeding behavior in the Beaufort Sea*, 32 POLAR BIOLOGY 383 (2009); John P. Whiteman et al., *Summer declines in activity and body temperature offer polar bears limited energy savings*, 349 SCIENCE 295 (2015).

[40] Nat'l Oceanic and Atmospheric Admin., Threatened Status for the Arctic, Okhotsk, and Baltic Subspecies of the Ringed Seal and Endangered Status for the Ladoga Subspecies of the Ringed Seal, 77 Fed. Reg. 76706 (Dec. 28, 2012) (to be codified at 50 C.F.R. pts. 223 & 224); Nat'l Oceanic and Atmospheric Admin., Threatened Status for the Beringia and Okhotsk Distinct Population Segments of the *Erignathus barbatus nauticus* Subspecies of the Bearded Seal, Fed. Reg. 76,740 (Dec. 28, 2012) (to be codified at 50 C.F.R. pt. 223).

18. If current greenhouse gas emissions trends continue, scientists estimate that two-thirds of global polar bear populations will be lost by 2050, including the extinction of both of Alaska's polar bear populations, while the remaining third will near extinction by the end of the century due to the disappearance of sea ice.[41] However, aggressive emissions reductions will allow substantially more sea ice to persist and increase the chances that polar bears will survive in Alaska and across their range.[42]

19. One recent study tied each metric ton of CO_2 emissions to a sustained loss of three square meters of September Arctic sea ice area based on the robust linear relationship between monthly mean September sea ice area and cumulative CO_2 emissions.[43] Based on the SAFE Rule's estimate of an increase of CO_2 emissions of 867 to 923 MMT over the lifetime of MY 1977 through MY 2029 vehicles, the Rule would lead to a sustained loss of 1,004 square miles to 1,069 square miles of summer sea ice habitat for the polar bear, not including the impacts from increases in methane and nitrous oxide. Based on the estimated increase of 7,800 MMT CO_2 between 2021 and 2100, the SAFE Rule would lead to a

[41] Steven C. Amstrup et al., *Forecasting the Range-wide Status of Polar Bears at Selected Times in the 21st Century*, *in* USGS Science Strategy to Support U.S. Fish and Wildlife Service Polar Bear Listing Decision, U.S. Department of the Interior 1(2007); Steven C. Amstrup et al., *Greenhouse Gas Mitigation Can Reduce Sea Ice Loss and Increase Polar Bear Persistence*, 468 NATURE 955 (2010) ("Amstrup 2010").

[42] Amstrup 2010; Todd C. Atwood et al., *Forecasting the Relative Influence of Environmental and Anthropogenic Stressors on Polar Bears*, 7 ECOSPHERE e01370 (2016); Eric V. Regehr et al., *Conservation status of polar bears (Ursus martimus) in relation to projected sea-ice declines*, 12 BIOLOGY LETTERS 20160556 (2016).

[43] Dirk Notz & Julienne Stroeve, *Observed Arctic sea ice loss directly follows anthropogenic CO_2 emission*, 354 SCIENCE 747 (2016) ("Notz & Stroeve 2016"), https://science.sciencemag.org/content/354/6313/747/tab-pdf.

sustained loss of at least 9,035 square miles of summer sea ice habitat, an area bigger than the state of New Jersey.

20. Similar to other research,[44] this study concluded that limiting warming to 2°C is not sufficient to allow Arctic summer sea ice to survive, but that a rapid reduction in greenhouse gas emissions that limits global temperature rise to 1.5°C gives Arctic summer sea ice "a chance of long-term survival at least in some parts of the Arctic Ocean."[45]

21. FWS's 2016 Final Polar Bear Conservation Management Plan clearly states that the polar bear cannot be recovered without significant reductions in the greenhouse gas emissions driving Arctic warming and sea ice loss: "It cannot be overstated that the single most important action for the recovery of polar bears is to significantly reduce the present levels of global greenhouse gas (GHG) emissions, which are the primary cause of warming in the Arctic."[46]

22. In short, the scientific evidence is clear that the substantial additional greenhouse gases emitted under the SAFE Rule will worsen the loss of sea ice, causing the likelihood of survival and recovery of the polar bear to diminish appreciably.

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[44] Carl-Friedrich Schleussner et al., *Science and policy characteristics of the Paris Agreement temperature goal*, 6 NATURE CLIMATE CHANGE 827, 830 (2016).
[45] Notz & Stroeve 2016 at 3-4.
[46] Polar Bear Conservation Management Plan 2016 at 11.

Listed Coral Species Will Be Harmed by the SAFE Rule

23. Extensive scientific evidence makes clear that listed coral species will be harmed by the significant increases in greenhouse gas emissions caused by the SAFE Rule. Rising ocean temperatures and ocean acidification driven by greenhouse gas pollution are causing a global coral reef crisis, threatening the continued existence of many coral species. In 2006, the National Marine Fisheries Service (NMFS) listed elkhorn and staghorn corals (*Acropora palmata* and *A. cervicornis*) as threatened, citing ocean warming as a key threat to these species.[47] In 2014 NMFS listed 20 additional coral species as threatened due principally due to ocean warming, ocean acidification, and disease as related to climate change.[48] NMFS' 2015 Final Recovery Plan for Elkhorn and Staghorn Corals stated that ocean warming and acidification are "among the greatest threats" to these corals and recommended actions to reduce greenhouse gas emissions to reduce these threats.[49]

24. Scientific evidence has definitively linked greenhouse gas pollution to harms to listed corals. The oceans have absorbed more than 90 percent of the

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[47] Nat'l Marine Fisheries Serv., Endangered and Threatened Species: Final Listing Determinations for Elkhorn Coral and Staghorn Coral, 71 Fed. Reg. 26852, 26859 (May 9, 2006) (to be codified at 50 C.F.R. pt. 223), https://www.govinfo.gov/content/pkg/FR-2006-05-09/pdf/06-4321.pdf.

[48] Nat'l Marine Fisheries Serv., Endangered and Threatened Wildlife and Plants: Final Listing Determinations on Proposal to List 66 Reef-Building Coral Species and to Reclassify Elkhorn and Staghorn Corals, 79 Fed. Reg. 53852, at 53885, 53886 (Sept. 10, 2014) (to be codified at 50 C.F.R. pt. 223).

[49] NAT'L MARINE FISHERIES SERV., RECOVERY PLAN FOR ELKHORN (*ACROPORA PALMATA*) AND STAGHORN (*A. CERVICORNIS*) Corals, at ix, I-31-32 (2015) ("NMFS Elkhorn and Staghorn Recovery Plan 2015"), https://data.nodc.noaa.gov/coris/library/NOAA/CRCP/project/2160/final_acropora_recovery_plan.pdf.

excess heat caused by greenhouse gas warming, making oceans much hotter and marine waves longer and more frequent.[50] Research has conclusively linked ocean warming, driven by rising greenhouse gas emissions, to the catastrophic, mass coral bleaching events that are devastating coral reefs.[51] Severe coral bleaching events are increasing in frequency and intensity, rising five-fold in the past several decades as atmospheric CO_2 rises.[52] The global coral bleaching event that lasted from 2014 to 2017 was the longest and most widespread, affecting more reefs than any previous mass bleaching event and causing mass bleaching of reefs that had never bleached before, with U.S. coral reefs particularly hard-hit.[53] Illustrating the harms to listed corals, ocean warming increases the susceptibility of threatened elkhorn and staghorn corals in the Caribbean (including the Florida Keys) to disease, fragmentation, and mortality.[54] Three listed star corals in the Caribbean

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[50] USGCRP Vol I 2017 at 364, 367; Thomas L. Frolicher et al., *Marine heatwaves under global warming*, 560 NATURE 360 (2018).

[51] Ove Hoegh-Guldberg et al., *Coral reefs under rapid climate change and ocean acidification*, 318 SCIENCE 1737 (2007); Simon D. Donner et al., *Coping with Commitment: Projected Thermal Stress on Coral Reefs under Different Future Scenarios*, 4 PLOS ONE e5712 (2009) ("Donner et al. 2009"); C. Mark Eakin et al., *Caribbean corals in crisis: record thermal stress, bleaching, and mortality in 2005*, 5 PLOS ONE e13969 (2010) ("Eakin 2010"); NAT'L MARINE FISHERIES SERV., SOUTHEAST REGIONAL OFFICE, ELKHORN CORAL AND STAGHORN CORAL RECOVERY PLAN, at 51 (Mar. 3, 2015); Terry P. Hughes et al., *Spatial and temporal patterns of mass bleaching of corals in the Anthropocene*, 359 SCIENCE 80 (2018) ("Hughes 2018").

[52] Hughes 2018 at 80.

[53] C. Mark Eakin et al., *Unprecedented three years of global coral bleaching 2014-17*, *in* State of the Climate in 2017, 99 BULL. OF THE AM. METEOROLOGICAL SOC'Y S74 (2018).

[54] Lynnette Roth et al., *Tracking Acropora fragmentation and population structure through thermal-stress events*, 263 ECOLOGICAL MODELLING 223 (2013); Emma F. Camp et al., *Acclimatization to high-variance habitats does not enhance physiological tolerance of two key Caribbean corals to future temperature and pH*, 283 PROC. OF THE ROYAL SOC'Y B 20160442 (2016); D.E. Williams et al., *Thermal stress exposure, bleaching response, and mortality in the threatened coral Acropora palmata*, 124 MARINE POLLUTION BULL. 189 (2017); Erinn M. Muller et al., *Bleaching causes loss of disease resistance within the threatened coral species Acropora cervicornis*, 7 ELIFE e35066 (2018).

(including the Florida Keys)—the boulder star coral (*Orbicella franksi*), mountainous star coral (*Orbicella faveolata*), and lobed star coral (*Orbicella annularis*)—have experienced long-term declines in reproduction following bleaching events caused by high water temperatures, which scientists warned: "may be catastrophic for the long-term maintenance of the population."[55]

25. Ocean acidification driven by greenhouse gas pollution is another significant threat to listed corals. Ocean acidification caused by the ocean's absorption of anthropogenic CO_2 has already resulted in more than a 30 percent increase in the acidity of ocean surface waters, at a rate likely faster than anything experienced in the past 300 million years.[56] Ocean acidification reduces the availability of key chemicals—aragonite and calcite—that corals and other marine species use to build their shells and skeletons and causes the dissolution of coral species.[57] Ocean acidification has been shown to decrease the fertilization, settlement success, growth, and calcification of listed elkhorn and staghorn corals.[58]

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[55] Don R. Levitan et al., *Long-term reduced spawning in Orbicella coral species due to temperature stress*, 515 MARINE ECOLOGY PROGRESS SERIES 1 (2014).
[56] Barbel Hönisch et al., *The Geological Record of Ocean Acidification*, 335 SCIENCE 1058 (2012); USGCRP Vol I 2017 at 372, 374.
[57] USGCRP Vol I 2017 at 371-372.
[58] Rebecca Albright et al., *Ocean acidification compromises recruitment success of the threatened Caribbean coral Acropora palmata*, 107 PROC. OF THE NAT'L ACAD. OF SCI. OF THE U.S. 20400 (2010); I.C. Enochs et al., *Effects of light and elevated pCO₂ on the growth and photochemical efficiency of Acropora cervicornis*, 33 CORAL REEFS 477 (2014); Chris Langdon et al., Two threatened Caribbean coral species have contrasting responses to combined temperature and acidification stress, 63 LIMNOLOGY AND OCEANOGRAPHY 2450 (2018).

