BEFORE THE UNITED STATES DEPARTMENT OF THE INTERIOR
PETITION FOR NO NEW OFFSHORE OIL & GAS LEASING

Center for Biological Diversity, Cook Inletkeeper, Healthy Gulf,
Wishtoyo Chumash Foundation, Petitioners

Filed With:

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United States Department of the Interior

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March 16, 2021

INTRODUCTION AND PETITIONED ACTION

As acknowledged by President Biden, we are facing a "profound climate crisis" and we have only a little time to pursue bold actions to avoid the most catastrophic impacts of climate change.[1] Our nation needs to swiftly shift away from fossil fuels and transition to clean and renewable energy.

Fossil fuels are killing our planet. The climate crisis is already causing devastating impacts from rising seas and coastal erosion; more destructive hurricanes and wildfires; increasing heatwaves, droughts, and floods; imperiling food and water security; and the collapse of ecosystems.

The overwhelming scientific consensus has conclusively determined that without significant, rapid emissions reductions, warming will exceed 1.5 degrees Celsius and will result in catastrophic damage around the world. Every fraction of additional warming above 1.5 degrees Celsius will worsen these harms, threatening people's lives, health, safety, and livelihoods; as well as the economy and national security for this generation and future generations.

The science demonstrates that global emissions must be reduced by half over the next decade to limit warming to below 1.5 degrees Celsius. The United States, based on our cumulative emissions and respective capabilities, must lead the way by reducing greenhouse gas emissions by at least 70 percent by 2030 and to near zero by 2040. Because fossil fuels are responsible for 75 percent of all greenhouse gas emissions and over 90 percent of carbon dioxide emissions, the Biden administration must immediately cease the expansion of fossil fuel development and implement a managed decline of fossil fuel extraction on public lands and waters — particularly considering the quantity of such areas already leased to oil companies, including over 12 million acres of federal waters currently subject to active oil and gas leases.

On January 27, 2021, President Biden issued an important Executive Order that directed the Secretary of the Interior to pause offshore oil and gas leasing:

> To the extent consistent with applicable law, the Secretary of the Interior shall pause new oil and natural gas leases on public lands or in offshore waters pending completion of a comprehensive review and reconsideration of Federal oil and gas permitting and leasing practices in light of the Secretary of the Interior's broad stewardship responsibilities over the public lands and in offshore waters, including potential climate and other impacts associated with oil and gas activities on public lands or in offshore waters."[2]

Any meaningful review will demonstrate that continued leasing is wholly inconsistent with the Secretary of the Interior's duties under the Outer Continental Shelf Lands Act ("OCSLA") to ensure offshore oil and gas development is balanced "with protection of the human, marine, and coastal environments," and consistent with "national needs."[3] Offshore oil and gas leasing also

[1] Executive Order Executive Order on Tackling the Climate Crisis at Home and Abroad (Jan. 27, 2021) (hereinafter "Biden Executive Order").
[2] *Id*., Sec. 208.
[3] 43 U.S.C. §§ 1802(2); 1332(3).

runs afoul of the Secretary's new duty to "prioritize action on climate change in its policy-making."[4]

New offshore oil and gas leasing will not only exacerbate the climate crisis, it will cause numerous other harms inherent in dangerous, dirty offshore drilling, including oil spills that would damage fisheries and coastal economies dependent on healthy wildlife and environments; dangerous air and water pollution and habitat destruction; and further negative impacts to frontline communities and imperiled wildlife from polar bears in the Arctic to Rice's whales in the Gulf of Mexico.

Accordingly, pursuant to the right to petition the government provided in the First Amendment to the U.S. Constitution,[5] the Administrative Procedure Act,[6] and OCSLA, the Center for Biological Diversity, Cook Inletkeeper, Healthy Gulf, and Wishtoyo Chumash Foundation hereby petition the Secretary of the Interior **to issue a new Outer Continental Shelf Oil and Gas Leasing Program under Section 18 of OCSLA, 43 U.S.C. § 1344, that contains no new leases in any region or planning area of the Outer Continental Shelf after the conclusion of the comprehensive review of the leasing program ordered by President Biden, to the extent that such a program is required by law**.

Granting the action requested in this petition will help protect our climate, wildlife, and frontline communities while the administration develops a plan to phase out fossil fuel extraction from federal waters. We must transform our extractive economy to a regenerative and inclusive one, in a manner that dismantles systemic racism and advances environmental, racial, and economic justice.

THE OUTER CONTINENTAL SHELF LANDS ACT PROVIDES THE SECRETARY WITH THE AUTHORITY TO GRANT THE PETITIONED ACTION

Congress enacted OCSLA in 1953 to establish a framework under which the Secretary of the U.S. Department of the Interior may lease areas of the outer continental shelf ("OCS") for purposes of exploring and developing the oil and gas deposits of the OCS's submerged lands.[7] The OCS generally begins three miles from shore — the outer boundary of state waters — and extends seaward to the limits of federal jurisdiction.[8]

[4] Biden Executive Order, Sec. 203(c).
[5] U.S. Const. amend. I; see also *United Mine Workers v. Ill. State Bar Ass'n*, 389 U.S. 217, 222 (1967) (explaining that the right "to petition for a redress of grievances [is] among the most precious of the liberties safeguarded by the Bill of Rights").
[6] 5 U.S.C. § 553(e); *see also id.* § 555(b) ("within a reasonable time, each agency shall proceed to conclude a matter presented to it"). Encompassed within this petition is a request for any and all regulations that may be necessary to effectuate the requested action.
[7] *See* 43 U.S.C. §§ 1331, *et seq.*
[8] *Id.* § 1331(a); 48 Fed. Reg. 10,605 (Mar. 14, 1983).

OCSLA charges the U.S. Department of the Interior with overseeing the "expeditious and orderly development [of offshore oil and gas resources], subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs."[9]

OCSLA establishes a multi-stage process for leasing, exploration, and development of the OCS.[10] As explained by the Supreme Court, the statute creates four separate stages to developing an offshore oil well: (1) formulation of a five-year leasing plan by the Department of the Interior; (2) lease sales; (3) exploration by the lessees; and (4) development and production.[11] "Each stage involves separate regulatory review that may, but need not, conclude in the transfer to lease purchasers of rights to conduct additional activities on the OCS."[12]

Section 18 of OCSLA governs the first stage of that process — the formulation of a five-year leasing plan. In particular, "Section 18 'establishes a process which will permit the Secretary of Interior to weigh energy potential, and other benefits against environmental and other risks in determining how, when and where oil and gas should be made available from the various Outer Continental Shelf areas to meet national energy needs.'"[13] It requires "the Secretary to prepare, maintain and periodically revise a leasing program consisting of a schedule of proposed sales, indicating, 'as precisely as possible, the size, timing and location of leasing activity which [the Secretary] determines *will best meet national energy needs* for the five-year period following its approval or reapproval.'"[14]

In developing five-year programs, the Secretary must consider several factors, including the overarching directive that management of the OCS be conducted in a manner that "considers economic, social, and environmental values of the renewable and nonrenewable resources contained in the outer Continental Shelf, and the potential impact of oil and gas exploration on other resource values of the outer Continental Shelf and the marine, coastal, and human environments."[15] OCSLA, "does not mandate any particular balance, but vests the Secretary with discretion to weigh the elements so as to 'best meet national energy needs.'"[16]

Pursuant to past five-year OCS oil and gas leasing programs and lease sales that occurred before Congress established Section 18, there are currently more than 12.4 million acres of federal waters subject to active oil and gas leases, including over 12.1 million acres of the Gulf of Mexico; over 158,900 acres of the Pacific Ocean; over 79,300 acres of the Arctic Ocean; and

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[9] 43 U.S.C. § 1332(3).
[10] *See* 43 U.S.C. §§ 1344, 1337, 1340, 1351.
[11] *See Sec'y of the Interior v. California*, 464 U.S. 312, 337 (1984).). Prior to drilling a well, an oil company must also obtain approval of an application for permit to drill. 30 C.F.R. § 550.281(a)(1).
[12] *California*, 464 U.S. at 337.
[13] *California by Brown v. Watt*, 668 F.2d 1290, 1297 (D.C. Cir. 1981) (citing H.R.Rep.No.1474, supra n.22, at 103 (1978), U.S.Code Cong. & Admin.News 1978, p. 1702).
[14] *Id.* (citing 43 U.S.C. § 1344(a)) (emphasis added).
[15] 43 U.S.C. § 1344(a)(1).
[16] *California v. Watt*, 668 F.2d at 1317.

over 76,600 acres of Cook Inlet.[17] Indeed, since the first offshore oil and gas lease sale in 1954, the federal government has offered over *2.66 billion acres* through numerous lease sales.[18]

This extensive offshore drilling has already contributed to, and exacerbated, the climate crisis and will continue to do so if not immediately curtailed. And while referred to as five-year programs, these programs can lock in offshore oil and gas drilling for decades. For example, in the most recent five-year leasing program for 2017 to 2022, the Department of the Interior stated that producing leases under the program have an expected lifespan of 40 to 70 years.[19]

The decisions the United States makes now about allocating lands and oceans for oil and gas leasing, exploration, development, infrastructure, and extraction will profoundly influence the nation's energy investment and infrastructure for decades to come, just at a period where science overwhelmingly tells us that a rapid shift away from fossil fuels is our only hope of a reasonable probability at avoiding catastrophic warming.

It is the nation's policy goal to "achieve net-zero emissions, economy-wide, by no later than 2050."[20] This means that national energy needs require halting new offshore oil and gas leasing, and not locking in even more dependence on fossil fuels.

Available information indicates that there is not only a need, but also a clear path for the United States to shift away from fossil fuels. Analysts have estimated that global oil demand may have peaked in 2019,[21] and numerous oil companies have also acknowledged that the world may have already, or soon will, reach peak oil demand.[22] "What is happening in the markets reflects the broader and continual shift away from traditional fuels."[23] Research supports that a 100 percent

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[17] Combined Leasing Report as of Mar. 1, 2021, https://www.boem.gov/sites/default/files/documents/about-boem/Lease%20stats%203-1-21.pdf

[18] Bureau of Ocean Energy Management, Table 1. All Lease Offerings, https://www.boem.gov/sites/default/files/documents/about-boem/Table%201%20SwilerTable%20BOEM16Oct2020.pdf (updated Mar. 18, 2020).

[19] *See, e.g.*, Bureau of Ocean Energy Management, 2017–2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program at 1-3, 6-20. Offshore oil and gas leases are issued for an initial term of five to ten years, but typically remain in production as long as oil or gas is produced in paying quantities. *See* 43 U.S.C. § 1337(b)(2)(A)-(B); 30 C.F.R. §§ 556.37(a)(2), 250.180(a).

[20] Biden Executive Order, Sec. 201.

[21] Jordan Blum, Oil, fossil fuel demand may have peaked in 2019 thanks to COVID-19:report, S&P Global (June 23, 2020), https://www.spglobal.com/platts/en/market-insights/latest-news/electricpower/062320-oil-fossil-fuel-demand-may-have-peaked-in-2019-thanks-to-covid-19-report.

[22] See Miranda Wilson, Peak oil demand could come sooner than expected — report, E&E News (June 22, 2020), https://www.eenews.net/energywire/stories/1063430843/print; Paul Takahashi, Oil demand to remain depressed into 2021, Houston Chronicle (Aug. 26, 2020), https://www.houstonchronicle.com/business/energy/article/Oil-demand-to-remain-depressed-into-2021-15516000.php.

[23] Kristi E. Swartz, NextExtra's market value surpasses Exxon's, E&E News (Oct. 5, 2020), https://www.eenews.net/energywire/stories/1063715429.

clean energy transition is possible.[24] Energy experts have produced detailed studies that describe the path away from fossil fuels to meet energy needs.[25] New electric generating capacity is coming primarily from wind and solar. According to the Energy Information Administration, renewable energy will "account for most new U.S. electricity generating capacity in 2021," with solar accounting for the largest share of new capacity at 39 percent, followed by wind at 31 percent.[26] Moreover, "[e]lectricity generation from renewable energy sources will rise from 20% in 2020 to 21% in 2021 and 23% in 2022."[27] Renewable energy costs have declined in recent years making them cost-competitive and reducing greenhouse gas emissions.[28] Accordingly, the climate emergency dictates that our nation's energy needs are to shift off of fossil fuel dependence.