26. Scientific research and federal documents conclude that greenhouse gas emissions must be immediately and rapidly reduced to prevent catastrophic loss and degradation of corals—with the target of keeping global average temperature rise below 1.5°C and returning atmospheric CO_2 levels below 350 parts per million (ppm) from current levels above 400 ppm.[59] NMFS's recovery plan for elkhorn and staghorn corals includes a recovery criterion with specific targets for ocean surface temperatures and ocean acidification levels[60] that are lower than today's levels and are consistent with a return to an atmospheric CO_2 concentration of less than 350 ppm,[61] a major decrease from 2019 levels averaging 410 ppm.

Listed Species on Coasts and Islands Will be Harmed by the SAFE Rule

[59] J.E.N. Veron et al., *The coral reef crisis: the critical importance of <350 ppm CO_2*, 58 MARINE POLLUTION BULL. 1428 (2009) ("Veron et al. 2009"); Intergovernmental Panel on Climate Change, *Summary for Policymakers*, *in* Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, at 8 (V. Masson-Delmotte et al. eds., 2018).

[60] NMFS Elkhorn and Staghorn Recovery Plan 2015. *See* Recovery Criterion 5, "Sea surface temperatures across the geographic range have been reduced to Degree Heating Weeks less than 4; and Mean monthly sea surface temperatures remain below 30°C during spawning periods; and Open ocean aragonite saturation has been restored to a state of greater than 4.0, a level considered optimal for reef growth."

[61] As stated by the Recovery Plan, "Current projections of increases in ocean temperature, coupled with the numerous other stressors acting on these depleted species, will inhibit recovery. Thus, reducing atmospheric CO_2 levels is likely needed to support recovery of elkhorn and staghorn corals. Model simulations by Donner et al. (2009) suggest that atmospheric CO_2 concentrations may need to be stabilized below 370 ppm to avoid degradation of coral reef ecosystems. Veron et al. (2009), based on the recent history of frequent mass bleaching events and correlated climate conditions, advocated the importance of atmospheric CO_2 concentrations of less than 350 ppm for coral reef health, as mass bleaching events, often associated with El Niño, began when atmospheric CO_2 concentrations were approximately 340 ppm. Veron et al. (2009) also discussed the 1997/98 mass bleaching event, when atmospheric CO_2 concentrations were 350 ppm, as the beginning of a decline in coral reef health from which there has been no significant long-term recovery."

27. The significant increase in greenhouse gas pollution under the SAFE Rule will worsen sea level rise and harm numerous listed species living on coasts and islands. According to the Fourth National Climate Assessment, global average sea level has risen by seven to eight inches since 1900,[62] and sea level rise is accelerating in pace.[63] The Fourth National Climate Assessment estimated that global sea level is very likely to rise by 1 to 4 feet by the end of the century relative to the year 2000, with sea level rise of 8.2 feet possible.[64] Sea level rise will be much more extreme without strong action to reduce greenhouse gas pollution. By the end of the century, global mean sea level is projected to increase by 0.8 to 2.6 feet under a lower emissions scenario, compared with 1.6 to 6 feet under a high emissions scenario.[65]

28. Scientific research and federal documents recognize that many listed coastal and island species are threatened by sea level rise driven by climate change. According to a 2013 analysis, on the current emissions trajectory, rising seas driven by warming temperatures threaten at least 17 percent of our nation's federally protected species, totaling 233 species in 23 coastal states.[66] For example, more than half of Florida's endangered species are threatened by rising sea levels

[62] USGCRP Vol II 2018 at 74.
[63] *Id.*
[64] USGCRP Vol II 2018 at 487, 758; USGCRP Vol II 2018 at 74.
[65] USGCRP Vol I 2017 at 344.
[66] CENTER FOR BIOLOGICAL DIVERSITY, DEADLY WATERS: HOW RISING SEAS THREATEN 233 ENDANGERED SPECIES (Dec. 2013).

and associated groundwater contamination.[67] Recent FWS listing rules for Florida coastal species have determined that sea level rise resulting from greenhouse gas pollution is a primary threat endangering these species, including the Florida bonneted bat (*Eumops floridanus*),[68] Cape Sable thoroughwort (*Chromolaena frusrata*),[69] Florida semaphore cactus (*Consolea corallicola*),[70] aboriginal prickly-apple (*Harrisa aboriginum*),[71] and Florida bristle fern (*Trichomanes punctatum ssp. floridanum*).[72] On the low-lying islands of the Florida Keys, the endangered Lower Keys marsh rabbit (*Sylvilagus palustris hefneri*) has lost almost half of its habitat to sea level rise,[73] and the endangered Key tree-cactus (*Pilosocereus robinii*) is dying off as the soil becomes too salty due to rising seas and intensifying hurricane storm surges made worse by climate change.[74] Habitat for the endangered Florida Key deer (*Odocoileus virginianus claviumis*) is shrinking as sea levels rise, and on Big Pine Key—a major population center—Key deer

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[67] *Id.*

[68] U.S. Fish and Wildlife Serv., Endangered and Threatened Wildlife and Plants; Endangered Species Status for the Florida Bonneted Bat, 78 Fed. Reg. 61004, at 61004 (Oct. 2, 2013) (to be codified at 50 C.F.R. pt. 17).

[69] U.S. Fish and Wildlife Serv., Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for *Chromolaena frustrata* (Cape Sable Thoroughwort), *Consolea corallicola* (Florida Semaphore Cactus), and *Harrisia aboriginum* (Aboriginal Prickly-Apple); Final Rule, 78 Fed. Reg. 63796, 63816 (Oct. 24, 2013) (to be codified at 50 C.F.R. pt. 17).

[70] *Id.* at 63817.

[71] *Id.* at 63817.

[72] U.S. Fish and Wildlife Serv., Endangered and Threatened Wildlife and Plants; Endangered Species Status for *Trichomanes punctatum ssp. floridanum* (Florida Bristle Fern); Final Rule, 80 Fed. Reg. 60440, at 60440 (Oct. 6, 2015) (to be codified at 50 C.F.R. pt. 17).

[73] Jason A. Schmidt et al. *Impacts of a half century of sea-level rise and development on an endangered mammal*, 18 GLOBAL CHANGE BIOLOGY 3536 (2012).

[74] J. Goodman et al., *Differential Response to Soil Salinity in Endangered Key Tree Cactus: Implications for Survival in a Changing Climate*, 7 PLOS ONE e32528 (2012).

habitat is projected to be almost completely inundated by 2100 if greenhouse gas emissions continue unchecked.[75]

29. Research and federal documents have also highlighted sea level rise as a primary threat to sea turtles[76] and shorebirds such as piping plovers (*Charadrius melodus*)[77] by eroding nesting beaches and reducing nesting success. For example, most (87 percent) loggerhead sea turtle (*Caretta caretta*) nesting occurs on the east coast of Florida,[78] where 43 percent of the turtle's nesting beaches are projected to disappear with just 1.5 feet of sea level rise.[79] The listing rules for the green sea turtle (*Chelonia mydas*)[80] and loggerhead sea turtle[81] conclude that sea level rise is

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[75] U.S. FISH AND WILDLIFE SERV., KEY DEER (*ODOCOILEUS VIRGINIANUS CLAVINUM*) 5-YEAR REVIEW: SUMMARY AND EVALUATION (2010), http://ecos.fws.gov/docs/five_year_review/doc3275.pdf.

[76] M.M.P.B. Fuentes et al., *Potential impacts of projected sea-level rise on sea turtle rookeries*, 20 AQUATIC CONSERVATION MARINE AND FRESHWATER ECOSYSTEMS 132 (2009); Lucy A. Hawkes et al., *Climate change and marine turtles*, 7 ENDANGERED SPECIES RES. 137 (2009); M. J. Witt et al., *Predicting the impacts of climate change on a globally distributed species: the case of the loggerhead turtle*, 213 J. OF EXPERIMENTAL BIOLOGY 901 (2010); M.M.P.B. Fuentes et al., *Vulnerability of sea turtle nesting grounds to climate change*, 17 GLOBAL CHANGE BIOLOGY 140 (2010); Milani Chaloupka et al., *Is climate change affecting the population dynamics of the endangered Pacific loggerhead sea turtle?*, 356 J. OF EXPERIMENTAL MARINE BIOLOGY AND ECOLOGY 136 (2008).

[77] U.S. FISH AND WILDLIFE SERVICE, RECOVERY PLAN FOR THE NORTHERN GREAT PLAINS PIPING PLOVER (*CHARADRIUS MELODUS*), VOLUME II: DRAFT REVISED RECOVERY PLAN FOR THE WINTERING RANGE OF THE NORTHERN GREAT PLAINS PIPING PLOVER (*CHARADRIUS MELODUS*) AND COMPREHENSIVE CONSERVATION STRATEGY FOR THE PIPING PLOVER (*CHARADRIUS MELODUS*) IN ITS COASTAL MIGRATION AND WINTERING RANGE IN THE CONTINENTAL UNITED STATES (2015).

[78] Nat'l Oceanic and Atmospheric Admin., Endangered and Threatened Species; Proposed Listing of Nine Distinct Population Segments of Loggerhead Sea Turtles as Endangered or Threatened; Proposed Rule, 75 Fed. Reg. 12598 (Mar. 16, 2010) (to be codified at 50 C.F.R. pts. 17, 223, & 224).

[79] Joshua S. Reece et al., *Sea level rise, land use, and climate change influence the distribution of loggerhead turtle nests at the largest USA rookery (Melbourne Beach, Florida)*, 493 MARINE ECOLOGY PROGRESS SERIES 259 (2013).

[80] U.S. Fish and Wildlife Serv. & Nat'l Marine Fisheries Serv., Endangered and Threatened Wildlife and Plants; Final Rule To List Eleven Distinct Population Segments of the Green Sea Turtle (*Chelonia mydas*) as Endangered or Threatened and Revision of Current Listings Under the Endangered Species Act, 81 Fed. Reg. 20058, 20078 (Apr. 6, 2016) (to be codified at 50 C.F.R. pt. 17).

[81] U.S. Fish and Wildlife Serv. & Nat'l Marine Fisheries Serv., Endangered and Threatened Species; Determination of Nine Distinct Population Segments of Loggerhead Sea Turtles as Endangered or Threatened, 76 Fed. Reg. 58868, 58910 (Sept. 22, 2011) (to be codified at C.F.R. pts. 223 & 224).

likely to have negative effects on these species through beach loss and reduced nesting success.

30. On the Hawaiian islands, rising temperatures caused by greenhouse gas pollution are causing population declines and increasing extinction risk for endangered bird species like the 'i'iwi (*Drepanis coccinea*), 'akikiki (*Oreomystis bairdi*), and 'akeke'e (*Loxops caeruleirostris*) by facilitating the spread of non-native mosquitoes carrying deadly avian malaria.[82] Endangered birds in Hawaii are now largely restricted to high-elevation habitat where it is too cold for disease-carrying mosquitoes to survive, but rising temperatures are allowing mosquitoes to move further upslope, infecting and killing more birds, leaving fewer and fewer high-elevation refuges, and escalating extinction risk for Hawaii's listed birds. Reducing greenhouse gas pollution is critical for lowering both the pace of climate change and the extinction risk for Hawaii's critically endangered native bird species.

The Increased NOx and SOx Pollution Resulting From the SAFE Rule Will Harm Listed Species

[82] Wei Liao et al., *Will a warmer and wetter future cause extinction of native Hawaiian forest birds?*, 21 GLOBAL CHANGE BIOLOGY 4342 (2015); Eben H. Paxton et al., 2016, *Collapsing avian community on a Hawaiian island*, 2 SCIENCE ADVANCES e1600029 (2016); Wei Liao et al., *Mitigating future avian malaria threats to Hawaiian forest birds from climate change*, 12 PLOS ONE e0168880 (2017).

31. Scientific research has clearly established the linkages between atmospheric NOx and SOx deposition and harms to listed species. In its 2020 Final Integrated Science Assessment on the ecological effects of NOx and SOx, the EPA identified 17 ways in which nitrogen and sulfur deposition have been shown to have a "causal relationship" to ecological effects, based on a review of the best-available science.[83]

32. One of the primary effects of the deposition of atmospheric nitrogen and sulfur, including NOx, SOx, and ammonia, is that it contributes to the acidification of terrestrial and aquatic ecosystems such as soils, rivers, and lakes.[84] As summarized by the SAFE Rule: "Atmospheric deposition of nitrogen and sulfur contributes to acidification, altering biogeochemistry and affecting animal and plant life in terrestrial and aquatic ecosystems across the United States."[85]

33. The acidification of surface water in streams and lakes by sulfur and nitrogen deposition can create inhospitable conditions for listed species and cause the decline or loss of acid-sensitive species—with more species lost at higher levels of acidification.[86] Acidified aquatic habitats have been found to have lower

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[83] U.S. ENVTL. PROTECTION AGENCY, INTEGRATED SCIENCE ASSESSMENT FOR OXIDES OF NITROGEN, OXIDES OF SULFUR, AND PARTICULATE MATTER— ECOLOGICAL CRITERIA (FINAL), CENTER FOR PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT, OFFICE OF RESEARCH AND DEVELOPMENT, EPA/600/R-20/278, at ES-1 (Sept. 2020) ("EPA 2020"), www.epa.gov/ncea/isa.

[84] EPA 2020 at ES-2.

[85] U.S. Envtl. Protection Agency & Nat'l Highway Traffic Safety Admin., The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks, Final Rule, 85 Fed. Reg. 24174, 24871 (Apr. 30, 2020) (to be codified at 40 C.F.R. pts. 86 & 600).

[86] Charles T. Driscoll et al., *Acidic deposition in the Northeastern United States: Sources and inputs, ecosystem effects, and management strategies*, 51 BIOSCIENCE 180 (2001) ("Driscoll et al. 2001"); EPA 2020 at IS-73.

numbers of species of fishes, macroinvertebrates, and plankton.[87] Illustrating harms to listed species, for the Atlantic salmon (*Salmo salar*) which has endangered populations in the Gulf of Maine, evidence indicates stream acidification increases mortality of young salmon and has limited the distribution and abundance of Atlantic salmon in the northeastern U.S.[88] For the endangered dwarf wedgemussel (*Alasmidonta heterodon*), FWS's recovery plan states that stream acidification can mobilize toxic metals, is harmful to mussels, and is thought to have contributed to the species' decline in, for example, the Fort River in Massachusetts.[89]

34. In terrestrial ecosystems, sulfur and nitrogen deposition can cause soil acidification which can decrease plant growth, lower soil fertility, and cause the injury or death of sensitive plant species.[90] Major effects in forests include the die-offs of sensitive tree species such as red spruce (*Picea rubens*) and sugar maple (*Acer saccharum*) and an altering of the structure and function of these forest ecosystems.[91] In Northeast U.S. forests, there is strong evidence that acidic deposition in the form of acidic mist and acidic cloud water causes the dieback of red spruce by decreasing the tolerance of the tree's needles to cold temperatures and increasing their susceptibility to freezing.[92]

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[87] EPA 2020 at IS-73
[88] EPA 2020 at 8-16 to 8-18.
[89] U.S. FISH AND WILDLIFE SERV., DWARF WEDGE MUSSEL (*ALASMIDONTA HETERODON*) RECOVERY PLAN, at 14 (1993), https://www.fws.gov/northeast/pafo/pdf/Dwarf%20wedgemussel%20Recovery%20Plan.pdf.
[90] EPA 2020 at IS-39.
[91] EPA 2020 at 5-6.
[92] Driscoll et al. 2001 at 187-188.

35. FWS and NMFS have identified numerous federally endangered and threatened species as threatened by or susceptible to acidifying atmospheric pollution from SO_2 and SOx. For plant species these include, among others, the Heller's Blazing Star (*Liatris helleri*)[93] and the Rock Gnome Lichen (*Gymnodema lineare*).[94] The FWS recovery plan for the Rock Gnome Lichen flags that "there is a high likelihood that current and previous air pollution levels, especially from sulfates, may be contributing to the decline of this species."[95]

36. FWS has also identified numerous animal species as being threatened by or susceptible to acidification from atmospheric pollution, including the Shenandoah Salamander (*Plethodon shenandoah*),[96] the Chiricahua Leopard Frog (*Rana chiricahuensis*),[97] and the Whooping Crane (*Grus americana*).[98] The recovery plan for the Chiricahua Leopard Frog states that acid rain has been found to adversely affect Chiricahua Leopard Frog populations,[99] likely through reduced hatching of eggs and reduced growth rates.[100]

[93] U.S. FISH AND WILDLIFE SERV., RECOVERY PLAN FOR (LIATRIS HELLERI) HELLER'S BLAZING STAR, at iii, 7 (2000), https://ecos.fws.gov/docs/recovery_plan/000128.pdf.
[94] U.S. FISH AND WILDLIFE SERV., RECOVERY PLAN FOR ROCK GNOME LICHEN (*GYMNODEMA LINEARE*), at 4, 9 (1997) ("Rock Gnome Lichen Recovery Plan"), https://ecos.fws.gov/docs/recovery_plan/970930b.pdf.
[95] Rock Gnome Lichen Recovery Plan at 4.
[96] U.S. FISH AND WILDLIFE SERV., SHENANDOAH SALAMANDER (*PLETHODON SHENANDOAH*) RECOVERY PLAN, at 1, 8-10 (1994), https://www.amphibians.org/wp-content/uploads/2019/04/Shenendoah-Salamander-Recovery-Plan.pdf.
[97] U.S. FISH AND WILDLIFE SERV., CHIRICAHUA LEOPARD FROG (*RANA CHIRICAHUENSIS*) FINAL RECOVERY PLAN, at 23-25, 40 (2007) ("Chiricahua Leopard Frog Recovery Plan"), https://www.fws.gov/guidance/sites/default/files/documents/119_Final_chiricahua%20leopard%20frog_Plan.pdf.
[98] U.S. FISH AND WILDLIFE SERV., INTERNATIONAL RECOVERY PLAN: WHOOPING CRANE (*GRUS AMERICANA*), THIRD REVISION, at C-1 (2007), https://www.nrc.gov/docs/ML1118/ML111880004.pdf.
[99] Chiricahua Leopard Frog Recovery Plan at 40.
[100] *Id.* at 44.

37. Additional impacts to species from SOx deposition include stimulating microbes to methylate mercury (Hg) which introduces this neurotoxin into the food chain and leads to its bioaccumulation.[101] Acute and chronic exposure to SO_2 also leads to phytotoxic effects on plants, including foliar injury, decreased photosynthesis, and decreased growth.[102]

38. In addition to contributing to acidification, NOx air pollutants including nitrogen dioxide (NO_2), as well as nitric acid (HNO_3), nitrate (NO_3^-), and ammonia (NH_3), cause well-documented impacts to listed species.[103] (*See* Exhibit B). One primary impact of NOx deposition is that it causes nitrogen enrichment of aquatic ecosystems, called "eutrophication," which results in the overgrowth of algae and aquatic plants, lowering oxygen levels in water and causing algal blooms that alter habitat by covering up substrate.[104] Nitrogen pollution has also been documented to increase nonnative plant species that directly harm native plant species by outcompeting them for space and resources and that indirectly harm animal species by excluding their food sources.[105] NOx can also lead to direct toxicity or lethal effects on listed species.[106]

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[101] EPA 2020 at ES-19.
[102] EPA 2020 at ES-13.
[103] Mark E. Fenn, *Ecological Effects of Nitrogen Deposition in the Western United States*, 53 BIOSCIENCE 404 (2003) ("Fenn 2003"); Daniel L. Hernandez et al., *Nitrogen Pollution is Linked to US Listed Species Declines*, 66 BIOSCIENCE 213 (2016) ("Hernandez 2016") (Attached as Exhibit B).
[104] Hernandez 2016 at 215; EPA 2020 at ES-15 to ES-19.
[105] Hernandez 2016 at 220.
[106] *Id.* at 215-217.

39. Importantly, a recent study of the effects of nitrogen pollution on federally listed species, based on analysis of FWS and NMFS documents, found that this threat is "substantial" and "geographically widespread."[107] The study found evidence of harm from nitrogen pollution for at least 78 federally listed taxa.[108] This includes at least 50 invertebrate species such as mollusks and arthropods, at least 18 vertebrate species of fish, amphibians, and reptiles, and at least 8 plant species.[109]

40. For example, nitrogen deposition from vehicle exhaust is a well-documented threat to the Bay Checkerspot butterfly (*Euphydryas editha bayensis*) which is restricted to patches of low-nutrient serpentinite soil in the San Francisco Bay area.[110] Nitrogen deposition has allowed exotic grasses to replace native forbs, including the Bay Checkerspot's larval host plant, leading to butterfly population declines and local extirpations.[111] In its most recent 5-year review for the Bay Checkerspot butterfly, FWS found that nitrogen deposition from smog created soil conditions that allowed for invasion of non-native plants, where the level of impact

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[107] *Id*. at 220.
[108] *Id*. at 215, 220.
[109] *Id.* at 216-217 at Tables 1, 2, 3.
[110] Fenn 2003; U.S. FISH AND WILDLIFE SERV., SACRAMENTO FISH AND WILDLIFE OFFICE, BAY CHECKERSPOT BUTTERFLY (*EUPHYDRYAS EDITHA BAYENSIS*) 5-YEAR REVIEW: SUMMARY AND EVALUATION (Aug. 2009) ("USFWS Bay checkerspot butterfly 5-Year Review"); Hernandez 2016.
[111] Stuart B. Weiss, *Cars, cows and checkerspot butterflies: nitrogen deposition and management of nutrient-poor grasslands for a threatened species*, 13 CONSERVATION BIOLOGY 1476 (1999); Laura F. Huenneke et al., *Effects of Soil Resources on Plant Invasion and Community Structure in Californian Serpentine Grassland*, 71 Ecology 478 (1990); Dena M. Vallano et al., *Simulated nitrogen deposition enhances the performance of an exotic grass relative to native serpentine grassland competitors*, 213 PLANT ECOLOGY 1015 (2012).

increased with proximity to a major interstate highway.[112] FWS itself concluded that "the butterfly is still at great risk from invasion of non-native vegetation, exacerbated by nitrogen deposition from air pollution."[113]

41. Endangered plant species such as the Presidio clarkia (*Clarkia franciscana*)—a beautiful flowering plant native to California serpentine grasslands—are also being harmed by nitrogen deposition from vehicle pollution which gives a competitive advantage to non-native plants.[114] In its most recent 5-year review for the Presidio clarkia, FWS identified nitrogen deposition from air pollution as a principal threat, explaining that "elevated inputs of atmospheric nitrogen deposition from air pollution have further accelerated the encroachment of native shrubs and nonnative shrubs and nonnative grasses and forbs…into *Clarkia franciscana* habitat."[115] The FWS 5-year review specifically highlights vehicle pollution as a key contributor to the nitrogen deposition harming the Presidio clarkia.[116] The FWS 5-year review identifies other potential harms to the Presidio clarkia from nitrogen deposition such as decreased diversity of mycorrhizal communities and predisposing plants to environmental stresses such as elevated concentrations of ozone, drought, frost, or insect attacks.[117]

[112] USFWS Bay checkerspot butterfly 5-Year Review at 13.
[113] *Id.* at 31.
[114] Hernandez 2016 at 218, Table 3.
[115] U.S. FISH AND WILDLIFE SERV., SACRAMENTO FISH AND WILDLIFE OFFICE, *CLARKIA FRANCISCANA* (PRESIDIO CLARKIA) 5-YEAR REVIEW: SUMMARY AND EVALUATION, at 43 (Nov. 2010).
[116] *Id.* at 50.
[117] *Id.* at 50.