Issuing a new five-year OCS leasing program with no leases in any OCS region would therefore be consistent with the declared Congressional purpose of OCSLA, which recognizes the "national interest in the effective management of the marine, coastal, and human environments," and policy of developing OCS resources "subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs."[29]

Indeed, OCSLA's legislative history demonstrates that Congress expected the proper balance to shift away from intensive extraction of oil and gas. When Congress enacted Section 18(a) in 1978, it sought to promote "orderly and efficient exploitation" of "almost untapped domestic oil and gas resources."[30] Congress recognized that this was more a stop-gap measure than a long-term solution to the nation's energy needs:

> Development of our OCS resources will afford us needed time — as much as a generation — within which to develop alternative sources of energy before the inevitable exhaustion of the world's traditional supply of fossil fuels. It will provide time to bring on-line, and improve energy technologies dealing with, solar, geothermal, oil shale, coal gasification and liquefaction, nuclear, and other energy forms.[31]

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[24] Hansen, Kenneth, et al. Status and perspectives on 100% renewable energy systems, 175 Energy 471-480 (2019); Brown, T.W., et al. Response to 'Burden of proof: A comprehensive review of the feasibility of 100% renewable-electricity systems, 92 Renewable and Sustainable Energy Reviews 834–847 (2018).
[25] Larson, Eric, et al. Net-Zero America: Potential Pathways, Infrastructure, and Impacts (Dec. 15, 2020); https://environmenthalfcentury.princeton.edu/sites/g/files/toruqf331/files/2020-12/Princeton_NZA_Interim_Report_15_Dec_2020_FINAL.pdf; Jacobson, Mark, Z., et al. 100% clean and renewable Wind, Water, and Sunlight (WWS) all-sector energy roadmaps for 53 towns and cities in North America, 42 Sustainable Cities and Society 22-37 (2018).
[26] U.S. Energy Information Administration, Today In Energy, Jan. 11, 2021, https://www.eia.gov/todayinenergy/detail.php?id=46416.
[27] U.S. Energy Information Administration, Short-Term Energy Outlook January 2021 at 3, 19–20.
[28] Lazard, Lazard's Levelized Cost of Energy Analysis: Version 13.0 (Nov. 2019); https://www.lazard.com/media/451086/lazards-levelized-cost-of-energy-version-130-vf.pdf.
[29] 43 U.S.C. § 1332(3).
[30] Continental Shelf Lands Act, Pub. L. No. 95-372, 3 U.S.C.C.A.N. 1450, 1460 (1978).
[31] H.R. Rep. No. 95-590, at 53 (1977).

In addition, a federal appellate court has recognized that delaying lease sales in a five-year program has "a tangible present economic benefit" because the "true costs of tapping OCS energy resources are better understood as more becomes known about the damaging effects of fossil fuel pollutants" and allows for the development of . . . renewable energy sources [that] reduce[] the need to rely on fossil fuels," among other benefits.[32] That same court has also recognized that "[t]he weight of [OCSLA Section 18(a)] elements may well shift with changes in technology, in environment, and in the nation's energy needs, meaning that the proper balance for 1980–85 may differ from the proper balance for some subsequent five-year period."[33]

Our environment and national energy needs have profoundly changed in the seven decades since Congress originally enacted OCSLA and the four decades since it enacted Section 18, as described more fully below. Indeed, the U.S. Department of Defense declared in 2014 that climate change "poses immediate risks to U.S. national security."[34] And, as recognized by President Biden himself, "[o]n the first day of [his] administration, according to the Intergovernmental Panel on Climate Change, there will be only 9 years left to stop the worst consequences of climate change."[35] Such reality, requires "immediate[] and ambitious[] action, because there's no time to waste."[36]

THE CLIMATE EMERGENCY DEMANDS IMMEDIATE ACTION TO HALT NEW OFFSHORE OIL AND GAS LEASING IN FEDERAL WATERS

The climate emergency demands immediate action to halt new offshore oil and gas leasing. Indeed, the best available science on climate change demonstrates that we not only need to end the federal fossil fuel leasing program, but phase-out existing production as well. As recently stated by several scientific experts, "[t]he scale of threats to the biosphere and all its lifeforms — including humanity — is in fact so great that it is difficult to grasp for even well-informed

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[32] *Ctr. for Sustainable Econ. V. Jewell*, 779 F.3d 588, 610 (D.C. Cir. 2015).

[33] *California v. Watt*, 668 F.2d at 1317. The D.C. Circuit's decision in *Ctr. for Biological Diversity v. U.S. Dep't of the Interior*, 563 F.3d 466 (D.C. Cir. 2012), does not preclude the Secretary from granting the petitioned action based on the climate crisis. The question presented in that case was whether OCSLA *mandates* that the Secretary consider the global climate effects of oil and gas consumption in developing a five-year program, not whether its consideration of such impacts would be *permissible*. *Id.* at 484. The court's statement that the Secretary lacks the discretion to consider such impacts is therefore dicta. As the Supreme Court has made clear, "broad language . . . unnecessary to the Court's decision . . . cannot be considered binding authority." *Kastigar v. United States*, 406 U.S. 441, 454–55 (1972). Any suggestion that the case should be read to mandate lease sales in a five-year program fails for similar reasons. Nothing in OCSLA restricts the Secretary's authority to consider the impacts of consuming the oil that could be developed under a five-year program. To the contrary, OCSLA provides the Secretary with more than sufficient authority to consider and analyze such impacts and choose to issue a five-year program with no new leases in light of that analysis.

[34] The White House, Findings from Select Federal Reports: THE NATIONAL SECURITY IMPLICATIONS OF A CHANGING CLIMATE, May 2015, https://obamawhitehouse.archives.gov/sites/default/files/docs/National_Security_Implications_of_Changing_Climate_Final_051915.pdf.

[35] Biden-Harris, 9 KEY ELEMENTS OF JOE BIDEN'S PLAN FOR A CLEAN ENERGY REVOLUTION, https://joebiden.com/9-key-elements-of-joe-bidens-plan-for-a-clean-energy-revolution/.

[36] *Id.*

experts" and our planet faces a "ghastly future" unless swift action is taken to reverse the climate crisis, including "a rapid exit from fossil fuel use."[37] In light of this reality, opening any additional public waters to new oil and gas leasing would be incredibly reckless and constitute a gross dereliction of the Secretary's obligation to ensure the OCS is managed consistent with protection of the environment and national energy needs.

An international scientific consensus has established that human-caused climate change is already causing widespread harms, climate change threats are becoming increasingly dangerous, and fossil fuels are the dominant driver of the climate crisis.

An overwhelming international scientific consensus has established that human-caused climate change is already causing widespread harms and that climate change threats are becoming increasingly dangerous. The Intergovernmental Panel on Climate Change ("IPCC"), the international scientific body for the assessment of climate change, concluded in its 2014 Fifth Assessment Report that: "[w]arming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen," and further that "[r]ecent climate changes have had widespread impacts on human and natural systems."[38]

The U.S. federal government has repeatedly recognized that human-caused climate change is causing widespread and intensifying harms across the country in the authoritative National Climate Assessments, scientific syntheses prepared by hundreds of scientific experts and reviewed by the National Academy of Sciences and federal agencies. Most recently, the Fourth National Climate Assessment, comprised of the 2017 *Climate Science Special Report* (Volume I)[39] and the 2018 *Impacts, Risks, and Adaptation in the United States* (Volume II),[40] concluded that "there is no convincing alternative explanation" for the observed warming of the climate over the last century other than human activities.[41] It found that "evidence of human-caused climate change is overwhelming and continues to strengthen, that the impacts of climate change are intensifying across the country, and that climate-related threats to Americans' physical, social, and economic well-being are rising."[42]

In 2009 the Environmental Protection Agency found that the then-current and projected concentrations of greenhouse gas pollution endanger the public health and welfare of current and

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[37] Bradshaw, C., et al. 2021. Understanding the Challenges of a Ghastly Future. Front. Conserv. Sci. Vol. 1, Article 615419.
[38] Intergovernmental Panel on Climate Change, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at 2.
[39] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/.
[40] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018).
[41] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 10.
[42] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018) at 36.

future generations, based on robust scientific evidence of the harms from climate change.[43] A 2018 study reviewed the scientific evidence that has emerged since 2009 and concluded that this evidence "lends increased support" for EPA's endangerment finding.[44] The study by 16 prominent scientists examined the topics covered by the endangerment finding and concluded that "[f]or each of the areas addressed in the [endangerment finding], the amount, diversity, and sophistication of the evidence has increased dramatically, clearly strengthening the case for endangerment."[45] The study also found that the risks of some impacts are even more severe or widespread than anticipated in 2009.

The National Climate Assessments decisively recognize the dominant role of fossil fuels in driving climate change. As stated by the Third National Climate Assessment: "observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas."[46] The Fourth National Climate Assessment reported that "fossil fuel combustion accounts for approximately 85 percent of total U.S. greenhouse gas emissions,"[47] which is "driving an increase in global surface temperatures and other widespread changes in Earth's climate that are unprecedented in the history of modern civilization."[48]

The National Climate Assessments make clear that the harms of climate change are long-lived, and the choices we make now on reducing greenhouse gas pollution will affect the severity of the climate change damages that will be suffered in the coming decades and centuries: "[t]he impacts of global climate change are already being felt in the United States and are projected to intensify in the future — but the severity of future impacts will depend largely on actions taken to reduce greenhouse gas emissions and to adapt to the changes that will occur."[49] As the Fourth National Climate Assessment explains:

> Many climate change impacts and associated economic damages in the United States can be substantially reduced over the course of the 21st century through global-scale reductions in greenhouse gas emissions, though the magnitude and timing of avoided risks vary by sector and region. The effect of near-term emissions mitigation on reducing risks is expected to become apparent by mid-century and grow substantially thereafter.[50]

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[43] U.S. EPA [U.S. Environmental Protection Agency], Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, 74 Federal Register 66496 (2009).
[44] Duffy, Philip B. et al., Strengthened Scientific Support for the Endangerment Finding for Atmospheric Greenhouse Gases, Science doi: 10.1126/science.aat5982 (2018) at 1.
[45] *Id.* at 1.
[46] Melillo, Jerry M et al. (eds.), Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014) at 2. *See also* Report Finding 1 at 15: "The global warming of the past 50 years is primarily due to human activities, predominantly the burning of fossil fuels."
[47] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 60.
[48] *Id.* at 39.
[49] *Id.* at 34.
[50] *Id.* at 1347.

Similarly, a 2014 White House report found that the cost of delay on reducing emissions is not only extremely steep but also potentially irreversible, and the costs rise exponentially with continued delays.[51] As summarized by the National Research Council:

> Emissions of carbon dioxide from the burning of fossil fuels have ushered in a new epoch where human activities will largely determine the evolution of Earth's climate. Because carbon dioxide in the atmosphere is long lived, it can effectively lock Earth and future generations into a range of impacts, some of which could become very severe. [E]mission reduction choices made today matter in determining impacts experienced not just over the next few decades, but in the coming centuries and millennia.[52]

The IPCC 2018 *Special Report* makes clear that greenhouse gas emissions must be halved in the next decade to avoid the most devastating consequences of climate change.

In 2018, the Intergovernmental Panel on Climate Change (IPCC) issued a *Special Report on Global Warming of 1.5°C* that quantified the devastating harms that would occur at 2°C warming, highlighting the necessity of limiting warming to 1.5°C to avoid catastrophic impacts to people and life on Earth.[53] The IPCC 2018 *Special Report* provides overwhelming evidence that climate hazards are more urgent and more severe than previously thought, and that aggressive reductions in emissions within the next decade are essential to avoiding the most devastating climate change harms.

The *Special Report* quantifies the harms that would occur at 2°C warming compared with 1.5°C, and the differences are stark. According to the IPCC's analysis, the damages that would occur at 2°C warming compared with 1.5°C include significantly more deadly heatwaves, drought and flooding; 10 centimeters of additional sea level rise within this century, exposing 10 million more people to flooding; a greater risk of triggering the collapse of the Greenland and Antarctic ice sheets with resulting multi-meter sea level rise; dramatically increased species extinction risk, including a doubling of the number of vertebrate and plant species losing more than half their range, and the virtual elimination of coral reefs; 1.5 to 2.5 million more square kilometers of thawing permafrost area with the associated release of methane, a potent greenhouse gas; a tenfold increase in the probability of ice-free Arctic summers; a higher risk of heat-related and ozone-related deaths and the increased spread of mosquito-borne diseases such as malaria and dengue fever; reduced yields and lower nutritional value of staple crops like maize, rice, and wheat; a doubling of the number of people exposed to climate change-induced increases in water

[51] The White House, The Cost of Delaying Action to Stem Climate Change (July 29, 2014), https://obamawhitehouse.archives.gov/the-press-office/2014/07/29/white-house-report-cost-delaying-action-stem-climate-change at 2.
[52] National Research Council, Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia (2011) at 3.
[53] 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).

stress; and up to several hundred million more people exposed to climate-related risks and susceptible to poverty by 2050.[54]

The IPCC report concludes that pathways to limit warming to 1.5°C with little or no overshoot require "a rapid phase out of CO_2 emissions and deep emissions reductions in other GHGs and climate forcers."[55] In pathways consistent with limiting warming to 1.5°C, global net anthropogenic CO_2 emissions must decline by about 45 percent from 2010 levels by 2030, reaching net zero around 2050.[56] For a two-thirds chance for limiting warming to 1.5°C, CO_2 emissions must reach net zero in 25 years.[57]

In short, the 2018 IPCC *Special Report* provides overwhelming scientific evidence for the necessity of immediate, deep greenhouse gas reductions across all sectors to avoid devastating climate change-driven damages, and underscores the high costs of inaction or delays, particularly in the next crucial decade, in making these cuts.

Human-caused climate change is causing widespread harms in the United States and worldwide, and these harms will worsen as greenhouse gas pollution continues to rise.