42. Nitrogen pollution is also a threat to numerous other endangered or threatened species, such as the Quino Checkerspot butterfly (*Euphydryas editha quino*)[118] and the desert tortoise (*Gopherus agassizii*).[119] Nitrogen pollution facilitates the spread of non-native species that displace the Quino Checkerspot butterfly's host plants[120] and the tortoise's forage plants, reducing the nutritional quality of available food for the butterfly and desert tortoise.[121]

43. A review on the effects of nitrogen deposition in the western United States highlighted the need for policy changes at the national level for reducing air pollution to protect endangered species from nitrogen deposition: "local land management strategies to protect these endangered species may not succeed unless they are accompanied by policy changes at the regional or national level that reduce air pollution."[122]

44. The best-available science clearly and conclusively demonstrates that the significant increases in greenhouse gas and criteria pollutant emissions caused

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[118] U.S. FISH AND WILDLIFE SERV., CARLSBAD FISH AND WILDLIFE OFFICE, QUINO CHECKERSPOT BUTTERFLY (*EUPHYDRYAS EDITHA QUINO*) 5-YEAR REVIEW: SUMMARY AND EVALUATION, , at 13, 15, 16 (2009) ("USFWS Quino checkerspot butterfly 5-Year Review"), https://www.fws.gov/carlsbad/SpeciesStatusList/5YR/20090813_5YR_QCB.pdf.

[119] Kenneth A. Nagy et al., *Nutritional quality of native and introduced food plants of wild desert tortoises*, 32 JOURNAL OF HERPETOLOGY 260 (1998) ("Nagy 1998"); Edith B. Allen et al., *Impacts of atmospheric nitrogen deposition on vegetation and soils at Joshua Tree National Park, in* The Mojave Desert: Ecosystems Processes and Sustainability 78-100 (R.H. Webb et al. eds., 2009) ("Allen et al. 2009"), https://www.fs.fed.us/psw/publications/bytnerowicz/psw_2009_bytnerowicz(allen)002.pdf.; U.S. FISH AND WILDLIFE SERV., TORTOISE RECOVERY OFFICE, MOJAVE POPULATION OF THE DESERT TORTOISE (*GOPHERUS AGASSIZII*) 5-YEAR REVIEW: SUMMARY AND EVALUATION, at 24, 33 (Sept. 2010) ("USFWS Mojave tortoise 5-YEAR Review"), https://www.fws.gov/carlsbad/SpeciesStatusList/5YR/20100930_RP_DETO.pdf.

[120] USFWS Quino checkerspot butterfly 5-Year Review, at 13, 15, 18.

[121] Nagy 1998; Allen et al. 2009; USFWS Mojave tortoise 5-YEAR Review at 24, 33.

[122] Fenn 2003 at 416.

by the SAFE Rule will harm federally threatened and endangered species in ways that are causally understood and measurable. By finalizing the SAFE Rule without consulting with the nation's wildlife agencies, EPA and NHTSA are threatening the existence of numerous species that I—and the Center—work so hard to protect.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on January 7, 2021 at Kensington, California.

Shaye Wolf

Shaye Wolf

Exhibit A: List of References

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Exhibit B

Nitrogen Pollution Is Linked to US Listed Species Declines

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Nitrogen (N) pollution is increasingly recognized as a threat to biodiversity. However, our understanding of how N is affecting vulnerable species across taxa and broad spatial scales is limited. We surveyed approximately 1400 species in the continental United States listed as candidate, threatened, or endangered under the US Endangered Species Act (ESA) to assess the extent of recognized N-pollution effects on biodiversity in both terrestrial and aquatic ecosystems. We found 78 federally listed species recognized as affected by N pollution. To illustrate the complexity of tracing N impacts on listed species, we describe an interdisciplinary case study that addressed the threat of N pollution to California Bay Area serpentine grasslands. We demonstrate that N pollution has affected threatened species via multiple pathways and argue that existing legal and policy regulations can be applied to address the biodiversity consequences of N pollution in conjunction with scientific evidence tracing N impact pathways.

Keywords: biodiversity, endangered species, eutrophication, nitrogen deposition

Biodiversity loss is a major environmental challenge, with a growing number of recognized drivers that interact in complex ways (Cardinale et al. 2012, Hooper et al. 2012). Habitat destruction, fragmentation, and direct exploitation of species have long been recognized as threats to biodiversity, and most policies for imperiled species (e.g., listed and unlisted species that are in decline) protection are designed with these direct drivers in mind (Sala et al. 2000). Recent climate and atmospheric changes, such as increased temperature, altered precipitation regimes, and increasing nitrogen (N) pollution, have created new threats to biodiversity (Novacek and Cleland 2001, Brook et al. 2008). Establishing the effects of these stressors on vulnerable species and addressing their impacts through existing species protection laws and regulations, such as the Endangered Species Act (ESA), the Clean Air Act (CAA), and the Clean Water Act (CWA), can be challenging. Attribution is hampered by sometimes long and difficult-to-trace chains of causation from climate and atmospheric stressors to impacts on vulnerable species. Nevertheless, it is clear that these emerging threats are contributing globally to ecosystem degradation and affecting a broad array of imperiled species through habitat modification and altered ecological interactions (Vitousek et al. 1997, Porter et al. 2013). Existing laws and policies to protect biodiversity were largely developed before these threats were fully recognized. For example, the ESA was passed in 1973, with major amendments in 1978, 1979, and 1982; the CAA was passed in 1963, with subsequent amendments passed in 1970, 1977, and 1990; and the CWA was passed in 1977. Although the CAA includes both primary standards to protect against adverse health effects and secondary standards to protect against welfare effects, such as damage to crops and vegetation, the secondary standards have historically not been set at levels low enough to protect sensitive plants. The efficacy of existing legal and policy tools (e.g., federal and state regulations, guidance, best management practices, and management strategies) to tackle emerging drivers of imperiled species decline depends on a clear understanding of how and why these emerging threats affect species of concern.

In this article, we focus on establishing the links between N pollution and imperiled biodiversity in the United States. Nitrogen pollution is a prevalent atmospheric and biogeochemical global change driver, with growing effects on terrestrial, aquatic, and coastal ecosystems. Nitrogen pollution and climate change as drivers of species imperilment share characteristics such as complex chains of causation and mechanisms for reducing threats, but climate change has been more explored in the recent literature (Povilitis and Suckling 2010). Moreover, although both are global environmental challenges, N pollution can be more readily addressed within the boundaries of a single nation, region, or watershed, providing opportunities to act on new knowledge within specific areas and with specific benefit to particular species.

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Nitrogen as an emerging biodiversity threat. Nitrogen from human-derived sources is already recognized as a major threat to biodiversity on local, regional, and global scales (Rockström et al. 2009). Agricultural fertilization, the increased production of leguminous crops, and fossil fuel combustion have doubled the amount of global reactive N in terrestrial and aquatic ecosystems (Gruber and Galloway 2008). In the United States, human-derived N inputs are estimated to be fourfold greater than natural N sources (Davidson et al. 2012) and have altered ecosystem productivity, function, and biodiversity (Bobbink et al. 2010, Cleland and Harpole 2010, Baron et al. 2013). The impacts of human-derived N enrichment are ubiquitous in both aquatic and terrestrial ecosystems, and N enrichment is known to affect a wide range of species (Baron et al. 2013, Porter et al. 2013). For example, one-third of US streams and two-fifths of US lakes are moderately to severely affected by excess N inputs (Davidson et al. 2012). Major adverse effects of N enrichment in aquatic systems include harmful algal blooms, hypoxia of fresh and coastal waters, and ocean acidification. At the global scale, increasing N emissions—and subsequently, N deposition—have been projected to occur in most terrestrial regions by 2030 (Dentener et al. 2006), potentially leading to further biodiversity loss in sensitive ecosystems (Sala et al. 2000, Phoenix et al. 2006).

In the past 15 years, understanding has grown of the ecological impacts of human-derived N inputs across taxa and ecosystem types. However, we have limited direct evidence of N pollution as a driver of biodiversity loss (although see Allen and Geiser 2011, Pasari et al. 2011, Chen et al. 2013, Gilliam 2014). Addressing the ecological impacts of and mitigation strategies for N pollution on threatened species requires studies that follow the long chain of causation of the effects of N deposition: the sources of N to ecosystems, the biological responses of organisms to increased N, the changes in ecological interactions in an ecosystem, and the potential for management efforts to minimize the impact on vulnerable species.

In this article, we aim to (a) assess the current threat posed by N to federally protected species in the continental United States and (b) illustrate the complexity in tracing N pollution impacts on federally listed species and the challenges associated with managing such impacts. First, we identify US threatened and endangered species vulnerable to the effects of N pollution by synthesizing federal documentation on the status and threats to species listed or proposed for listing under the federal ESA. We then present a case study of an interdisciplinary approach to tracing the causal chain of N pollution impacts on listed species and addressing the threat of N pollution on a vulnerable ecosystem: California Bay Area serpentine grasslands. As part of this case study, we highlight crucial opportunities for mobilizing existing legal and policy tools to address the N impacts on one listed species and demonstrate how an improved understanding of the ecological mechanisms by which N affects sensitive species could strengthen US policies for controlling N pollution in general.

N impacts on federally listed species

Although the environmental consequences of N pollution in the United States are increasingly well documented (Greaver et al. 2012), many of the direct and indirect effects of N pollution on sensitive species and ecosystems are either poorly understood or insufficiently synthesized for use in decision making. The lists of endangered, threatened, and candidate species protected under the ESA (category definitions found within ESA Section 3), along with associated Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) documents detailing the status of and ongoing threats to each of these approximately 1400 species, provide an excellent and internally consistent data set from which to derive and synthesize information about the nature and extent of N pollution impacts on sensitive US biota. For each federally listed species, available knowledge of species biology, habitat needs, and threats are compiled in listing documents, including the petitions for listing, Federal Register notices of proposed and final listing decisions, recovery plans, and five-year review documents. Each of these documents is characterized by relative consistency in the scope of knowledge review for each species and the evidence standard applied in determining whether to include a threat as a factor contributing to species decline.

For a species to be listed as threatened or endangered under the ESA, the species must undergo a detailed accounting of how the species is threatened by one or more of the following mechanisms: (a) the present or threatened destruction, modification, or curtailment of its habitat or range; (b) overuse for commercial, recreational, scientific, or educational purposes; (c) disease or predation; (d) the inadequacy of existing regulatory mechanisms; or (e) other natural or manmade factors affecting its continued existence (ESA Section 4(a)(1), 16 USC 1533). The listing of a species is based on the "best scientific and commercial data available" and is summarized in a required section of the listing documents called "Summary of Factors Affecting the Species," which provides a detailed review of the impacts on a species within each of the five categories above.

We surveyed the listing documents of all candidate and listed terrestrial and aquatic species (including all vertebrates, invertebrates, and vascular plants) within the continental United States, seeking to determine the extent to which the FWS and the NMFS—the federal agencies in charge of ESA implementation—recognize the effects of N pollution on imperiled species. Specifically, we examined all relevant FWS and NMFS documents available for each listed or candidate species for records of N or nutrient impacts. We gathered the following information for each listed species: species current home range, ecosystem classification, inclusion in a recovery plan, critical habitat designation, cause of species decline, and documentation of N (i.e., atmospheric deposition or aquatic runoff) impacts on species status and designation. We considered a species to be affected by N pollution if the listing documents included one or more of the following words in the "Summary of Factors Affecting the Species": *nitrogen* or any specific form of N (e.g. NH_4, NO_x), *fertilizer* (as long as the documentation did not explicitly mention phosphorus fertilizer), or *eutrophication* (as long as the eutrophication was not explicitly a result of phosphorus pollution). Impacts from factors that may be related to N pollution (e.g., *runoff* or *sedimentation*) but did not explicitly mention N in the documentation were not sufficient to include the species in our list. Furthermore, listing documents tended to describe existing impacts and not potential or projected future impacts on species. Therefore, our estimates are likely conservative, because the number of affected species is likely higher than the ones we identify because of N impacts not reflected in the federal documents, unrecognized indirect impacts of N, and amplifying interactions between N and other environmental factors, such as climate change (Greaver et al. 2012).

We found 78 species formally recognized in federal agency documents as harmed by N loading across aquatic (n = 66) and terrestrial (n = 12) systems within the continental United States (excluding Hawaii and Alaska; tables 1–3, figure 1). Most of the N-affected species are endangered or proposed endangered (n = 55), followed by threatened (n = 20) and candidate (n = 3). Across taxa, most N-affected species are invertebrates (n = 52) such as mollusks and arthropods (table 1), followed by vertebrates (fish, amphibians, and reptiles; n = 18; table 2), and plants (n = 8; table 3). There were no N-threatened mammals mentioned. However, there were species in all taxonomic groups, including mammals, which were noted to be indirectly affected by factors associated with N pollution. For example, the endangered West Indian manatee (*Trichechus manatus*) is affected by harmful red tide algal blooms, which can be a result of inorganic N pollution (Camargo and Alanzo 2006).

We spatially categorized the N-affected species by state within an FWS Region: Pacific Region 1 (Idaho, Oregon, Washington), Southwest Region 2 (Arizona, New Mexico, Oklahoma and Texas), Great Lakes–Big Rivers Region 3 (Illinois, Indiana, Iowa, Michigan, Missouri, Minnesota, Ohio, and Wisconsin), Southeast Region 4 (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee), Northeast Region 5 (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia), Mountain–Prairie Region 6 (Colorado, Kansas, Montana, North Dakota, Nebraska, South Dakota, Utah, and Wyoming), and Pacific Southwest Region 8 (California and Nevada).

The majority of N-affected species are located in the Southeast (n = 53, FWS Region 4), with very few species located in Midwest/Mountain regions (n = 3, FWS Region 6; figure 1). Generally, affected species are not confined to areas with historically high N pollution, such as the Northeast (n = 14, FWS Region 5). This is likely due to several factors, including multiple N impact pathways that are dispersed across large spatial scales and not typically accounted for in recent analyses (Sobota et al. 2013), species that are affected even at relatively low levels of N pollution and therefore not correlated with the magnitude of N pollution, and high concentrations of geographically restricted taxa in US regions with relatively low N pollution.

Pathways of N impact on species

We grouped the nature of N effects on surveyed species into the following four categories: (1) direct toxicity or lethal effects of N, (2) eutrophication lowering dissolved oxygen levels in water or causing algal blooms that alter habitat by covering up substrate, (3) N pollution increasing nonnative plant species that directly harm a plant species through competition, and (4) N pollution increasing nonnative plant species that indirectly harm animal species by excluding their food sources. Here, we highlight specific examples of each N impact pathway on listed species.

Direct toxicity or lethal effects of N. At least nine species in our survey are directly affected by toxic or lethal N effects. This pathway primarily affected species of freshwater mussels (table 1), although direct toxicity was also a potential threat for two amphibian species (*Anaxyrus californicus* and *Eurycea tonkawae*; table 2) and one plant species (*Hackelia venusta*; table 3). Although direct toxicity experiments are rare in the literature, evidence confirms that N deposition can directly harm sensitive species via several mechanisms. Atmospheric N compounds can directly affect plant nutrient-uptake mechanisms, leading to toxicity and negative consequences for growth and photosynthesis in higher plants and lower plants such as mosses (Pearson and Stewart 1993). Inorganic N pollution is also highly toxic to aquatic species such as fish and amphibians, impairing their ability to survive, grow, and reproduce, and may be a contributing factor to the observed global decline of amphibians (Shinn et al. 2008, Johnson et al. 2010). For example, NH_3 toxicity in fish and invertebrates may occur via asphyxiation, reduction in blood oxygen–carrying capacity, disruption of osmoregulatory activity in the liver and kidneys, and repression of the immune system, leading to increased disease susceptibility (Camargo and Alonso 2006, Grizzetti et al. 2011). However, the toxic concentration of NH_3 changes with water pH, water temperature, and the period of exposure. Ammonia in neutral or slightly acidic water is less toxic than when in basic water. Similar toxic effects of nitrite and nitrate have been seen in fishes and crayfishes, although certain freshwater crustaceans, insects, and fishes are more sensitive than seawater organisms because of the ameliorating effects of higher water salinity and chloride ion concentration. The toxicity of these pollutants is also dependent on the period of exposure and chloride concentration (Camargo et al. 2005).

A recent US Environmental Protection Agency report (EPA 2013) reviewed acute and chronic ammonia toxicity data for numerous fish, invertebrate, and amphibian species, with emphasis on freshwater unionid mussels and nonpulmonate snails. The report recommended that a single

Table 1. A list of the federally listed invertebrate species documented as impacted by reactive nitrogen (N).

Scientific name	Common name	Status	Taxonomic group	FWS region	N impact pathway
Euphydryas editha bayensis	Bay checkerspot	T	IV (insect)	8	5
Pseudanophthalmus paulus	Nobletts Cave beetle	C	IV (insect)	4	2, 3
Acropora cervicornis	Staghorn coral	T	IV	4	3
Acropora Palmata	Elkhorn coral	T	IV	4	2, 3
Alasmidonta heterodon	Dwarf wedgemussel	E	IV	5	2, 3
Campeloma decampi	Slender campeloma	E	IV	4	2, 3
Cumberlandia monodonta	Spectacle case	E	IV	3, 4, 5	1, 2, 3
Cyprogenia stegaria	Fanshell	E	IV	3, 4, 5	2
Elimia crenatella	Lacey elimia	T	IV	4	2, 3
Elimia melanoides	Black mudalia	C	IV	4	2
Elliptio chipolaensis	Chipola slabshell	T	IV	4	2
Elliptio steinstansana	Tar River spinymussel	E	IV	4	2, 3
Elliptoideus sloatianus	Purple bankclimber	T	IV	4	1, 2
Epioblasma brevidens	Cumberlandian Combshell	E	IV	4, 5	1, 2, 3
Epioblasma capsaeformis	Oyster mussel	E	IV	4	1, 2
Epioblasma florentina curtisi	Curtis pearlymussel	E	IV	4	2, 3
Epioblasma obliquata perobliqua	White catspaw	E	IV	3	2
Epioblasma othcaloogensis	Southern acornshell	E	IV	4	2, 3
Epioblasma penita	Southern combshell	E	IV	4	2, 3
Epioblasma torulosa gubernaculum	Green blossom	E	IV	4, 5	1, 2, 3
Fusconaia burkei	Tapered pigtoe	T	IV	4	2, 3
Fusconaia cuneolus	Finerayed pigtoe	E	IV	4, 5	2, 3
Fusconaia escambia	Narrow pigtoe	T	IV	4	2, 3
Fusconaia rotulata	Round ebonyshell	E	IV	4	2, 3
Hamiota australis	Southern sandshell	T	IV	4	2, 3
Lampsilis altilis	Finelined pocketbook	T	IV	4	2, 3
Lampsilis higginsii	Higgins eye	E	IV	3	1, 2, 3
Lampsilis powellii	Arkansas fatmucket	T	IV	4	2
Lampsilis virescens	Alabama lamp mussel	E	IV	4	2
Lanx sp. 1	Banbury Springs limpet	E	IV	1	2, 3
Leptodea leptodon	Scaleshell mussel	E	IV	3, 4, 6	2, 3
Leptoxis ampla	Round rocksnail	T	IV	4	2, 3
Physa natricina	Sanke River physa snail	E	IV	1	2
Plethobasus cicatricosus	White wartyback	E	IV	4	1
Plethobasus cooperianus	Orangefoot	E	IV	3, 4, 5	2
Plethobasus cyphyus	Sheepnose	E	IV	3	2, 3
Pleurobema clava	Clubshell	E	IV	3, 4	2
Pleurobema curtum	Black clubshell	E	IV	4	3
Pleurobema marshalli	Flat pigtoe	E	IV	4	2, 3
Pleurobema pyriforme	Oval pigtoe	E	IV	4	2
Pleurobema strodeanum	Fuzzy pigtoe	T	IV	4	2, 3
Pleurobema taitianum	Heavy pigtoe	E	IV	4	2, 3
Pleurocera foreman	Rough hornsnail	E	IV	4	2, 3
Popenaias popeii	Texas hornshell	C	IV	2	2
Ptychobranchus jonesi	Southern kidneyshell	E	IV	4	2, 3
Pyrgulopsis ogmorhaphe	Royal marstonia	E	IV	4	2, 3
Pyrgulopsis pachyta	Armored snail	E	IV	4	2
Quadrula cylindrica	Rabbitsfoot	E	IV	3, 4, 5	1, 2, 3
Quadrula intermedia	Cumberland	E	IV	4, 5	2, 3
Villosa choctawensis	Choctaw bean	E	IV	4	2
Villosa fabalis	Rayed bean	E	IV	3, 5	1, 2, 3
Villosa perpurpurea	Purple bean	E	IV	4, 5	1, 2, 3

Note: The pathways of N impacts to species are grouped into the following five categories: 1, direct toxicity or lethal effects of N; 2, eutrophication lowering dissolved oxygen levels; 3, eutrophication causing algal blooms that alter habitat by covering up substrate; 4, N pollution increasing nonnative plant species, directly harming a species through competition; and 5, N pollution increasing nonnative plant species, indirectly harming species by excluding their food sources. The listed species-status categories include candidate (C), endangered (E), proposed endangered (PE), and threatened (T). The US Fish and Wildlife Service (FWS) Regions include the Pacific Region (1), the Southwest Region (2), the Great Lakes Big River Region (3), the Southeast Region (4), the Northeast Region (5), the Mountain Prairie Region (6), the Alaska Region (7), and the California and Nevada Region (8).

Table 2. A list of the federally listed vertebrate species documented as impacted by reactive nitrogen (N).

Scientific name	Common name	Status	Taxonomic group	FWS region	N impact pathway
Anaxyrus californicus	Arroyo toad	E	A	8	1
Eurycea tonkawae	Jollyville plateau	PE	A	2	1
Acipenser oxyrinchus	Atlantic sturgeon	E	F	4, 5	2, 3
Chasmistes brevirostris	Shortnose sucker	E	F	1, 8	2, 3
Chasmistes cujus	Cui-ui	E	F	8	2
Cottus sp. 8	Grotto sculpin	PE	F	3	2
Crystallaria cincotta	Diamond darter	PE	F	5	2, 3
Deltistes luxatus	Lost River sucker	E	F	1, 8	2
Etheostoma chermocki	Vermilion darter	E	F	4	3
Etheostoma etowahae	Etowah darter	E	F	4	2, 3
Etheostoma moorei	Yellowcheek darter	E	F	4	2, 3
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	E	F	8	2
Notropis buccula	Smalleye shiner	PE	F	2	3
Notropis girardi	Arkansas River shiner	T	F	2, 4, 6	2
Noturus placidus	Neosho madtom	T	F	2, 3, 6	2
Percina aurolineata	Goldline darter	T	F	4	2
Chelonia mydas	Green turtle	E	R	1, 4	5
Gopherus agassizii	Desert Tortoise (Sonoran population)	T	R	2	5

Note: The abbreviations for pathways of N impacts to species, listed species categories, and FWS Regions are defined in table 1.