As detailed in the National Climate Assessments, key climate change impacts include rising temperatures, the increasing frequency of heat waves and other extreme weather events, the flooding of coastal regions by sea level rise and increasing storm surge, the rapid loss of Arctic sea ice and the collapse of Antarctic ice shelves, declining global food and water security, increasing species extinction risk, ocean acidification, and the global collapse of coral reefs.[58] As summarized by the Fourth National Climate Assessment:

In addition to warming, many other aspects of global climate are changing, primarily in response to human activities. Thousands of studies conducted by researchers around the world have documented changes in surface, atmospheric, and oceanic temperatures; melting glaciers; diminishing snow cover; shrinking sea ice; rising sea levels; ocean acidification; and increasing atmospheric water vapor.[59]

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[54] 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) at SPM-8 to SPM-14.
[55] *Id.* at 2-28.
[56] *Id.* at SPM-15.
[57] *Id.*
[58] Melillo, Jerry M et al. (eds.), Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014); U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/;
U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/.
[59] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 10.

Rising temperatures

Global average surface temperatures have risen by 1.8°F (1.0°C) since 1901, most of which occurred during the past three decades.[60] As of 2018, 16 of the last 17 years were the warmest ever recorded by human observations.[61] Global average temperature reached a record high in 2016, which scientists determined was "only possible" because of anthropogenic climate change,[62] with 2017 ranked as the second hottest year on record.[63]

The United States warmed by 1.8°F (1.0°C) between 1901 and 2016, with the most rapid warming occurring after 1979.[64] The U.S. is expected to warm by an additional 2.5°F (1.4°C), on average, by mid-century relative to 1976-2005, and record-setting hot years will become commonplace.[65] By late century, much greater warming is projected, ranging from 2.8 to 7.3°F (1.6 to 4.1°C) under a lower emissions scenario and 5.8 to 11.9°F (3.2 to 6.6°C) under a higher emissions scenario,[66] with the largest increases in the upper Midwest and Alaska.[67] The urban heat island effect—which is expected to strengthen as urban areas expand and become denser—will amplify climate-related warming even beyond those dangerous increases.[68]

Increasing frequency of extreme weather events

Extreme weather events are striking with increasing frequency, most notably heat waves and heavy precipitation events.[69] In the contiguous United States, extreme temperatures are expected to increase even more than average temperatures, with more intense heat waves and 20 to 30

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[60] *Id.* at 13.
[61] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018) at 76.
[62] Knutson, Thomas R. et al., CMIP5 model-based assessment of anthropogenic influence on record global warmth during 2016, 99 Bulletin of the American Meteorological Society S11 (2017).
[63] National Aeronautics and Space Administration, Long-term warming trend continued in 2017: NASA, NOAA, Release 18-003, January 18, 2018, https://www.nasa.gov/press-release/long-term-warming-trend-continued-in-2017-nasa-noaa
[64] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 17.
[65] *Id.* at 11.
[66] *Id.* at 17.
[66] *Id.* at 17 and 136: The high emissions scenario RCP 8.5 corresponds to a rise of CO_2 levels from the current-day 400 ppm up to 936 ppm by the end of this century. The lower emissions scenarios RCP4.5 and RCP 2.6 correspond to atmospheric CO_2 levels remaining below 550 and 450 ppm by 2100, respectively. These scenarios are numbered according to change in radiative forcing by 2100: +2.6, +4.5, +8.5 watts per square meter (W/m^2).
[67] *Id.* at Figure ES.4.
[68] *Id.* at 17.
[69] Coumou, Dim & Stefan Rahmstorf, A decade of weather extremes, 2 Nature Climate Change 491 (2012); Intergovernmental Panel on Climate Change, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Special Report of the Intergovernmental Panel on Climate Change (2012); Herring, Stephanie C. et al., Explaining extreme events of 2016 from a climate perspective, 99 Bulletin of the American Meteorological Society S1 (2017); U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 18-20.

more days per year above 90°F by mid-century for most regions under a higher emissions scenario.[70] Heavy precipitation has become more frequent and intense in most regions of the U.S. since 1901,[71] as more water vapor is available to fuel extreme rain and snowstorms as the world warms.[72] Heavy precipitation events are projected to continue to increase in frequency and intensity across the United States, with the number of extreme events rising by two to three times the historical average by the end of the century under a higher emissions scenario.[73] Climate warming also has exacerbated recent historic droughts by reducing soil moisture and contributing to earlier spring melt and reduced water storage in snowpack.[74] As conditions become hotter and drier, climate change is contributing to an increase in area burned by wildfire and a lengthening of the wildfire season in recent decades.[75]

A growing body of attribution studies (i.e., studies assessing how human-caused climate change may have affected the strength and likelihood of individual extreme events) has determined that human-caused climate change has not only intensified many recent extreme weather events, but that some extreme weather events could not have happened without human-induced climate change.[76] For example, in 2016, the intense marine heat wave off Alaska — which drove oyster farm failures, harmful algal blooms, mass seabird die offs, and failed subsistence harvests — was found to be up to fifty times more likely due to anthropogenic warming.[77] The sequence of consecutive record-breaking temperatures in 2014–2016 had a negligible (<0.03%) likelihood of occurring in the absence of anthropogenic warming.[78] And an extreme winter weather event recently wreaked havoc in Texas, causing unprecedented blackouts and other problems that left millions without power over several days of subfreezing temperatures.[79]

Climate change-related extremes are also weakening the ability of the terrestrial biosphere (vegetation and soil) to uptake carbon, a significant development because the terrestrial

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[70] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 185, 199.
[71] *Id.* at 20.
[72] *Id.* at 214.
[73] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 207, 218.
[74] *Id.* at 45, 236.
[75] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/
[76] Herring, Stephanie C. et al., Explaining extreme events of 2016 from a climate perspective, 99 Bulletin of the American Meteorological Society S1 (2017). The Bulletin of the American Meteorological Society has published an annual attribution study compendium since 2011.
[77] Oliver, Eric C. et al., Anthropogenic and natural influences on record 2016 marine heat waves, 99 Bulletin of the American Meteorological Society S44 (2017); Walsh, John E. et al., The high latitude marine heat wave of 2016 and its impacts on Alaska, 99 Bulletin of the American Meteorological Society S39 (2017).
[78] Mann, Michael E. et al., Record temperature streak bears anthropogenic fingerprint, 44 Geophysical Research Letters 7936 (2017).
[79] Justin Worland, The Texas Power Grid Failure Is a Climate Change Cautionary Tale, Time Magazine, Feb. 18, 2021, https://time.com/5940491/texas-power-outage-climate/; Irina Ivanova, Texas Frozen Power Grid Is a Preview of Climate Change Disasters to Come, CBS News, Feb. 19, 2021, https://www.cbsnews.com/news/texas-power-outage-storm-climate-change/.

biosphere absorbs about 25 percent of anthropogenic carbon dioxide emissions.[80] Droughts, heat waves and other extreme climate-related events reduce soil moisture, lowering carbon uptake now and projected into the future.

Intensifying storms

Climate change has contributed to an increase in North Atlantic hurricane activity since the 1970s.[81] Hurricane-generated storm surge events — the enormous walls of water pushed onto the coast — have also become more frequent and severe.[82] One study found that large storm surge events of Hurricane Katrina magnitude have already doubled in response to warming during the 20th century, and projected that Atlantic hurricane surge events will increase in frequency by twofold to sevenfold for each 1°C in temperature rise.[83] As the climate warms, Atlantic and eastern North Pacific hurricane rainfall and intensity are projected to increase, making hurricanes more destructive.[84] Studies of Hurricane Harvey concluded that climate warming made the storm's record rainfall more likely and intense.[85] Climate change is also projected to increase the frequency and severity of landfalling "atmospheric rivers" on the West Coast.[86]

Rising seas

Global average sea level rose by seven to eight inches since 1900 as the oceans have warmed and land-based ice has melted.[87] Sea level rise is accelerating in pace with almost half of recorded sea level rise occurring since 1993.[88] The Fourth National Climate Assessment estimated that global sea level is very likely to rise by 1.0 to 4.3 feet by the end of the century relative to the

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[80] Green, Julia K. et al., Large influence of soil moisture on long-term terrestrial carbon uptake, 564 Nature 476 (2019).

[81] Elsner, James B. et al., The increasing intensity of the strongest tropical cyclones, 455 Nature 92 (2008); Saunders, Mark A. & Adam S. Lea, Large contribution of sea surface warming to recent increase in Atlantic hurricane activity, 451 Nature 557 (2008); U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 257; U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 74.

[82] Komar, Paul D. & Jonathan C. Allan, Increasing hurricane-generated wave heights along the U.S. east coast and their climate controls, 24 Journal of Coastal Research 479 (2008); Grinsted, Aslak et al., Homogeneous record of Atlantic hurricane surge threat since 1923, 109 PNAS 19601 (2012).

[83] Grinsted, Aslak et al., Projected hurricane surge threat from rising temperatures, 110 PNAS 5369 (2013).

[84] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 74.

[85] Emanuel, Kerry, Assessing the present and future probability of Hurricane Harvey's rainfall 2017, 114 PNAS 12681 (2017); Risser, Mark D. and Michael F. Wehner, Attributable human-induced changes in the likelihood and magnitude of the observed extreme precipitation during Hurricane Harvey, 44 Geophysical Research Letters 12,457 (2017); van Oldenborgh, Geert J. et al., Attribution of extreme rainfall from Hurricane Harvey, 12 Environmental Research Letters 124009 (2017).

[86] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 74.

[87] *Id.*

[88] *Id.* at 74, 339.

year 2000, with sea level rise of 8.2 feet possible.[89] 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 RCP 2.6 scenario, compared with 1.6 to 6 feet under a high emissions RCP 8.5 scenario.[90] The impacts of sea level rise will be long-lived: under all emissions scenarios, sea levels will continue to rise for many centuries.[91]

Coastal flooding from sea level rise and intensifying storm surge

Coastal regions are threatened by increased flooding due to sea level rise and intensifying storm surge.[92] A nation-wide study estimated that approximately 3.7 million Americans live within three feet of high tide, putting them at extreme risk of flooding from sea level rise in the next few decades, with the most vulnerable residents in Florida, Louisiana, California, New York and New Jersey.[93] Another study forecast that 4.2 million Americans would be at risk of flooding from three feet of sea level rise, while 13.1 million people would be at risk from six feet of sea level rise, driving mass human migration and societal disruption.[94] An analysis of 136 of the world's largest coastal cities projected that global flood losses of US$6 billion per year in 2005 will grow to US$1 trillion or more per year by 2050 due to sea level rise and subsidence, if no adaptation actions are taken, with Miami, New York and New Orleans suffering the highest current and projected economic losses in the U.S.[95]

Coastal flooding is becoming more damaging as Atlantic hurricanes and hurricane-generated storm surges grow more severe due to climate change.[96] Sea levels on the U.S. East Coast from

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[89] *Id.* at 74, 487, 758.
[90] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 344.
[91] Melillo, Jerry M. et al. (eds.), Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014), https://www.globalchange.gov/browse/reports/climate-change-impacts-united-states-third-national-climate-assessment-0 at 45. Also U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 345-346.
[92] Climate Central, Surging Seas Risk Zone Map, http://sealevel.climatecentral.org/ (accessed March 22, 2019); Hauer, Mathew E. et al., Millions projected to be at risk from sea-level rise in the continental United States, 6 Nature Climate Change 691 (2016); See online mapping tools at National Oceanic and Atmospheric Administration, Office for Coastal Management, DigitalCoast, Sea Level Rise Viewer, https://coast.noaa.gov/digitalcoast/tools/slr.html.
[93] Strauss, Benjamin H. et al., Tidally adjusted estimates of topographic vulnerability to sea level rise and flooding for the contiguous United States, 7 Environmental Research Letters 014033 (2012).
[94] Hauer, Matthew E. et al., Millions projected to be at risk from sea-level rise in the continental United States, 6 Nature Climate Change 691 (2016); Hauer, Mathew E., Migration induced by sea-level rise could reshape the US population landscape, 7 Nature Climate Change 321 (2017).
[95] Hallegatte, Stephane et al., Future flood losses in major coastal cities, 3 Nature Climate Change 802 (2013).
[96] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II,U.S. Global Change Research Program (2018), https://nca2018.globalchange.gov/, at 99.