Table 3. A list of the federally listed plant species documented as impacted by reactive nitrogen (N).

Scientific name	Common name	Status	Taxonomic group	FWS region	N impact pathway
Arenaria paludicola	Marsh sandwort	E	P	8	3
Astragalus tener var. titi	Coastal dunes milk-vetch	E	P	8	4
Clarkia franciscana	Presidio clarkia	E	P	8	4
Hackelia venusta	Showy stickseed	E	P	1	1, 4
Halophila johnsonii	Johnson's sea grass	T	P	4	2, 3
Helonias bullata	Swamp pink	T	P	4, 5	4
Paronychia chartacea	Paper-like whitlow wort	T	P	4	4
Potamogeton clystocarpus	Little aguja pondweed	E	P	2	2

Note: The abbreviations for pathways of N impacts to species, listed species categories, and FWS Regions are defined in table 1.

national acute and a single national chronic water-quality criterion should be applied to all US waters. Surveyed species identified as most sensitive in the acute data set included the oyster mussel (*Epioblasma capsaeformis*) and Higgins eye (*Lampsilis higginsii*), both federally endangered (table 1). The federally endangered Lost River sucker (*Deltistes luxatis*) was identified as a sensitive species in both the acute and chronic data sets (table 2).

Eutrophication (lower dissolved-oxygen levels, algal blooms, and habitat alteration). The large majority of N-affected species on the ESA list are threatened by eutrophication-related factors (n = 67), such as low dissolved-oxygen levels, algal blooms leading to habitat alteration, or both (tables 1–3). Freshwater ecosystems are particularly vulnerable to these indirect effects of N deposition. Increased N leads to shifts in species composition of primary producers, increased producer biomass and organic matter sedimentation, and reductions in dissolved oxygen, water clarity, and light availability that alters the habitat and trophic dynamics of aquatic species (Smith 2003, Camargo and Alonso 2006). The limited dispersal ability of freshwater invertebrates such as mussels and crustaceans makes them particularly vulnerable to these impacts from nutrient deposition (Master et al. 2000, Camargo and Alonso 2006). Particular species traits are often associated with vulnerability to specific drivers (Zavaleta et al. 2009), and it appears that dispersal ability may influence species vulnerability to the harmful effects of N deposition in both terrestrial and aquatic ecosystems.

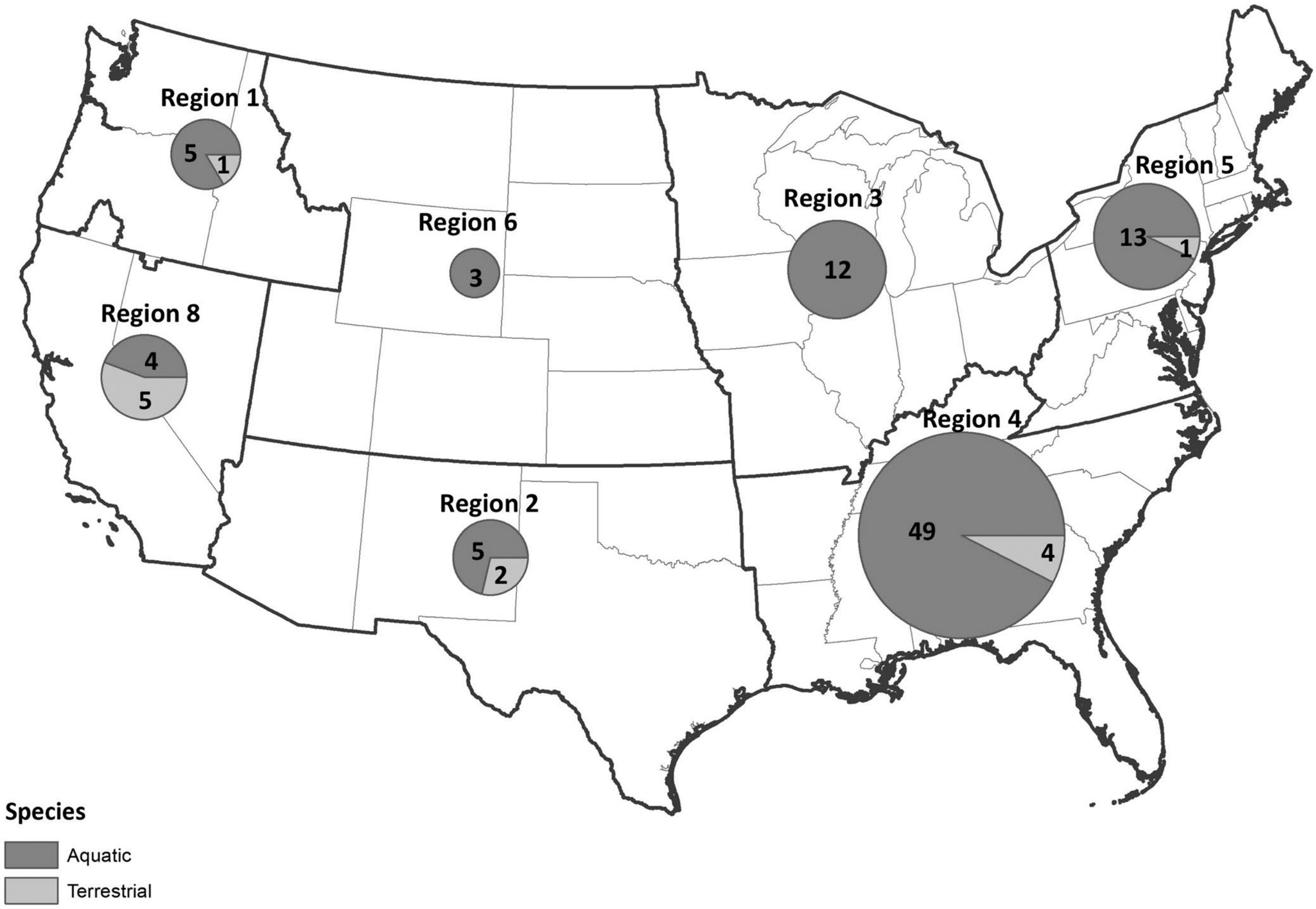

Figure 1. A Fish and Wildlife Service (FWS) Regional Map of the continental United States, with the relative magnitude and distribution of federally listed plant and wildlife species (terrestrial versus aquatic) documented as impacted by nitogen (N, from atmospheric deposition or aquatic runoff).

N pollution increasing nonnative plant species, directly harming a species through competition. Five federally listed plant species (*Astragalus tener var. titi*, *Clarkia franciscana*, *Hackelia venusta*, *Helonias bullata*, and *Paronychia chartacea*) were directly harmed through competition with a nonnative species (table 3). For example, *C. franciscana* is a native species in California serpentine grasslands that, like many native serpentine plants, is outcompeted by nonnative annual grasses (box 1; Harrison and Viers 2007). Increasing levels of N pollution in many nutrient-limited ecosystems may affect native species via several mechanisms, including interspecific competition and changes in interactions with herbivores and pathogens (Gilliam 2014). These community alterations can transform species composition by creating environmental conditions more favorable for faster-growing plants, such as exotic grasses, than for native plants that are adapted to nutrient-deficient soils (Bobbink et al. 2010, Gilliam 2014). Such a shift in resource availability may be the primary mechanism controlling invasive establishment and persistence in many ecosystems (Davis and Pelsor 2001, Ochoa-Hueso et al. 2011). Researchers have investigated the effects of N pollution on competition between native and exotic species in a wide variety of systems (Grime 1973, Pennings et al. 2005, Pfeifer-Meister et al. 2008, Abraham et al. 2009, Bobbink et al. 2010, Vallano et al. 2012). However, both the role of N pollution and the mechanisms underlying the successful invasion of exotic plant species require more study to reveal the full extent of N impacts on invasion-mediated species declines.

N pollution increasing nonnative plant species, indirectly harming native animal species by excluding their food sources. Although only three listed species—the Bay checkerspot butterfly (*Euphydryas editha bayensis*), green turtle (*Chelonia mydas*), and desert tortoise (*Gopherus agassizii*)—were documented as harmed by a loss of food availability as a consequence of competitive exclusion, this pathway is also the most indirect and difficult to assess. For example, short-term experimental studies have documented N limitation and N effects on food availability for the Bay checkerspot butterfly and native–exotic plant competitive outcomes in Bay Area serpentine grasslands (box 1; Huenneke et al. 1990, Weiss 1999, Vallano

Box 1. Is N deposition damaging critical habitat for a listed butterfly? Understanding and addressing indirect N threats to protected biodiversity.

The diversity of the nitrogen (N) impact pathways, affected habitats, and life-history characteristics of vulnerable species makes it difficult to generalize about the effects of N on vulnerable species and ecosystems. The most challenging cases, however, involve the indirect effects of N on whole ecosystems over long time scales and ultimately habitat alteration for a protected species.

Nitrogen deposition due to increasing fossil-fuel emissions in the San Francisco Bay Area contributes to the recent invasion of nutrient-poor, edaphically defined serpentine grasslands by nonnative annual grasses (e.g., *Festuca perennis*, *Bromus hordeaceus*; Weiss 1999). These invaders are in turn displacing rare native and endemic plant species, including the larval host plants and adult nectar sources for the federally listed Bay checkerspot butterfly (BCB; *Euphydryas editha bayensis*; Weiss 1999).

The chain of causation linking N deposition to declines in the butterfly is long and complex. However, its establishment is crucial for understanding how to conserve threatened species and provides the basis for effective action. The demonstration of harm to the BCB requires evidence linking regional increases in atmospheric N pollution to local inputs in serpentine systems, to accumulation in those systems, to changes in plant species composition and biomass, to declines in the host plant, and finally—and crucially for conservation and policy strategy—to declines in BCB populations (figure 2).

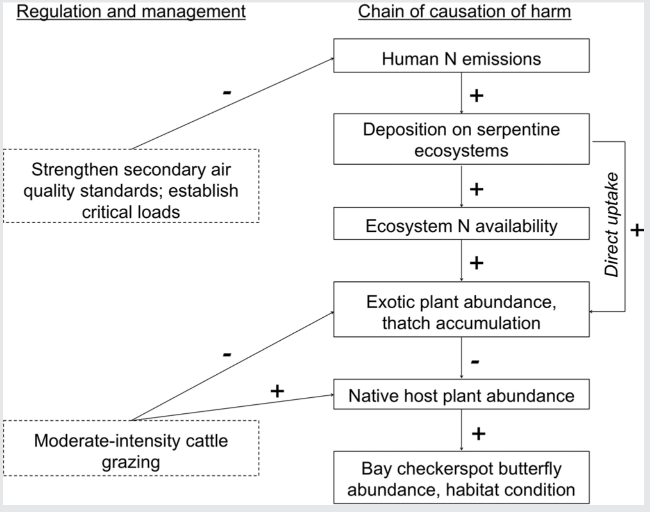

Figure 2. The chain of causation of nitrogen (N) emissions on the federally threatened Bay checkerspot butterfly (BCB), including the existing management strategies and necessary regulatory changes to mitigate the impacts of N on the BCB. Plus and minus signs denote the direction of the response of each component of the system to changes in the previous component.

1. Evidence of increasing N in serpentine grasslands

The San Francisco Bay Area generally experiences chronic low levels of atmospheric N deposition but includes several hotspots of elevated N deposition in areas located downwind of large and expanding urban centers (Fenn et al. 2003). Although contributions from NO_x emissions have declined in recent years, increased NH_3 emissions from combustion and agricultural operations are likely having a more substantial impact on ecosystems (Bishop et al. 2010).

2. The effects of N on current BCB habitat

The effects of N additions in serpentine grasslands are fairly well documented in field fertilization studies. The impacts of high levels of N fertilization include declines in the abundance of *P. erecta*, the BCB's host plant (Koide et al. 1988), increases in invader aboveground biomass (Koide et al. 1988, Huenneke et al. 1990), and increases in invasion and biomass leading to the dominance by exotics of formerly native-dominated patches (Huenneke et al. 1990). Realistic increases in N have also led to differences in microbial activity and N cycling (Esch et al. 2013). Likewise, Vallano and colleagues (2012) documented increases in invader biomass and invader competitive dominance over *P. erecta* under N addition in a controlled growth-chamber study.

3. The efficacy and consequences of management strategies

Grazing by cattle is the dominant management strategy implemented to mitigate the effects of exotic species on BCB habitat (Weiss 1999). Moderate intensity grazing has been shown experimentally to be an effective management tool for reducing invasive grass cover under current levels of N deposition (Pasari et al. 2014, Beck et al. 2015). Grazing reduced exotic cover and increased the stability of native species richness and cover across years, maintaining a more consistent food supply for the BCB in this inherently heterogeneous system (Beck et al. 2015). However, the impacts of grazing were not universally positive for all native species. Some native species (primarily native grasses) were negatively affected by grazing, and variability in grazing intensity influenced the community and ecosystem response to grazing within years (Esch et al. 2013, Pasari et al. 2014). Grazing is clearly the best management tool currently available to manage serpentine ecosystems and has been used to successfully maintain BCB habitat for over three decades. However, because grazing only addresses the proximate impacts of increased N deposition, it is an incomplete solution to the problem. Policy interventions are necessary to curb N emissions and therefore reduce the impact of N on threatened species in this system to levels below established critical loads.

Tzankova and colleagues (2011) demonstrated that the documented chain of causation of the effects of N on BCB reproduction brings a legal ability to argue that N deposition is causing ESA-prohibited harm, take, and jeopardy of federally listed wildlife. In the BCB case, this effectively means that the species-protection provisions of the ESA might be used to trigger an otherwise unlikely rethinking of the current federal and state ambient air–quality standards and emission-control decisions that determine the amount of reactive N deposited on the BCB's serpentine grassland habitat—the kind of rethinking necessary to ensure protection of the BCB and other threatened species.

et al. 2012), but recent studies have also begun to reveal long-term N accumulation via deposition to serpentine plants and soils, as well as to quantify the fates and effects of this additional N on species loss, biodiversity, and ecosystem processes (box 1; Ochoa-Hueso et al. 2010, Esch et al. 2013, Pasari et al. 2014, Beck et al. 2015). The extent of the impacts of N accumulation on species interactions is likely greater than currently recognized, and additional research is needed to determine how N deposition impacts trophic relationships in threatened and endangered species.

Addressing the threat of N pollution

We show that the recognized threat to federally protected species from N pollution is substantial (at least 78 listed taxa harmed), geographically widespread, and posed by a variety of pathways linking N to direct organismal harm in some cases and habitat alterations leading to population decline in many others. Given the existence and nature of both federal protections for listed biodiversity and regulatory standards for N as a pollutant, an opportunity and a need exist to update pollution thresholds to fulfill the federal regulatory mandate to protect listed animals and plants.

We next provide an example of how even in cases with the most indirect links between N pollution and species decline, a chain of causation can be established through literature review combined with targeted experimental and observational studies on a timescale of one to a few years and used as the basis for effectively leveraging regulatory tools (see box 1). The links from N deposition to declines in a listed species, the Bay Checkerspot butterfly, are complex but possible to substantiate through a range of investigations at the atmosphere–ecosystem interface and the intersections of ecosystem, community, and population ecology, involving both historical and comparative approaches.

For instance, both quantitative and qualitative knowledge of the sensitivity of listed species and their habitat to additional N deposition are required for the calculation of ecosystem critical N loads where listed plant and wildlife species are found. The concept of identifying a "critical load" (defined as the level of input of a pollutant below which no harmful ecological effect occurs over the long term; Pardo et al. 2011) and setting thresholds for ecosystems is increasingly used to assess the status of vulnerable ecosystems in response to atmospheric N deposition. To date, critical loads have been designated for many ecosystems, but the links between these identified thresholds and habitat alteration are uncertain (Fenn et al. 2010, Pardo et al. 2011). The potential loss of biodiversity is highly sensitive to the degree to which ecosystems respond to N deposition (Clark et al. 2013). Therefore, accurate assessments of critical loads are necessary to ensure protection of biodiversity.

Thresholds for both atmospheric and aquatic N inputs need to be set in sensitive ecosystems on the basis of integration of observational, experimental, and modeling studies on N pollution at realistic levels (chronic low N inputs) combined with observations on N loading and accumulation along multiple scales and management conditions (Bobbink et al. 2010, Davidson et al. 2012, Baron et al. 2013). For example, in California serpentine grasslands, the current estimated *CL* (defined as the level above which nonnative grasses invade and replace native forbs) is 6 kilograms N per hectare per year (Weiss 1999, Fenn et al. 2010), approximately half the rate of current levels of N deposition found in the habitat of the threatened Bay Checkerspot Butterfly (Weiss 1999). The body of knowledge needed to make this determination included the synthesis of several scientific studies across disciplines (atmospheric chemistry, ecology, and biogeochemistry), scales, and techniques. Ecological knowledge regarding species impacts of N inputs, including population and possibly individual-level impacts of the habitat modifications caused by excessive N loading, is necessary for accurately updating N thresholds, effective conservation, and science policy (box 1).

Nitrogen pollution is only one widespread form of environmental change that interacts with other long-standing and emerging stressors, such a climate change, with a high likelihood of exacerbating declines in populations of threatened species. A need persists to look comprehensively at other drivers and the interactions among them, because many more species and ecosystems, both listed and not, are likely affected both by N pollution itself and its interactions with other threats. Interdisciplinary science-policy efforts are more necessary than ever to tackle these more complex—but very widespread—challenges to biodiversity conservation and ecosystem stewardship.

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DECLARATION OF KATE ZALZAL

I, Kate Zalzal, declare as follows:

1. I am a member of the Environmental Defense Fund (EDF) and have been a member since 2012.

2. I reside in the town of Lyons, Colorado, with my husband and three children.

3. We recently welcomed our youngest child to the family in January 2018, and as a mother of three, I need a car that will fit myself, my husband, and all of our children. I also use my vehicle for a variety of purposes that often require me to transport multiple passengers. One of my children has attended dance classes, another plays on a soccer team and goes to practices, and in the summer both of my older children often participate in summer camps. I drive our kids to these activities and often participate in carpools with other families who likewise have children in these activities.

4. My family also travels around the Colorado mountains in the summertime and wintertime for camping trips and other activities. We regularly visit my parents, who live in the mountains between Lyons and Estes Park. Driving to these places makes four-wheel drive, all-wheel drive, or other similar features valuable during both the summer and winter.

5. Within the last two years, we replaced our four-wheel drive vehicle, which had broken down, with a vehicle with similar capabilities that is lower polluting and more fuel efficient. We use this vehicle for family trips to the mountains in the summer and the winter. Our family also has a second vehicle, purchased before we had children, that no longer fits our whole family and so we are planning to replace it within the next five years.

6. One of my highest priorities in shopping for a new car is high fuel efficiency. Because I often have to drive to surrounding towns, it is important for me to save on fuel costs by driving a car that gets better mileage than my current vehicle.

7. I am also very concerned about the climate pollution emitted by passenger vehicles, and it is important to me to own a car that releases fewer of these harmful emissions.

8. When we replace our smaller vehicle, we intend to purchase an electric vehicle that will fit our family and that we will use primarily for transportation around town and for the frequent trips we take to surrounding communities. Accordingly, I am planning to purchase an electric minivan, SUV or similar vehicle. I intend to purchase an electric vehicle because it has zero tailpipe emissions, it is substantially less costly to operate than a gasoline powered vehicle and likewise has fewer maintenance and other associated costs. Colorado has also

recently extended its state tax incentives for electric vehicles purchases through 2025, which, coupled with federal incentives, makes the financial savings associated with purchasing an electric vehicle even more attractive for me and my family.

9. Since I started shopping for a new car, I have realized that there are currently not many options for electric minivans or SUVs. For instance, there is only one plug-in hybrid minivan currently available on the market—the Chrysler Pacifica—and there are currently no, similar all-electric vehicles available for purchase. In addition, I am aware that the electric vehicle offerings for sale in other states are not always available in Colorado, further limiting electric vehicle options for me and other Colorado consumers.

10. At the same time, I am aware that a substantially greater number of electric vehicles will be available for purchase over the course of the next 5 years, when we intend to purchase a new car. These include some all electric minivans, like the VW ID Buzz and other all electric vehicles that would fit my family and meet our needs.

11. I understand that this rapid expansion of electric vehicle model availability is being driven by changing market dynamics and reduced battery prices in combination with policies, most notably the state of California's standards for zero emission vehicles ("State Zev Standards"), which are part of the

California Advanced Clean Car Program ("State Clean Car Standards"). These State ZEV Standards require automakers to generate a certain number of credits, driven by their sales of electric vehicles in California and other states that have adopted the State ZEV Standards.

12. I am also aware that Colorado has recently adopted the State ZEV Standards and that automakers would have to begin complying with those requirements for model year 2023 vehicles. When it adopted the State ZEV Standards, Colorado found that these Standards would require that automakers make additional electric vehicles available for sale in Colorado, beyond those that would be available absent the Standards. I understand that automakers supported adoption of State ZEV Standards in Colorado and indicated their view that the Standards would result in accelerated EV model availability in the state.

13. I am aware that the Environmental Protection Agency and the National Highway Traffic Safety Administration previously adopted Clean Car Standards, which require automakers to reduce greenhouse gas emissions and improve the fuel efficiency of new vehicles sold in the United States. I understand that these standards are based on a vehicle's "footprint," meaning that for each class of vehicles—including those we are considering purchasing—the standards require emission reductions and improvements in fuel economy over time.

14. I am aware that in a recent joint rulemaking, NHTSA finalized a regulation stating that California is preempted from exercising its unique authority under the Clean Air Act to set more-protective vehicle emission standards through a waiver issued by EPA.[1] Furthermore, I am aware that in the same joint rulemaking, EPA withdrew the Clean Air Act waiver granted to California that allows the state to set protective vehicle emission standards. I understand that the combined effect of these EPA and NHTSA actions would be to invalidate the State Clean Cars Program, including the State ZEV Standards. This, in turn would prevent Colorado from implementing these standards that are distinct from and more protective than the federal rule.