Cape Hatteras to Boston are rising three to four times faster than the global average,[97] which when combined with intensifying hurricanes and storm surge, is greatly increasing the flooding risk along the East Coast.[98] Under a lower emissions RCP 4.5 scenario, storm surge is projected to increase by 25 to 47 percent along the U.S. Gulf and Florida coasts due to the combined effects of sea level rise and growing hurricane intensity.[99] The increasing frequency of extreme precipitation events is also compounding coastal flooding risk when storm surge and heavy rainfall occur together.[100]

Since the 1960s, sea level rise has increased the frequency of high tide flooding by a factor of 5 to 10 for several U.S. coastal communities, and flooding rates are accelerating in many Atlantic and Gulf Coast cities.[101] For much of the U.S. Atlantic coastline, a local sea level rise of 1.0 to 2.3 feet (0.3 to 0.7 m) would be sufficient to turn nuisance high tide events into major destructive floods.[102] In Florida and Virginia, nuisance flooding due to sea level rise has already resulted in severe property damage and social disruption.[103] The frequency, depth, and extent of tidal flooding are expected to continue to increase in the future.[104]

Rapid Arctic warming and polar ice loss

Alaska and the Arctic have experienced some of the most severe and rapid warming associated with climate change, with temperatures rising at twice the rate of the rest of the globe on average.[105] Arctic summer sea ice extent has decreased by 40 percent during the past several decades, and sea ice thickness is also plummeting.[106] The Arctic lost 95 percent of its oldest and thickest sea ice during the past three decades, and the remaining thinner, younger ice is more

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[97] Sallenger, Asbury H. et al., Hotspot of accelerated sea-level rise on the Atlantic coast of North America, 2 Nature Climate Change 884 (2012).
[98] Little, Christopher M. et al., Joint projections of US East Coast sea level and storm surge, 5 Nature Climate Change 1114 (2015).
[99] Balaguru, Karthik et al., Future hurricane storm surge risk for the U.S. gulf and Florida coasts based on projections of thermodynamic potential intensity, 138 Climatic Change 99 (2016).
[100] Wahl, T. et al., Increasing risk of compound flooding from storm surge and rainfall for major US cities, 5 Nature Climate Change 1093 (2015).
[101] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II,U.S. Global Change Research Program (2018), https://nca2018.globalchange.gov/, at 98-99.
[102] *Id.* at 99.
[103] Atkinson, Larry P. et al., Sea level rise and flooding risk in Virginia, CCPO Publications, Paper 102 (2013), http://digitalcommons.odu.edu/ccpo_pubs/102; Wdowinski, Shimon et al., Increasing flooding hazard in coastal communities due to rising sea level: Case study of Miami Beach, Florida, 126 Ocean & Coastal Management 1 (2016).
[104] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II,U.S. Global Change Research Program (2018), https://nca2018.globalchange.gov/, at 75.
[105] *Id.* at 92.
[106] Meier, Walter N. et al., Arctic sea ice in transformation: A review of recent observed changes and impacts on biology and human activity, 51 Reviews of Geophysics 185 (2014); U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II, U.S. Global Change Research Program (2018), https://nca2018.globalchange.gov/, at 1192-1193.

vulnerable to melting.[107] Sea ice loss has accelerated since 2000, with Alaska's coast suffering some of the fastest losses.[108] The length of the sea ice season is shortening as ice melts earlier in spring and forms later in autumn.[109] Along Alaska's northern and western coasts, the sea ice season has already shortened by more than 90 days.[110] As sea ice continues to plummet, the Arctic is projected to be nearly ice-free in summer by 2040.[111] As summarized by the Fourth National Climate Assessment:

> Since the early 1980s, annual average arctic sea ice has decreased in extent between 3.5% and 4.1% per decade, become thinner by between 4.3 and 7.5 feet, and began melting at least 15 more days each year. September sea ice extent has decreased between 10.7% and 15.9% per decade (*very high confidence*). Arctic-wide ice loss is expected to continue through the 21st century, *very likely* resulting in nearly sea ice-free late summers by the 2040s (*very high confidence*)."[112]

The Greenland and Antarctic ice sheets are losing ice at an accelerating rate through increasing glacier calving and surface melting, and are approaching or already may have passed a tipping point of irreversible melting. A 2019 study found that Greenland's southwest ice sheet is losing ice at nearly four times the rate it did in 2003, and concluded that "Greenland's air–sea–ice system crossed one or more thresholds or tipping points near the beginning of this millennium, triggering more rapid deglaciation."[113] Another study found that, over the past two decades, Greenland's ice sheets have been melting at a rate 50 percent higher than pre-industrial levels and 33 percent above 20th-century levels, meaning that more meltwater is running off Greenland's ice sheet now than at any time in the last 350 years and likely going back 6,000 to 7,000 years.[114] A separate study estimated that the rate of Arctic ice loss from melting glaciers and the Greenland ice sheet tripled during the past decade compared with the previous two decades, now adding over a millimeter to the global sea level each year.[115] The rate of ice loss from the

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[107] Osborne, Emily, et al. (eds.), Arctic Report Card 2018, NOAA (2018), https://www.arctic.noaa.gov/Report-Card at 2.
[108] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 305.
[109] Parkinson, Claire L., Spatially mapped reductions in the length of the Arctic sea ice season, 41 Geophysical Research Letters 4316 (2014).
[110] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 307.
[111] Overland, James E. & Muyin Wang, When will the summer Arctic be nearly sea ice free? 40 Geophysical Research Letters 2097 (2013); U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 303.
[112] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 29, 303.
[113] Bevis, Michael et al., Accelerating changes in ice mass within Greenland and the ice sheet's sensitivity to atmospheric forcing, 116 PNAS 6 (2019).
[114] Trusel, Luke D. et al., Nonlinear rise in Greenland runoff in response to post-industrial Arctic warming, 564 Nature 104 (2018).
[115] Box, Jason E. et al., Global sea-level contribution from Arctic land ice: 1971-2017, 13 Environmental Research Letters 125012 (2018).

massive Antarctic ice sheet has increased by more than six-fold since the late 1970s, leading to 250 billion tons of ice pouring into the ocean each year, and research suggests that the East Antarctic ice sheet, once thought to be stable, is losing substantial amounts of ice.[116] Glaciers are also rapidly melting, raising sea levels and threatening water supplies in many regions.[117] Permafrost is thawing worldwide as temperatures rise, and the carbon dioxide and methane released from thawing permafrost has the potential to amplify human-induced warming, possibly significantly.[118]

Biodiversity loss

Anthropogenic climate change is causing widespread harm to life across the planet. Climate change is increasing stress on species and ecosystems — causing changes in distribution, phenology, physiology, vital rates, genetics, ecosystem structure and processes — in addition to increasing species extinction risk.[119] Climate change is already affecting 82 percent of key ecological processes that underpin ecosystem function and support basic human needs.[120] Climate change-related local extinctions are already widespread and have occurred in hundreds of species, including almost half of the 976 species surveyed.[121] Nearly half of terrestrial non-flying threatened mammals and nearly one-quarter of threatened birds may have already been negatively impacted by climate change in at least part of their range.[122] Furthermore, across the globe, populations of terrestrial birds and mammals that are experiencing greater rates of climate warming are more likely to be declining at a faster rate.[123] Genes are changing, species' physiology and physical features such as body size are changing, species are moving to try to

[116] Rignot, Eric et al., Four decades of Antarctic ice sheet mass balance from 1979-2017, 116 PNAS 4 (2019); Slater, Thomas and Andrew Shepherd, Antarctic ice losses tracking high, 8 Nature Climate Change 1025 (2018); IMBIE, Mass balance of the Antarctic ice sheet from 1992 to 2017, 558 Nature 219 (2018).
[117] Intergovernmental Panel on Climate Change, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014)
at 4; U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 303.
[118] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 74; Biskaborn, Boris K. et al., Permafrost is warming at a global scale, 10 Nature Communications 264 (2019).
[119] Warren, Rachel et al., Increasing impacts of climate change upon ecosystems with increasing global mean temperature rise, 106 Climatic Change 141 (2011).
[120] Scheffers, Brett R. et al., The broad footprint of climate change from genes to biomes to people, 354 Science 719 (2016).
[121] Wiens, John J., Climate-related local extinctions are already widespread among plant and animal species, 14 PLoS Biology e2001104 (2016).
[122] Pacifici, Michela et al., Species' traits influenced their response to recent climate change, 7 Nature Climate Change 205 (2017). The study concluded that "populations of large numbers of threatened species are likely to be already affected by climate change, and … conservation managers, planners and policy makers must take this into account in efforts to safeguard the future of biodiversity."
[123] Spooner, Fiona E.B. et al., Rapid warming is associated with population decline among terrestrial birds and mammals globally, 24 Global Change Biology 4521 (2018).

keep pace with suitable climate space, species are shifting their timing of breeding and migration, and entire ecosystems are under stress.[124]

Because climate change is occurring at an unprecedented pace with multiple synergistic impacts, human-caused climate change is increasing the extinction risk for many species. Numerous studies have projected catastrophic species losses during this century if climate change continues unabated: 15 to 37 percent of the world's plants and animals committed to extinction by 2050 under a mid-level emissions scenario[125]; the potential extinction of 10 to 14 percent of species by 2100[126]; global extinction of five percent of species with 2°C of warming and 16 percent of species with business-as-usual warming[127]; and the loss of more than half of the present climatic range for 58 percent of plants and 35 percent of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species.[128] It is predicted that within a century, over 300 North American bird species will lose at least half of their current ranges due to climate change.[129]

Scientists have warned that the Earth is fast approaching a global "state-shift" that could result in unanticipated and rapid changes to biological systems.[130] As summarized by the Third National Climate Assessment, "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."[131]

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[124] Parmesan, Camille & Gary Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 Nature 37 (2003); Root, Terry L. et al., Fingerprints of global warming on wild animals and plants, 421 Nature 57 (2003); Parmesan, Camille, Ecological and evolutionary responses to recent climate change, 37 Annual Review of Ecology Evolution and Systematics 637 (2006); Chen, I-Ching et al., Rapid range shifts of species associated with high levels of climate warming, 333 Science 1024 (2011); Maclean, Ilya M. D. & Robert J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 Proceedings of the National Academy of Sciences of the United States of America 12337 (2011); Warren, Rachel et al., Increasing impacts of climate change upon ecosystems with increasing global mean temperature rise, 106 Climatic Change 141 (2011); Cahill, Abigail E. et al., How does climate change cause extinction?, 280 Proceedings of the Royal Society B 20121890 (2012).

[125] Thomas, Chris. D. et al., Extinction risk from climate change, 427 Nature 145 (2004).

[126] Maclean, Ilya M. D. & Robert J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 PNAS 12337 (2011).

[127] Urban, Mark C., Accelerating extinction risk from climate change, 348 Science 571 (2015).

[128] Warren, Rachel et al., Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss, 3 Nature Climate Change 678 (2013).

[129] National Audubon Society, Audubon's Birds and Climate Change Report (2014) at p. 5, http://climate.audubon.org/sites/default/files/NAS_EXTBIRD_V1.3_9.2.15%20lb.pdf.

[130] Barnosky, Anthony D. et al., Approaching a state shift in Earth's biosphere, 486 Nature 52 (2012).

[131] Melillo, Jerry M. et al. (eds.), Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014), https://www.globalchange.gov/browse/reports/climate-change-impacts-united-states-third-national-climate-assessment-0 at 196.

Public health harms

Climate change poses serious threats to public health and well-being.[132] The Fourth National Climate Assessment concluded that "[t]he health and well-being of Americans are already affected by climate change, with the adverse health consequences projected to worsen with additional climate change."[133] The health impacts from climate change include increased exposure to heat waves, floods, droughts, and other extreme weather events; increases in vector-, food- and waterborne infectious diseases; decreases in the quality and safety of air, food, and water including rising food insecurity and increases in air pollution; displacement; and stresses to mental health and well-being.[134] Although everyone is vulnerable to health harms from climate change, populations experiencing greater health risks include children, older adults, low-income communities, some communities of color, immigrant groups, and persons with disabilities and pre-existing medical conditions.[135] The 2015 Lancet Commission on Health and Climate Change warned that climate change is causing a global medical emergency, concluding that "the implications of climate change for a global population of 9 billion people threatens to undermine the last half century of gains in development and global health."[136]

Climate change-driven health impacts are already occurring in the United States, particularly from illnesses and deaths caused by extreme weather events which are increasing in frequency and intensity.[137] Heat is the leading cause of weather-related deaths in the U.S., and extreme heat is projected to increase future mortality on the scale of thousands to tens of thousands of additional premature deaths per year across the U.S. by the end of this century.[138] Hot days have

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[132] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 540; U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016); Melillo, Jerry M et al., Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014), https://www.globalchange.gov/browse/reports/climate-change-impacts-united-states-third-national-climate-assessment-0 at 220.

[133] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 540.

[134] *Id.*; U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016); Melillo, Jerry M et al. (eds.), Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014), https://www.globalchange.gov/browse/reports/climate-change-impacts-united-states-third-national-climate-assessment-0 at 221; Sheffield, Perry and Philip J. Landrigan, Global climate change and children's health: Threats and strategies for prevention, 119 Environmental Health Perspectives 291 (2011).

[135] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 548; U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016).

[136] Watts, Nick et al., Health and climate change: policy responses to protect public health, 386 The Lancet 1861 (2015) at 1861.

[137] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 541.

[138] U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016).

been conclusively linked to an increase in heat-related deaths and illnesses — particularly among older adults, pregnant women, and children — including cardiovascular and respiratory complications, renal failure, electrolyte imbalance, kidney stones, negative impacts on fetal health, and preterm birth.[139] One study estimated that nearly one-third of the world's population is currently exposed to a deadly combination of heat and humidity for at least 20 days a year, and that percentage is projected to rise to nearly three-quarters by the end of the century without deep cuts in greenhouse gas pollution, with particular impacts to the southeastern U.S.[140]
Extreme precipitation events have become more common in the United States, contributing to increases in severe flooding in some regions.[141] Floods are the second deadliest of all weather-related hazards in the United States and can lead to drowning, contaminated drinking water, and mold-related illnesses.[142]

Air pollutants — particularly ozone, particulate matter, and allergens — are expected to increase with climate change.[143] Climate-driven increases in ozone will cause more premature deaths, hospital visits, lost school days, and acute respiratory symptoms.[144] In 2020, projected climate-related increases in ground-level ozone concentrations could lead to an average of 2.8 million more occurrences of acute respiratory symptoms, 944,000 more missed school days, and over 5,000 more hospitalizations for respiratory-related problems.[145] The continental U.S. could pay an average of $5.4 billion (2008$) in health impact costs associated with climate-related increases in ozone in 2020, with California experiencing the greatest impacts estimated at $729 million.[146]

Risks from infectious diseases are increasing as climate change alters the geographic and seasonal distribution of tick- and mosquito-borne diseases like Lyme disease and West Nile virus.[147] The risk of human exposure to Lyme disease — the most common vector-borne illness in the U.S.[148] — is expected to increase as ticks carrying Lyme disease and other pathogens

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[139] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 544-545.
[140] Mora, Camilo et al., Global risk of deadly heat, 7 Nature Climate Change 501 (2017).
[141] Melillo, Jerry M et al., Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014), https://www.globalchange.gov/browse/reports/climate-change-impacts-united-states-third-national-climate-assessment-0 at 221.
[142] *Id.* at 224.
[143] U.S. Environmental Protection Agency, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, 74 Federal Register 66496 (2009); U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, (2016).
[144] U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016).
[145] Union of Concerned Scientists, Rising Temperatures and Your Health: Rising Temperatures, Worsening Ozone Pollution (2011).
[146] *Id*.
[147] U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016).
[148] Schwartz, Amy M., et al., Surveillance for Lyme Disease — United States, 2008-2015, 66 MMWR , Centers for Disease Control and Prevention (2017).

become active earlier in the season and expand northward in response to warming temperatures.[149] The two species of ticks capable of spreading Lyme disease have already expanded to new regions of the U.S. partly because of rising temperatures: in 2015, they were found in more than 49 percent of counties in the continental U.S., a nearly 45 percent increase since 1998.[150] Rising temperatures and changes in rainfall have also contributed to the maintenance of West Nile virus in parts of the United States,[151] and cases of West Nile disease are projected to more than double by 2050 due in part to increasing temperatures, resulting in approximately $1 billion per year in hospitalization costs and premature deaths under a higher emissions scenario.[152]

Numerous studies have emphasized that many lives could be saved with rapid reductions in greenhouse gas pollution.[153] The Fourth National Climate Assessment concludes that "reducing greenhouse gas emissions would benefit the health of Americans in the near and long term."[154] The Assessment projects that "by the end of this century, thousands of American lives could be saved and hundreds of billions of dollars in health-related economic benefits gained each year under a pathway of lower greenhouse gas emissions."[155] Another recent study reported that faster reductions in carbon pollution will prevent millions of premature deaths globally. Compared with a 2°C pathway, a 1.5°C pathway is projected to result in 153 million fewer premature deaths worldwide due to reduced PM 2.5 and ozone exposure, including 130,000 fewer premature deaths in Los Angeles and 120,000 in the New York metropolitan area.[156]

Threats to water resources

Climate change is altering the water cycle in ways that threaten water supplies in the United States. As summarized by the Fourth National Climate Assessment, variable precipitation and

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[149] U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016).
[150] Eisen, Rebecca J., County-Scale Distribution of *Ixodes scapularis* and *Ixodes pacificus* (Acari: Ixodidae) in the Continental United States, 53 Journal of Medical Entomology 349 (2016).
[151] Harrigan, Ryan J. et al., A continental risk assessment of West Nile virus under climate change, 20 Global Change Biology 2417(2014); Paz, Shlomit, Climate change impacts on West Nile virus transmission in a global context, 370 Philosophical Transactions of the Royal Society B 20130561 (2015).
[152] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 552.
[153] Gasparrini, Antonio et al., Projections of temperature-related excess mortality under climate change scenarios, 1 Lancet Planet Health e360 (2017); Hsiang, Solomon et al., Estimating economic damage from climate change in the United States, 356 Science 1362 (2017); Silva, Raquel A. et al., Future global mortality from changes in air pollution attributable to climate change, 7 Nature Climate Change 647 (2017); Burke, Marshall et al., Higher temperatures increase suicide rates in the United States and Mexico, 8 Nature Climate Change 723 (2018); Shindell, Drew et al., Quantified, localized health benefits of accelerate carbon dioxide emissions reductions, 8 Nature Climate Change 723 (2018).
[154] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 541.
[155] *Id*.
[156] Shindell, Drew et al., Quantified, localized health benefits of accelerated carbo n dioxide emissions reductions, 8 Nature Climate Change 291 (2018).

rising temperature due to climate change are "intensifying droughts, increasing heavy downpours, and reducing snowpack. Reduced snow-to-rain ratios are leading to significant differences between the timing of water supply and demand. Groundwater depletion is exacerbating drought risk. Surface water quality is declining as water temperature increases and more frequent high-intensity rainfall events mobilize pollutants such as sediments and nutrients."[157]

Snowpack is important for providing water in many parts of the United States. In the western U.S., earlier spring snowmelt, reduced snowpack, lower snow water equivalent (i.e. the amount of water contained in snowpack), and reduced river flows have been attributed to human-caused warming.[158] As temperatures rise, western U.S. winter and spring snowpack are projected to continue to decline,[159] and more precipitation will fall as rain instead of snow in the cold season in many parts of the U.S.[160] Under higher emissions scenarios, reductions in snowfall and earlier snowmelt are expected to lead to more frequent "hydrological" drought conditions in the western U.S., characterized by deficits in runoff.[161]

As a key example, the Colorado River Basin is one of the most important water systems in the United States, encompassing seven western states and providing water for 40 million people. Across much of the Colorado River Basin, spring snowpack, runoff, and streamflow have declined, disrupting the region's water supply.[162] Rising temperatures are contributing to significantly declining Colorado River flows, and flow losses due to warming alone may exceed 20 percent by mid-century.[163] Drought activity in the Colorado River Basin is projected to increase as temperatures continue to rise and snowpack declines.[164]

Climate change is also playing an important role in reducing soil moisture as temperatures rise,

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[157] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 146.
[158] Barnett, Tim, et al., Human-induced changes in the hydrology of the Western United States, 319 Science 1080 (2008); Pierce, David et al., Attribution of declining Western U.S. snowpack to human effects, American Meteorological Society 6425 (2008); Hidalgo, H.G. et al., Detection and attribution of streamflow timing changes to climate change in the western United States, 22 Journal of Climate 3838 (2009); U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Volume I (2017), https://science2017.globalchange.gov/at 231, 236.
[159] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017) https://science2017.globalchange.gov/ at 207, 231.
[160] *Id.* at 207.
[161] *Id.* at 231, 232, 239, 240.
[162] Garfin, Gregg et al. (eds.), Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment, Southwest Climate Alliance (2013); U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 236.
[163] Udall, Bradley & Jonathan Overpeck, The twenty-first century Colorado River hot drought and implications for the future, 53 Water Resources Research 2404 (2017).
[164] Cayan, Daniel R. et al., Future dryness in the southwest US and the hydrology of the early 21st century drought, 107 PNAS 107 (2010).

intensifying "agricultural" droughts.[165] Under higher emissions scenarios, continuing decreases in surface soil moisture and widespread drying over most of the United States are projected.[166] Future warming is expected to lead to greater frequencies and magnitudes of agricultural droughts throughout the continental United States as evapotranspiration outpaces precipitation.[167]
Declining food security

In the United States, climate change threatens food security for millions of Americans. About 14 percent of U.S. households currently do not have food security — defined as access by all people at all times to enough food for an active, healthy life — and more than 48 million people live in food insecure homes.[168] Climate change threatens food security through a number of pathways, including through reduced crop and livestock production, contamination of food supplies, changes in land use and land availability, and decreasing access to food.[169]

Climate-related harms to crop and livestock production include increases in weeds, diseases, and insect pests; rising heat stress increasing livestock mortality; insufficient winter chill hours needed for many important tree crops; degradation of soils; changes in water availability; and the increasing frequency of extreme weather events.[170] The Third National Climate Assessment warned that "[c]limate disruptions to agricultural production have increased in the past 40 years and are projected to increase over the next 25 years" and that "[b]y mid-century and beyond, these impacts will be increasingly negative on most crops and livestock."[171]

A 2017 study using multiple independent methods projected negative temperature impacts on the yields of four major crops that make up two-thirds of human caloric intake and are critical for food security.[172] The U.S. is expected to suffer the greatest losses globally for maize (averaging −10.3% per degree Celsius warming) and soybeans (−6.8% per degree Celsius), with large losses for wheat (−5.5% per degree Celsius).[173] Research also indicates that crops will become less

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165 U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 237.
166 *Id*.
167 *Id*.
168 Public Health Institute/Center for Climate Change and Health, Food Security, Climate Change and Health (2016).
169 Melillo, Jerry M. et al. (eds.), Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014) at 150; Brown, M.E. et al., Climate Change, Global Food Security, and the U.S. Food System (2015).
170 Melillo, Jerry M et al. (eds.), Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014), https://www.globalchange.gov/browse/reports/climate-change-impacts-united-states-third-national-climate-assessment-0 (2014) at 150; Brown, M.E. et al., Climate Change, Global Food Security, and the U.S. Food System (2015); U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 391–437.
171 Melillo, Jerry M et al. (eds.), Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program (2014) at 150.
172 Zhao, Chuang et al., Temperature increase reduces global yields of major crops in four independent estimates, 114 PNAS 9326 (2017).
173 *Id.*

nutritious as carbon dioxide levels increase, worsening the global prevalence of malnutrition. In one study, major crops, including wheat, barley, rice and potato, when grown at carbon dioxide levels projected for the year 2100, had 6 to 15 percent less protein than the same crops grown at current carbon dioxide levels, as well as fewer key nutrients such as zinc, calcium and magnesium.[174] The United States is one of the countries projected to suffer the largest increases in pest-related crop losses as warming increases the population growth and metabolic rates of insects.[175] Further, since agriculture is the biggest driver of water shortages in the world, accounting for 70 percent of global water withdrawals, future changes in water availability will profoundly impact agricultural production on the whole.[176]

Livestock cultivation occurs over approximately 30 percent of the Earth's ice-free land surface, and provides a livelihood for over a billion people globally. As with crop yields, one of the greatest threats to livestock yields is heat stress.[177] Heat stress diminishes food intake and physical activity for livestock. This leads to less growth, survival, and reproductive rates, and also lower production of meat, milk, and eggs. Heat stress can also weaken immune function in livestock, contributing to the need for more veterinary medications. Increasing temperatures also require greater water intake, which presents further complications if increasing temperatures are combined with increasing drought as predicted for some locations. Such conditions also allow for certain pathogens and parasites to expand their ranges, resulting in increased livestock exposure.[178]

Fisheries and aquaculture provide 4.3 billion people with 15 to 20 percent of their intake of animal protein.[179] Ocean warming and ocean acidification threaten marine food resources by disrupting marine communities, promoting harmful algal blooms and the spread of diseases, and increasing contaminants in fish and shellfish.[180] For example, the types of fish caught in fisheries are starting to change due to increasing ocean temperatures. In the rapidly warming Northeast Atlantic Ocean, for instance, fish species are migrating northward over time as waters become warmer, meaning that fish catches in higher latitudes now contain more warm water species, whereas fish catches in lower latitudes contain fewer subtropical species.[181] This shift in fish distribution has negative implications for fisheries that rely on specific fish species for subsistence. In addition, fish populations are already collapsing, including Pacific cod whose biomass dropped by nearly 80 percent from 2013 to 2017 in the Gulf of Alaska, coinciding with

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[174] U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016) at 198.
[175] Deutsch, Curtis A. et al., Increase in crop losses to insect pests in a warming climate, 361 Science 916 (2018).
[176] United Nations Convention to Combat Desertification, The Global Land Outlook (2017), https://www.unccd.int/actions/global-land-outlook-glo.
[177] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 406-408.
[178] Brown, M.E. et al. Climate Change, Global Food Security, and the U.S. Food System (2015) at 57.
[179] *Id.* at 58.
[180] Tirado, M. C. et al., Climate change and food safety: A review, 43 Food Research International 1745 (2010).
[181] Porter, J.R. et al., Food security and food production systems, Climate Change 2014: Impacts, Adaptation, and Vulnerability Part A: Global and Sectoral Aspects, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate (2014) at p. 493.

a period of anomalously warm water.[182] And the fish have continued to decline. Federal managers recently closed the cod fishery in the area for the first time ever, citing the historically low population caused by climate change.[183]

Algal bloom species have been expanding their ranges, and many are dangerous to humans because of the toxins they produce that make their way into shellfish. These toxins when consumed by humans are associated with illnesses such as amnesic shellfish poisoning, diarrheic shellfish poisoning, neurotoxic shellfish poisoning, and paralytic shellfish poisoning. These illnesses may cause respiratory and digestive problems, memory loss, seizures, skin lesions, and even death.[184] As an example of their increasing prevalence, cases of paralytic shellfish poisoning (PSP) were just a few decades ago primarily seen along the west coast of the United States. At present, cases of PSP have expanded along both U.S. coasts, and also throughout Southeast Asia, Europe, and South America.[185] Consuming raw shellfish can also spread pathogens such as *Vibrio* bacteria which are linked to conditions as mild as diarrhea or as severe and fatal blood infections. Ocean warming has a known impact on both the abundance of *Vibrio* and harmful algal blooms.[186]

Ocean warming

U.S. and global oceans are being hard-hit by climate change. The world's oceans have absorbed more than 90 percent of the excess heat caused by greenhouse gas warming, resulting in average sea surface warming of 1.3°F (0.7°C) per century since 1900.[187] A 2019 study estimated that oceans are warming 40 percent faster than scientists projected, and that the rate of ocean warming is accelerating.[188] Rapid warming of the oceans has widespread impacts and has contributed to increases in rainfall intensity, rising sea levels, the destruction of coral reefs, declining ocean oxygen levels, and ice loss from glaciers, ice sheets and polar sea ice.[189] Global average sea surface temperature is projected to rise by 4.9°F (2.7°C) by the end of the century under a higher emissions scenario, with even greater warming in the coastal waters of the Northeastern U.S. and Alaska.[190]

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[182] NMFS, Alaska Cod Populations Plummeted During The Blob Heatwave— New Study Aims to Find Out Why, Nov. 8, 2019, https://www.fisheries.noaa.gov/feature-story/alaska-cod-populations-plummeted-during-blob-heatwave-new-study-aims-find-out-why.