15. I am also familiar with the recent joint EPA and NHTSA rule that dramatically weakens the federal greenhouse and fuel economy standards for passenger cars.[2]

16. As a Colorado resident who intends to purchase a new electric vehicle in the next 5 years, I am concerned that these actions will harm me by limiting the availability of electric vehicles that meet my and my family's needs. Specifically, I am concerned that eliminating these standards will limit my ability to purchase an EV by removing important drivers supporting increased EV model availability in

[1] 84 Fed. Reg. 51,310 (Sept. 27, 2019).
[2] 85 Fed. Reg. 24,174 (April 30, 2020).

the coming years. Also, by blocking Colorado's ability to implement State ZEV Standards, the NHTSA and EPA actions will likely return the state to a place where Colorado consumers do not have access to EVs that might otherwise be available in different states across the country.

17. I declare that the foregoing is true and correct.

Executed May 28, 2020

Kate Zalzal

January 14, 2021

Mr. Mark Langer
Clerk, United States Court of Appeals
for the D.C. Circuit
333 Constitution Ave. NW
Washington, DC 20001

RE: *Competitive Enterprise Institute v. National Highway Traffic Safety Administration*, Case No. 20-1145 (and consolidated cases)
Oral argument not yet scheduled

Dear Mr. Langer:

These consolidated petitions seek review of actions by the U.S. Environmental Protection Agency and National Highway Traffic Safety Administration (collectively, the Agencies). The Agencies filed certified indexes of administrative record in this Court on July 6, 2020. ECF No. 1850358. The indexes omit materials that the Agencies later acknowledged, in correspondence with the undersigned, are part of their administrative records for judicial review. Petitioners have cited several of these materials in their proof merits briefs filed today.

Most of the cited materials are publicly available and thus accessible to all parties. But certain of these materials are not publicly available, though the Agencies have produced them to the undersigned. To ensure that all parties have access to these cited record materials as they prepare their briefs, these materials are attached (as Exhibits B and C) to the accompanying declaration of the undersigned.

Sincerely,

/s/ Matthew Littleton
Matthew Littleton
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Counsel for Petitioner Environmental Defense Fund in Cases No. 20-1168, -1169

No. 20-1145

Consolidated with Cases No. 20-1167, -1168,
-1169, -1173, -1174, -1176, -1177 & -1230

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

COMPETITIVE ENTERPRISE INSTITUTE et al.,

Petitioners,

v.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION et al.,

Respondents,

ALLIANCE FOR AUTOMOTIVE INNOVATION et al.,

Intervenors for Respondents.

DECLARATION OF MATTHEW LITTLETON

I, Matthew Littleton, declare as follows pursuant to 28 U.S.C. § 1746:

1. I am an attorney practicing in District of Columbia. I am a member in good standing of the bars of the District of Columbia and the State of New York, as well as the bar of this Court.

2. I am among the counsel for Petitioner Environmental Defense Fund in Cases No. 20-1168 and -1169. With respect to the events described below, I acted with the consent of and on behalf of all petitioners in those cases—collectively, Public Interest Organization Petitioners.

3. Chloe Kolman and Daniel Dertke of the U.S. Department of Justice, Environment and Natural Resources Division, Environmental Defense Section, are among the counsel for respondents National Highway Traffic Safety Administration (NHTSA) and U.S. Environmental Protection Agency (EPA) (collectively, Agencies).

4. On July 6, 2020, Ms. Kolman filed in this Court the Agencies' certified indexes of administrative record in this matter.

5. On September 1, 2020, I emailed Mr. Dertke a letter (Ex. A) regarding several undocketed materials omitted from the certified indexes but that the Agencies had acknowledged in prior correspondence are part of their administrative records. Among those materials are tables that the Agencies had generated using an online table designer cited in footnote 1934 of their joint notice of final rulemaking, *see* 85 Fed. Reg. at 24,736. My letter requested that the Agencies produce those tables.

6. On October 29, 2020, Mr. Dertke emailed a response to my request for these tables. Mr. Dertke explained that although the Agencies had not preserved the specific tables generated by the online table designers during the rulemaking process, NHTSA was able to locate the data from those tables and produced that data as two pdf files. These files are attached hereto as Exhibits B and C. Mr. Dertke stated that the data in these files are identical to the data contained in the tables the Agencies generated during the rulemaking process, with redactions of deliberative material that was later added.

I declare under penalty of perjury that the foregoing is true and correct.

Matthew Littleton

Executed on January 14, 2021, in Washington, D.C.

Exhibit A

September 1, 2020

By electronic mail

Daniel Dertke
Environmental Defense Section
Environment & Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, DC 20044
daniel.dertke@usdoj.gov

Re: *Competitive Enterprise Institute v. NHTSA*, D.C. Cir. No. 20-1145 (and consolidated cases)

Dear Dan:

Your letter of August 20, 2020, regarding administrative records in the above-referenced cases requested that petitioners identify and request specific materials omitted from the record indexes but not readily available. Your email of August 24, 2020, stated that "the [A]gencies do agree to use their best efforts to expeditiously produce any undocketed cited sources upon request of any Petitioner in this case." **Petitioner Environmental Defense Fund requests that the Agencies provide the undocketed, cited materials described below expeditiously and, in any event, no later than September 8, 2020.** Please transmit the materials by email to the address provided in my signature block. If the materials' size makes email transmission impracticable, please make these materials available to me by other electronic means (e.g., an FTP site).

Your letter confirmed that NHTSA and EPA consider sources cited in the Federal Register notice for the Final Rules to be part of each agency's administrative record. Among these sources are those related to the calculations of the Final Rules' congestion benefits. The calculations rely heavily on the Federal Highway Administration's 1997 Highway Cost Allocation Study, and the notice indicates that the Study is available online. Final Rules, 85 Fed. Reg. at 24,736 & n.1934. But the online version of the Study omits the appendices thereto, which seem not to be available in the public domain. **Please produce the Federal Highway Administration 1997 Highway Cost Allocation Study, including all appendices thereto.**

The Federal Register notice for the Final Rules calculates an increase in congestion benefits due in part to an ostensible rise in vehicle occupancy, which the Agencies evidently calculated by means of online table designers. *See* Final Rules, 85 Fed. Reg. at 24,737 & n.1941. But the notice's citation to the table *designers* themselves does not specify the particular data (i.e., the exact tables the Agencies used the table designers to generate) on which the Agencies relied for their conclusions about increased vehicle occupancy. **Please produce the exact tables that the Agencies generated using the online table designer cited in footnote 1941 of the notice.**

The Federal Register notice for the Final Rules cites an "internal" Department of Energy study entitled "Estimated Cost of EV Batteries 2018-19 analysis" to support the Agencies' "cell yield" input in the "BatPac" model. *See* Final Rules, 85 Fed. Reg. at 24,502 & n.1212. This study appears not to be publicly available. **Please produce the Department of Energy study cited by the Agencies in footnote 1212 of the notice.**

Thank you for your prompt attention. Please contact me as soon as possible with any questions you have regarding the scope of this request. I will contact you under separate cover if my client needs access to other materials that the Agencies have conceded are part of their administrative records despite being omitted from their certified indexes and public rulemaking dockets.

Sincerely,

/s/ Matthew Littleton
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Counsel for Petitioner Environmental Defense Fund in Cases No. 20-1168 and -1169

Exhibit B

Year	Age	Person Trips (in millions)	Person Miles (in millions)	Vehicle Trips (in millions)	Vehicle Miles (in millions)	[redacted]
1995	5-15	58,254.60	392,399.10	200.77	1,750.82	
1995	16-17	11,881.32	83,755.25	4,640.76	28,572.27	
1995	18-24	38,255.65	357,612.82	24,645.91	220,595.98	
1995	25-29	32,335.21	317,612.53	23,301.29	227,626.59	
1995	30-34	41,785.03	414,594.77	30,738.59	302,481.51	
1995	35-39	39,340.47	379,898.69	30,167.75	269,904.23	
1995	40-44	36,437.23	347,987.33	28,496.24	264,004.44	
1995	45-49	29,781.30	300,180.46	23,279.31	222,971.07	
1995	50-54	20,750.60	224,510.50	15,592.81	155,592.05	
1995	55-59	15,971.81	159,635.89	11,828.89	109,274.90	
1995	60-64	15,037.18	145,058.34	10,876.91	92,812.88	
1995	65-69	15,239.55	121,560.78	10,831.96	80,562.96	
1995	70-74	12,321.63	93,005.76	8,271.94	53,154.83	
1995	75-79	6,881.24	45,907.42	4,322.27	25,879.68	
1995	80-84	3,332.53	19,241.05	1,905.05	9,424.44	
1995	85+	1,325.02	8,161.12	644.88	3,759.58	
[redacted]						

Exhibit C

Respondent Age	TD Vehicle Occupancy (Mean)							
	Trip Mode, derived							All
	Car	SUV	Van	Pickup truck	Motorcycle / Moped	RV (motor home, ATV, snowmobile)	Rental car (Including Zipcar / Car2Go)	
age6-15	2.16	2.73	3.47	3.38	.	1	.	2.59
16-20	1.37	1.5	2.07	1.58	1.08	1.22	1.78	1.43
21-25	1.43	1.52	2.11	1.32	1.36	1.21	3.25	1.46
26-30	1.67	1.85	3.92	1.5	1.05	2.3	2.22	1.84
31-35	1.51	2.09	2.84	1.62	1.04	3.35	1.5	1.77
36-40	1.59	2.17	2.75	1.6	1.2	1.23	1.94	1.88
41-45	1.68	2.01	2.67	1.45	1.01	1.62	1.98	1.82
46-50	1.62	1.9	2.4	1.54	1.11	2.58	2.64	1.76
51-55	1.47	1.69	1.72	1.49	1.38	1.98	1.72	1.55
56-60	1.45	1.68	1.91	1.38	1.11	1.06	2.33	1.53
61-65	1.48	1.72	1.79	1.44	1.24	2.08	1.81	1.56
66-70	1.5	1.63	1.82	1.51	1.21	1.7	1.98	1.56
71-75	1.63	1.66	1.72	1.53	1.02	1.51	2.9	1.63
76-80	1.58	1.67	1.88	1.52	1.5	1.63	1.88	1.61
81-85	1.41	1.48	2.42	1.31	1	1.92	2.03	1.52
86-88	1.44	1.68	1.34	1.51	.	.	.	1.48
89+	1.54	1.17	1.25	1.09	.	.	.	1.47
All	**1.54**	**1.83**	**2.44**	**1.49**	**1.2**	**1.83**	**2.19**	**1.67**

Respondent Age	TD Vehicle Occupancy (Sample Size)							
	Trip Mode, derived							All
	Car	SUV	Van	Pickup truck	Motorcycle / Moped	RV (motor home, ATV, snowmobile)	Rental car (Including Zipcar / Car2Go)	
age6-15	141	58	12	13	.	2	.	226
16-20	9593	2968	372	1844	47	21	5	14850
21-25	14172	3711	443	2198	100	23	23	20670
26-30	19588	8334	1281	3630	139	24	59	33055
31-35	21241	12915	2919	4963	107	9	93	42247
36-40	19495	14120	4460	5329	120	21	108	43653
41-45	19413	13654	4087	5868	131	17	114	43284
46-50	23558	15463	3881	7314	175	20	125	50536
51-55	27912	16679	3691	10117	277	50	171	58897
56-60	33905	19624	3807	11932	277	38	223	69806
61-65	36489	21109	4013	12219	279	90	215	74414
66-70	33148	20348	3628	10849	161	126	86	68346
71-75	22102	11857	2708	6735	86	77	54	43619
76-80	14641	6426	1894	3239	22	54	26	26302
81-85	8631	2876	1117	1417	9	28	28	14106
86-88	2749	758	244	303	.	.	.	4054
89+	1981	294	164	175	.	.	.	2614
All	**308759**	**171194**	**38721**	**88145**	**1930**	**600**	**1330**	**610679**