[183] Kavitha George, Alaska Public Media, Dec. 6, 2019, https://www.alaskapublic.org/2019/12/06/extremely-low-cod-numbers-linked-to-the-marine-heatwave-lead-feds-to-close-the-gulf-of-alaska-fishery-for-the-first-time/

[184] Tirado, M. C. et al., Climate change and food safety: A review, 43 Food Research International 1745 (2010).

[185] Gilbert, P. et al., The global complex phenomena of harmful algal blooms, 18 Oceanography 136 (2005).

[186] Tirado, M. C. et al., Climate change and food safety: A review, 43 Food Research International 1745 (2010).

[187] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 364, 367.

[188] Cheng, Lijing et al., How fast are the oceans warming?, 363 Science 128 (2019).

[189] *Id*.

[190] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 368.

Large-scale oxygen losses that create harmful low or no-oxygen zones have been developing in the coastal and open oceans due in large part to ocean warming.[191] In the past 50 years, open-ocean low-oxygen zones have expanded by an area the size the European Union, no-oxygen areas have more than quadrupled in size, and the number of low-oxygen sites near the coast has increased tenfold.[192]

Large-scale marine heatwaves have increased more than 20-fold due to anthropogenic climate change.[193] These marine heatwaves cause major disruption in ocean ecosystems. For example, they have contributed to mortality of sea birds, marine mammals and salmon in the Pacific Northwest.

<u>Ocean acidification</u>

The global oceans have absorbed more than a quarter of the CO_2 emitted to the atmosphere by human activities, which has significantly increased the acidity of the surface ocean. Ocean acidification has reduced the availability of key chemicals—aragonite and calcite—that many marine species use to build their shells and skeletons.[194] 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.[195] Ocean acidity could increase by 150 percent by the end of the century if CO_2 emissions continue unabated.[196] In the United States, the West Coast, Alaska, and the Gulf of Maine are experiencing the earliest, most severe changes due to ocean acidification.[197] Regions of the East and Gulf Coasts are also vulnerable because of local stressors such as coastal eutrophication from fertilizer runoff and river discharge that increase acidification.[198]

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[191] *Id.* at 364, 377.
[192] Breitburg, Denise et al., Declining oxygen in the global ocean and coastal waters, 359 Science 46 (2018).
[193] Laufkötter, Charlotte, et al., High-impact marine heatwaves attributable to human-induced global warming, 369 Science 1621–1625 (2020).
[194] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 371-372.
[195] Hönisch, Barbel et al., The geological record of ocean acidification, 335 Science 1058 (2012); U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 372, 374.
[196] Orr, James C. et al., Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms, 437 Nature 681 (2005); Feely, Richard et al., Ocean acidification: Present conditions and future changes in a high CO_2 world, 22 Oceanography 36 (2009).
[197] Feely, Richard A. et al., Evidence for upwelling of corrosive 'acidified' water onto the continental shelf, 320 Science 1490 (2008); Ekstrom, Julia A. et al., Vulnerability and adaptation of U.S. shellfisheries to ocean acidification, 5 Nature Climate Change 207 (2015); Mathis, Jeremy T. et al., Ocean acidification in the surface waters of the Pacific-Arctic boundary regions, 28 Oceanography 122 (2015); Mathis, Jeremy T. et al., Ocean acidification risk assessment for Alaska's fishery sector, 136 Progress in Oceanography 71 (2015); Chan, F. et al., The West Coast Ocean Acidification and Hypoxia Science Panel: Major Findings, Recommendations, and Actions, California Ocean Science Trust (April 2016).
[198] Ekstrom, Julia A. et al., Vulnerability and adaptation of U.S. shellfisheries to ocean acidification, 5 Nature Climate Change 207 (2015).

Ocean acidification negatively affects a wide range of marine species by hindering the ability of calcifying marine creatures like corals, oysters, and crabs to build protective shells and skeletons and by disrupting metabolism and critical biological functions.[199] The adverse effects of ocean acidification are already being observed in wild populations, including severe shell damage to pteropods (marine snails at the base of the food web) along the U.S. west coast,[200] reduced coral calcification rates in reefs worldwide,[201] and mass die-offs of larval Pacific oysters in the Pacific Northwest.[202] An expert science panel concluded in 2016 that "growth, survival and behavioral effects linked to OA [ocean acidification] extend throughout food webs, threatening coastal ecosystems, and marine-dependent industries and human communities."[203]

Coral reef crisis

The world's coral reefs, which support one-third of marine species and the livelihoods of a half billion people, are in crisis. Rising ocean temperatures and ocean acidification caused by greenhouse gas pollution threaten the continued survival of corals and coral reef ecosystems due to the increasing frequency of mass bleaching events and the dissolution of corals due to ocean acidification.[204] An estimated 50 percent of the world's coral reefs have already been lost,[205] and an estimated one-third of all reef-building coral species are at risk of extinction.[206] The 2014 to 2017 global coral bleaching event was the longest and most widespread on record, affecting more reefs than any previous mass bleaching event and causing mass bleaching of reefs that had

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[199] Fabry, Victoria J. et al., Impacts of ocean acidification on marine fauna and ecosystem processes, 65 ICES Journal of Marine Science 414 (2008); Kroeker, Kristy J. et al., Impacts of ocean acidification on marine organisms: quantifying sensitivities and interactions with warming, 19 Global Change Biology 1884 (2013).
[200] Bednaršek, N. et al., *Limacina helicina* shell dissolution as an indicator of declining habitat suitability owing to ocean acidification in the California Current Ecosystem, 281 Proceedings of the Royal Society B 20140123 (2014).
[201] Albright, Rebecca et al., Reversal of ocean acidification enhances net coral reef calcification, 531 Nature 362 (2016).
[202] Barton, Alan et al., The Pacific oyster, *Crassostrea gigas*, shows negative correlation to naturally elevated carbon dioxide levels: Implications for near-term ocean acidification effects, 57 Limnology and Oceanography 698 (2012).
[203] Chan, Francis et al., The West Coast Ocean Acidification and Hypoxia Science Panel: Major Findings, Recommendations, and Actions, California Ocean Science Trust, Oakland, California, USA (April 2016) at 4.
[204] Hoegh-Guldberg, Ove et al., Coral reefs under rapid climate change and ocean acidification, 318 Science 1737 (2007); Eakin, C. Mark et al., Caribbean corals in crisis: record thermal stress, bleaching, and mortality in 2005, 5 PLoS ONE e13969 (2010).
[205] Jackson, Jeremy, Status and Trends of Caribbean Coral Reefs: 1970-2012, Executive Summary, Global Coral Reef Monitoring Network - IUCN (2014) at 14, Figure 3: Average coral cover in the Caribbean declined by more than 50 percent since the 1970s; Bruno, John F. & Elizabeth R. Selig, Regional decline of coral cover in the Indo-Pacific: Timing, extent, and subregional comparisons, 8 PLoS One e711 (2007) at 4: Average coral cover in the Indo-Pacific declined by nearly 50 percent between the 1980s and 2003.
[206] Carpenter, Kent E. et al., One-third of reef-building corals face elevated extinction risk from climate change and local impacts, 321 Science 560 (2008).

never bleached before, with U.S. reefs particularly hard-hit.[207] Since the first mass bleaching events began in the 1980s, severe bleaching events have increased five-fold and now occur every six years on average, which is too frequent to allow full recovery of coral reefs.[208] Coral scientists have warned that unless global temperature is kept under 1.5°C and atmospheric CO_2 concentration is restored to less than 350 ppm, coral reefs and reef-dependent marine life will be committed to a terminal and irreversible decline.[209]

Economic impacts

The Fourth National Climate Assessment makes clear that human-caused climate change is already leading to substantial economic losses in the U.S. and that these losses will be much more severe under higher emissions scenarios, impeding economic growth:

> Without substantial and sustained global mitigation and regional adaptation efforts, climate change is expected to cause growing losses to American infrastructure and property and impede the rate of economic growth over this century.[210]

In the absence of more significant global mitigation efforts, climate change is projected to impose substantial damages on the U.S. economy, human health, and the environment. Under scenarios with high emissions and limited or no adaptation, annual losses in some sectors are estimated to grow to hundreds of billions of dollars by the end of the century. It is very likely that some physical and ecological impacts will be irreversible for thousands of years, while others will be permanent.[211]

According to the Fourth National Climate Assessment, the number of extreme weather events per year costing more than one billion dollars per event has increased significantly since 1980, with total costs exceeding $1.1 trillion.[212] The National Oceanic and Atmospheric

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[207] Lewis, Sophie C. & J. Mallela, A multifactor analysis of the record 2018 Great Barrier Reef bleaching, 99 Bulletin of the American Meteorological Society S144 (2017); National Oceanic and Atmospheric Administration, Global coral bleaching event likely ending , but scientists forecast high ocean temperatures may persist in some areas (June 19, 2017), http://www.noaa.gov/media-release/global-coral-bleaching-event-likely-ending.

[208] Hughes, Terry P. et al., Spatial and temporal patterns of mass bleaching of corals in the Anthropocene, 359 Science 80 (2018).

[209] Veron, John E.N. et al., The coral reef crisis: the critical importance of <350 ppm CO_2, 58 Marine Pollution Bulletin 1428 (2009); Frieler, Katja, et al., Limiting global warming to 2ºC is unlikely to save most coral reefs, 3 Nature Climate Change 165 (2012); van Hooidonk, Ruben et al., Opposite latitudinal gradients in projected ocean acidification and bleaching impacts on coral reefs, 20 Global Change Biology 103 (2014): Even on the lowest emissions pathway considered (RCP 2.6) in which CO_2 concentrations peak at ~430ppm around 2050 followed by a decline to around 400 ppm CO_2 by the end of the century, 88 percent of reef locations experience severe bleaching events annually by the end of the century.

[210] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018), https://nca2018.globalchange.gov/ at 25.

[211] *Id.* at 1357.

[212] *Id.* at 81.

Administration estimated that, between 2015 and April 2018, 44 billion-dollar weather and climate disasters struck the United States, producing nearly $400 billion in damages.[213] The 2017 Atlantic Hurricane season alone is estimated to have caused more than $250 billion in damages and hundreds of deaths throughout the U.S. Caribbean, Southeast, and Southern Great Plains.[214]

By the end of the century, the Fourth National Climate Assessment estimates that warming on our current trajectory would cost the U.S. economy hundreds of billions of dollars each year and up to 10 percent of U.S. gross domestic product due to damages including lost crop yields, lost labor, increased disease incidence, property loss from sea level rise, and extreme weather damage.[215] Ultimately, the magnitude of financial burdens imposed by climate change depends on how effectively we curb emissions. Across sectors and regions, significant reductions in emissions will substantially lower the costs resulting from climate change damages.[216] For example, annual damages associated with additional extreme temperature-related deaths are projected at $140 billion (in 2015$) under the higher RCP 8.5 emissions scenario compared with $60 billion under the lower RCP 4.5 scenario by 2090.[217] Annual damages to labor would be approximately $155 billion under RCP 8.5, but reduced by 48 percent under RCP 4.5.[218] While coastal property damage would carry an annual cost of $118 billion under RCP 8.5 in 2090, 22 percent of this cost would be avoided under RCP 4.5.[219]

<u>Tipping points and compound climate extremes</u>

The Fourth National Climate Assessment concluded with very high confidence that large-scale shifts in the climate system, known as tipping points, and the compound effects of simultaneous extreme climate events have the potential to create unanticipated and potentially abrupt and irreversible "surprises" that become more likely as warming increases.[220] The IPCC Fifth Assessment Report similarly concluded that "with increasing warming, some physical and ecological systems are at risk of abrupt and/or irreversible changes" and that the risk "increases as the magnitude of the warming increases."[221] The crossing of tipping points could result in climate states wholly outside human experience and result in severe physical and socioeconomic impacts.[222]

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[213] *Id.* at 66.
[214] *Id.*
[215] *Id.* at 1358, 1360.
[216] *Id.* at 1349.
[217] *Id.* at 552.
[218] *Id.* at 1349.
[219] *Id*.
[220] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 32, 411-423; Lenton, Timothy M. et al, Tipping elements in the Earth's climate system, 105 PNAS 1786 (2008).
[221] Intergovernmental Panel on Climate Change, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at 72-73.
[222] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 411.

There is evidence that warm-water coral reefs and Arctic ecosystems are already experiencing irreversible regime shifts, and the climate system is close to crossing other tipping points.[223] For example, research indicates that a critical tipping point important to the stability of the West Antarctic Ice Sheet has been crossed, and that rapid and irreversible collapse of the ice sheet is likely in the next 200 to 900 years.[224] According to the Fourth National Climate Assessment, "observational evidence suggests that ice dynamics already in progress have committed the planet to as much as 3.9 feet (1.2 m) worth of sea level rise from the West Antarctic Ice Sheet alone" and that "under the higher RCP8.5 scenario, Antarctic ice could contribute 3.3 feet (1 m) or more to global mean sea level over the remainder of this century, with some authors arguing that rates of change could be even faster."[225] Another potential tipping point is the release of carbon as CO_2 and methane from thawing Arctic permafrost, which has the potential to "drive continued warming even if human-caused emissions stopped altogether."[226] Increased rainfall and meltwater from Arctic glaciers have the potential to slow a major ocean current called the Atlantic meridional overturning circulation ("AMOC"). If the AMOC slows or collapses, the northeastern U.S. will see a dramatic increase in regional sea levels of as much as 1.6 feet (0.5 meters).[227] A recent analysis suggests the Earth System is at risk of crossing a planetary threshold that could lock in a rapid pathway toward much hotter conditions ("Hothouse Earth") propelled by self-reinforcing feedbacks, and that this risk could exist at 2°C temperature rise and increase significantly with additional warming.[228]

The disastrous effects of compound extreme events are already occurring, such as during Hurricane Sandy when sea level rise, abnormally high ocean temperatures, and high tides combined to intensify the storm and associated storm surge, and an atmospheric pressure field over Greenland steered the hurricane inland to an "exceptionally high-exposure location."[229]

[223] Intergovernmental Panel on Climate Change, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2014) at 73-74.
[224] Joughin, Ian et al., Marine ice sheet collapse potentially under way for the Thwaites Glacier Basin, West Antarctica, 344 Science 735 (2014); Mouginot, Jérémie et al., Sustained increase in ice discharge from the Amundsen Sea Embayment, West Antarctica, from 1973 to 2013, 41 Geophysical Research Letters 1576 (2014); Rignot, Eric et al., Widespread, rapid grounding line retreat of Pine Island, Thwaites, Smith, and Kohler glaciers, West Antarctica, from 1992 to 2011, 41 Geophysical Research Letters 3502 (2014); DeConto, Robert M. & David Pollard, Contribution of Antarctica to past and future sea-level rise, 531 Nature 591 (2016); Hansen, James et al., Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observation that 2°C global warming could be dangerous, 16 Atmospheric Chemistry and Physics 3761 (2016).
[225] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 420.
[226] *Id.* at 303, 314-315, 419; Koven, Charles D. et al., Permafrost carbon-climate feedbacks accelerate global warming, 108 PNAS 14769 (2011); Commane, Róisín et al., Carbon dioxide sources from Alaska driven by increasing early winter respiration from Arctic tundra, 114 PNAS 5361 (2017).
[227] *Id.* at 418.
[228] Steffen, Will et al., Trajectories of the Earth System in the Anthropocene, 115 PNAS 33 (2018).
[229] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 416.

Fossil fuel companies are responsible for the majority of greenhouse gas emissions and global warming.

Research has found that a group of the world's largest fossil fuel producers are responsible for the majority of greenhouse gas emissions and global warming since the Industrial Revolution and during the past three decades. A study that analyzed emissions primarily from companies that produce fossil fuels found that 63 percent of global industrial CO_2 and methane emissions between 1751 and 2010 came from just 90 international entities — 56 crude oil and natural gas producers, 37 coal extractors, and 7 cement producers. These 90 entities — consisting of 50 investor-owned companies, 31 majority state-owned companies, and 9 centrally-planned state industries — are responsible for 914 billion tonnes of CO_2-equivalent ($GtCO_2e$) emissions. Cumulatively, investor-owned entities are responsible for 315 $GtCO_2e$, state-owned companies for 288 $GtCO_2e$, and nation-states for 312 $GtCO_2e$.[230]

Based on historical data and climate modeling, emissions from these 90 fossil fuel "majors" have contributed an estimated 57 percent to the observed rise in atmospheric CO_2, approximately 50 percent to the rise in global mean surface temperature, and approximately 32 percent to global mean sea level rise between 1751 and 2010.[231] A separate study attributed 71 percent of global industrial greenhouse gas emissions since 1988 to just 100 fossil fuel producers, with 51 percent of emissions since 1988 attributable to just 25 corporate and state producers, including ExxonMobil, Shell, BP, Chevron, and Peabody.[232]

Several U.S. fossil fuel companies rank in the top 20 worst cumulative emitters, including Chevron at #1, ExxonMobil at #2, ConocoPhillips at #9, Peabody Energy at #12, and Consol Energy, Inc. at #18.[233] Cumulative emissions from the 20 largest investor-owned and state-owned energy companies alone account for 30 percent of the global industrial emissions between 1751 and 2010. Emissions from the top 20 contributed approximately 27 percent of the increase in atmospheric CO_2, approximately 24 percent of the increase in warming, and approximately 13 to 16 percent of the increase in global sea level rise.[234]

Fourteen companies were consistently found to be in the top 20 in terms of the global impacts of their emissions: seven investor-owned companies (Chevron, ExxonMobil, BP, Royal Dutch Shell, ConocoPhillips, Peabody Energy, and Total), and seven majority state-owned companies (Saudi Aramco, Gazprom, National Iranian oil Company, Pemex, Petroleos de Venezuela, Coal India, and Kuwait Petroleum). Chevron is the largest company contributor to rises in both global

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[230] Heede, Richard, Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854-2010, 122 Climatic Change 229 (2014).
[231] Ekwurzel, Brenda et al., The rise in global atmospheric CO_2, surface temperature, and sea level from emissions traced to major carbon producers, 144 Climatic Change 579 (2017).
[232] CDP and Climate Accountability Institute, The Carbon Majors Database, CDP Carbon Majors Report 2017 (July 2017), https://www.cdp.net/en/articles/media/new-report-shows-just-100-companies-are-source-of-over-70-of-emissions.
[233] Heede, Richard, Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854-2010, 122 Climatic Change 229 (2014).
[234] Ekwurzel, Brenda et al., The rise in global atmospheric CO_2, surface temperature, and sea level from emissions traced to major carbon producers, 144 Climatic Change 579 (2017).

temperatures and sea level rise between 1880 and 2010 and the second-largest contributor to the rise in atmospheric carbon dioxide. Meanwhile, ExxonMobil is the third-largest contributor to both the historical rise in atmospheric CO_2 and warming, and the second-largest contributor to global sea level rise.[235]

The year 1988 marks when James Hansen testified in the U.S. Congress that the human signal of climate change had been detected. 1988 was also the year in which the Intergovernmental Panel on Climate Change was formed to provide a scientific basis for policy action on climate change.[236] Yet, half of all industrial emissions of CO_2 since the Industrial Revolution have been emitted *since* 1988. In the face of scientific evidence of the dangers of fossil fuel emissions and resulting climate change, fossil fuel producers failed to reduce their emissions or disclose climate risks,[237] and instead often worked in direct contradiction to emissions reduction goals and spread climate misinformation.[238]

For instance, between 1988 and 2005, ExxonMobil invested over $16 million into front groups that spread misleading claims about climate science.[239] Rather than changing their business models, fossil fuel companies remain focused on not only exploiting existing oil, gas, and coal reserves, but also on developing new ones. Rather than supporting fair and effective climate policies, fossil fuel majors including Chevron, Shell, and ConocoPhillips remain members of the American Legislative Exchange Council's Energy, Environment and Agriculture Task Force which is focused on repealing renewable energy standards and regional climate policy initiatives in U.S. states.[240] Rather than disclosing climate risks, ExxonMobil consistently focused on the uncertainties surrounding climate change in its New York Times advertorials, while only acknowledging the true risks in less public internal and peer-reviewed communications.[241] In October 2018, the New York Attorney General sued Exxon for lying to its investors about

[235] *Id.*
[236] Hansen, James et al., Global climate changes as forecast by Goddard Institute for Space Studies three-dimensional model, 93 Journal of Geophysical Research 9341 (1988); Frumhoff, Peter et al., The climate responsibilities of industrial carbon producers, 132 Climatic Change 157 (2015).
[237] Frumhoff, Peter et al., The climate responsibilities of industrial carbon producers, 132 Climatic Change 157 (2015).
[238] Union of Concerned Scientists, The Climate Accountability Scorecard: Ranking Major Fossil Fuel Companies on Climate Deception, Disclosure, and Action (2016).
[239] Ward, Robert, Letter dated Sept 4, 2006 from the Royal Society to ExxonMobil (accessed January 17, 2018); Frumhoff, Peter et al., The climate responsibilities of industrial carbon producers, 132 Climatic Change 157 (2015).
[240] Frumhoff, Peter et al., The climate responsibilities of industrial carbon producers, 132 Climatic Change 157 (2015).
[241] Supran, Geoffrey and Oreskes, Naomi, Assessing ExxonMobil's climate change communications (1977-2014), 12 Environ. Res. Lett. 084019 (2017).

climate change.[242] Fossil fuel companies have not even begun to pay their fair share of the costs for climate damages and adaptation.[243]

Climate change impacts are long-lasting.

The greenhouse gases currently in the atmosphere commit the planet to long-lasting climate change impacts that are irreversible on a multi-century to millennial time scale.[244] CO_2 has a long residence time in the atmosphere, meaning that a large fraction of the CO_2 emitted to date will remain in the atmosphere for tens to hundreds of thousands of years.[245] Climatic changes that are caused by CO_2 emissions, such as surface warming, ocean warming, sea level rise, and ocean acidification are long-lasting and irreversible on human timescales.[246] Even if all greenhouse emissions were to completely cease today, significant ongoing regional changes in temperature and precipitation would still occur,[247] global average temperatures would not drop significantly for at least 1,000 years,[248] and sea-level rise would continue for millennia.[249] The National Research Council cautioned that "emission reduction choices made today matter in determining impacts that will be experienced not just over the next few decades, but also into the coming centuries and millennia."[250]

New fossil fuel production and infrastructure must be halted and much existing production must be phased out to avoid the worst dangers from climate change.

Scientific research has established that there is no room in the global carbon budget for new fossil fuel extraction if we are to avoid the worst dangers from climate change. Instead, new fossil fuel production and infrastructure must be halted and much existing production must be phased out to meet the Paris Agreement climate targets and avoid catastrophic climate damages.

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242 Mufson, Steven, *New York sues ExxonMobil, saying it 'misled' investors about climate change risks,* The Washington Post, October 24, 2018, https://www.washingtonpost.com/energy-environment/2018/10/24/new-york-sues-exxonmobil-accusing-it-deceiving-investors-about-climate-change-risks/?utm_term=.b3da65e26bf4.
243 Union of Concerned Scientists, The Climate Accountability Scorecard: Ranking Major Fossil Fuel Companies on Climate Deception, Disclosure, and Action (2016).
244 Intergovernmental Panel on Climate Change, 2013: Summary for Policymakers *in* Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2013) at 26.
245 Clark, Peter U. et al., Consequences of twenty-first century policy for multi-millennial climate and sea-level change, 6 Nature Climate Change 360 (2016).
246 Archer, David & Victor Brovkin, The millennial atmospheric lifetime of anthropogenic CO_2, 90 Climatic Change 283 (2008); Solomon, Susan et al., Irreversible climate change due to carbon dioxide emissions, 106 PNAS 1704 (2009).
247 Gillett, Nathan P. et al, Ongoing climate change following a complete cessation of carbon dioxide emissions, 4 Nature Geoscience 83 (2011).
248 Archer, David & Victor Brovkin, The millennial atmospheric lifetime of anthropogenic CO_2, 90 Climatic Change 283 (2008); Solomon, Susan et al., Irreversible climate change due to carbon dioxide emissions, 106 PNAS 1704 (2009).
249 Solomon, Susan et al., Irreversible climate change due to carbon dioxide emissions, 106 PNAS 1704 (2009).
250 National Research Council, Warming World: Impacts by Degree (2011) at 3.

Although the United States withdrew from the Paris Agreement under President Trump, President Biden has already taken action to have the United States rejoin the agreement. Under the Paris Agreement, countries commit to the climate change target of holding the long-term global average temperature "to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels" under the Paris Agreement.[251] The Paris Agreement established the 1.5°C climate target given the evidence that 2°C of warming would lead to catastrophic climate harms.[252] Scientific research has estimated the global carbon budget—the remaining amount of carbon dioxide that can be emitted — for maintaining a likely chance of meeting the Paris climate targets, providing clear benchmarks for United States and global climate action.[253]

Importantly, a 2016 global analysis found that the carbon emissions that would be released from burning the oil, gas, and coal in the world's currently operating fields and mines would fully exhaust and exceed the carbon budget consistent with staying below 1.5°C.[254] The reserves in currently operating oil and gas fields alone, even excluding coal mines, would likely lead to warming beyond 1.5°C.[255] An important conclusion of the analysis is that no new fossil fuel extraction or infrastructure should be built, and governments should grant no new permits for extraction and infrastructure. Furthermore, many of the world's existing oil and gas fields and coal mines will need to be closed before their reserves are fully extracted in order to limit

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[251] United Nations Framework Convention on Climate Change, Conference of the Parties, Nov. 30-Dec. 11, 2015, Adoption of the Paris Agreement Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (December 12, 2015), http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf ("Paris Agreement"). The United States signed the Paris Agreement on April 22, 2016 as a legally binding instrument through executive agreement, and the treaty entered into force on November 4, 2016.
[252] 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 (October 6, 2018), http://www.ipcc.ch/report/sr15/.
[253] The 2018 IPCC special report on *Global Warming of 1.5°C* estimated the carbon budget for a 66 percent probability of limiting warming to 1.5°C at 420 $GtCO_2$ and 570 $GtCO_2$ from January 2018 onwards, depending on the temperature dataset used. At the current emissions rate of 42 $GtCO_2$ per year, this carbon budget would be expended in just 10 to 14 years. *See* 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 (October 6, 2018), at SPM-16.
[254] Oil Change International, The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production (September 2016), http://priceofoil.org/2016/09/22/the-skys-limit-report/ at Table 3. According to this analysis, the CO_2 emissions from developed reserves in existing and under-construction global oil and gas fields and existing coal mines are estimated at 942 Gt CO_2, which vastly exceeds the 1.5°C-compatible carbon budget estimated in the 2018 IPCC report on *Global Warming of 1.5°C* at 420 $GtCO_2$ to 570 $GtCO_2$.
[255] The CO_2 emissions from developed reserves in currently operating oil and gas fields alone are estimated at 517 Gt CO_2, which would likely exhaust the 1.5°C-compatible carbon budget estimated in the 2018 IPCC report on *Global Warming of 1.5°C* at 420 $GtCO_2$ to 570 $GtCO_2$.

warming to 1.5°C.[256] In short, the analysis established that there is no room in the carbon budget for new fossil fuel extraction or infrastructure anywhere, including in the United States, and much existing fossil fuel production must be phased out to avoid the catastrophic damages from climate change.[257]

Other studies issued since then reinforce these findings. For example, a 2019 analysis underscored that the United States must halt new fossil fuel extraction and rapidly phase out existing production to avoid jeopardizing our ability to meet the Paris climate targets and avoid the worst dangers of climate change.[258] The analysis showed that the U.S. oil and gas industry is on track to account for 60 percent of the world's projected growth in oil and gas production between now and 2030 — the time period over which the IPCC concluded that global carbon dioxide emissions should be roughly halved to meet the 1.5°C Paris Agreement target.[259] Between 2018 and 2050, the United States is poised to unleash the world's largest burst of CO_2 emissions from new oil and gas development — primarily from shale and largely dependent on fracking — estimated at 120 billion metric tons of CO_2 which is equivalent to the lifetime CO_2 emissions of nearly 1,000 coal-fired power plants. Based on a 1.5°C IPCC pathway, U.S. production alone would exhaust nearly 50 percent of the world's total allowance for oil and gas by 2030 and exhaust more than 90 percent by 2050.

Additionally, the United Nations' November 2019 "Emissions Gap" report reiterated the need for urgent action to cut fossil fuel emissions. According to the report, if the world is to limit global warming to 1.5°C, countries must cut emissions by at least 7.6 percent per year over the next decade, for a total emissions reduction of 55 percent between 2020 and 2030.[260] The United Nations' November 2019 "Production Gap" report shows that countries like the United States are on course to extract vastly more fossil fuels than what is allowed to meet a 1.5°C or even 2°C target. Countries' current fossil fuel production plans would lead to 120 percent more fossil fuel emissions by 2030 than would be consistent with a 1.5°C pathway, and 210 percent more by

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[256] Oil Change International, The Sky's Limit California: Why the Paris Climate Goals Demand That California Lead in a Managed Decline of Oil Extraction (2018), http://priceofoil.org/ca-skys-limit at 7, 13.

[257] This conclusion was reinforced by the IPCC Fifth Assessment Report which estimated that global fossil fuel reserves exceed the remaining carbon budget (from 2011 onward) for staying below 2°C (a target incompatible with the Paris Agreement) by 4 to 7 times, while fossil fuel resources exceed the carbon budget for 2°C by 31 to 50 times. *See* Bruckner, Thomas et al., 2014: Energy Systems *in* Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press (2014), at Table 7.2.

[258] Oil Change International, Drilling Toward Disaster: Why U.S. Oil and Gas Expansion Is Incompatible with Climate Limits (January 2019), http://priceofoil.org/drilling-towards-disaster.

[259] 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), http://www.ipcc.ch/report/sr15/ at SPM-15.

[260] United Nations Environment Programme, Emissions Gap Report 2019, UNEP, Nairobi (2019), at 25, 26,
https://wedocs.unep.org/bitstream/handle/20.500.11822/30797/EGR2019.pdf?sequence=1&isAllowed=y.

2040.[261] The United States is a primary contributor to this dangerous over-production of fossil fuels as the world's largest oil and gas producer and second largest coal producer, with current policies projected to lead to a 30 percent increase in oil and gas production by 2030.[262]

Moreover, the Energy Information Administration ("EIA") released its Annual Energy Outlook for 2020 that contains energy-related projections through 2050. The report indicates that without significant policy changes and a rapid transition away from fuels, annual U.S. greenhouse gas emissions are projected to begin rising again by the 2030s.[263] This means that the United States will not be anywhere close to where scientists say it needs to be to reduce its contributions to the climate crisis and avert the most catastrophic impacts of climate change.

These analyses highlights that the United States has an urgent responsibility to lead in the transition from fossil fuel production to 100 percent clean energy, as a wealthy nation with ample financial resources and technical capabilities, and due to its dominant role in driving climate change and its harms. The U.S. is currently the world's largest oil and gas producer and third-largest coal producer.[264] The U.S. is also the world's largest historic emitter of greenhouse gas pollution, responsible for 25 percent of cumulative global CO_2 emissions since 1870, and is currently the world's second highest emitter on an annual and per capita basis.[265] The U.S. must focus its resources and technology to rapidly phase out extraction while investing in a just transition for affected workers and communities currently living on the front lines of the fossil fuel industry and its pollution.[266]

Research on the United States' carbon budget and the carbon emissions locked in U.S. fossil fuels similarly establishes that the U.S. must halt new fossil fuel production and rapidly phase out existing production to avoid the worst dangers of climate change. An analysis of U.S. fossil fuel resources demonstrates that the potential carbon emissions from already leased fossil fuel resources on U.S. federal lands would essentially exhaust the remaining U.S. carbon budget consistent with the 1.5°C target. This 2015 analysis estimated that recoverable fossil fuels from U.S. federal lands would release up to 349 to 492 $GtCO_2eq$ of carbon emissions, if fully extracted and burned.[267] Of that amount, already leased fossil fuels would release 30 to 43

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261 United Nations Environment Programme, et al., The Production Gap: The discrepancy between countries' planned fossil fuel production and global production levels consistent with limiting warming to 1.5°C or 2°C (2019), at 4, 14, http://productiongap.org/.
262 *Id.* at 31.
263 U.S. Energy Information Administration, Annual Energy Outlook 2020 with projections to 2050, Jan. 2020, https://www.eia.gov/outlooks/aeo/pdf/AEO2020%20Full%20Report.pdf.
264 Oil Change International, Drilling Toward Disaster: Why U.S. Oil and Gas Expansion Is Incompatible with Climate Limits (January 2019), http://priceofoil.org/drilling-towards-disaster at 5.
265 LeQuéré, Corinne et al., Global carbon budget 2018, 10 Earth System Science Data 2141 (2018) at Figure 5, 2167; Global Carbon Project, Global Carbon Budget 2018 (published on 5 December 2018) https://www.globalcarbonproject.org/carbonbudget/18/files/GCP_CarbonBudget_2018.pdf at 19 (Historical cumulative fossil CO_2 emissions by country).
266 Piggot, Georgia et al., Realizing a just and equitable transition away from fossil fuels, Discussion brief, Stockholm Environment Institute (January 2019), https://www.sei.org/publications/just-and-equitable-transition-fossil-fuels/.
267 Ecoshift Consulting, et al., The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels, Prepared for Center for Biological Diversity & Friends of the Earth (2015).

$GtCO_2eq$ of emissions, while as yet unleased fossil fuels would emit 319 to 450 $GtCO_2eq$ of emissions. Thus, carbon emissions from already leased fossil fuel resources on federal lands alone (30 to 43 $GtCO_2eq$) would essentially exhaust the U.S. carbon budget for a 1.5°C target (25 to 57 $GtCO_2eq$)[268], if these leased fossil fuels are fully extracted and burned. The potential carbon emissions from unleased federal fossil fuel resources (319 to 450 $GtCO_2eq$) would exceed the U.S. carbon budget for limiting warming to 1.5°C many times over.[269] This does not include the additional carbon emissions that will be emitted from fossil fuels extracted on non-federal lands, estimated up to 500 $GtCO_2eq$ if fully extracted and burned.[270]

In 2018, the U.S. Geological Survey and Department of the Interior estimated that carbon emissions released from extraction and end-use combustion of fossil fuels produced on federal lands alone — not including non-federal lands — accounted for approximately one quarter of total U.S. carbon emissions during 2005 to 2014.[271] This research further establishes that the United States must halt new fossil fuel projects and close existing fields and mines before their reserves are fully extracted to achieve the Paris climate targets and avoid the worst damages from climate change.

Research that models the emissions pathways needed to meet the Paris climate targets also shows that a rapid end to fossil fuel extraction is critical. The 2018 IPCC special report on *Global Warming of 1.5°C* concluded that pathways to limit warming to 1.5°C with little or no overshoot require "a rapid phase out of CO_2 emissions and deep emissions reductions in other GHGs and climate forcers."[272] In pathways consistent with 1.5°C, global net anthropogenic CO_2 emissions must decline by about 45 percent from 2010 levels by 2030 and reach net zero around 2045 or 2050.[273] Additionally, 1.5°C-consistent pathways require a full decarbonization of the power sector by mid-century.[274] The report makes clear the necessity of immediate, deep greenhouse gas reductions to avoid devastating climate change-driven damages, and underscores the high costs of inaction or delays, particularly in the next crucial decade, in making these cuts.
Ending the approval of new fossil fuel production and infrastructure is also critical for preventing "carbon lock-in," where approvals and investments made now can lock in decades-worth of fossil fuel extraction that we cannot afford. New approvals for wells, mines, and fossil fuel infrastructure — such as pipelines and marine and rail import and export terminals — require

[268] Robiou du Pont, Yann et al., Equitable mitigation to achieve the Paris Agreement goals, 7 Nature Climate Change 38 (2017), at Supplemental Table 1.
[269] Ecoshift Consulting, et al., The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels, Prepared for Center for Biological Diversity & Friends of the Earth (2015), at 4.
[270] *Id.* at 3 ("the potential GHG emissions of federal fossil fuels (leased and unleased) are 349 to 492 Gt CO2e, representing 46 percent to 50 percent of potential emissions from all remaining U.S. fossil fuels").
[271] Merrill, Matthew D. et al., Federal lands greenhouse gas emissions and sequestration in the United States—Estimates for 2005–14: U.S. Geological Survey Scientific Investigations Report 2018–5131 (2018) at 8.
[272] 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), http://www.ipcc.ch/report/sr15/ at 2-28.
[273] *Id.* at SPM-15.
[274] *Id.* at 2-29.

upfront investments that provide financial incentives for companies to continue production for decades into the future.[275] As summarized by Green and Denniss (2018):

> When production processes require a large, upfront investment in fixed costs, such as the construction of a port, pipeline or coalmine, future production will take place even when the market price of the resultant product is lower than the long-run opportunity cost of production. This is because rational producers will ignore 'sunk costs' and continue to produce as long as the market price is sufficient to cover the marginal cost (but not the average cost) of production. This is known as 'lock-in.'"[276]

Given the long-lived nature of fossil fuel projects, ending the approval of new fossil fuel projects is necessary to avoid the lock-in of decades of fossil fuel production and associated emissions.

A 2019 study highlighted the importance of immediately halting all new fossil fuel infrastructure projects to preserve a livable planet. The study found that phasing out all fossil fuel infrastructure at the end of its design lifetime, starting immediately, preserves a 64 percent chance of keeping peak global mean temperature rise below 1.5°C.[277] This means replacing fossil fuel power plants, cars, aircraft, ships, and industrial infrastructure with zero carbon alternatives at the end of their lifespans, starting now. The study found that delaying mitigation until 2030 reduces the likelihood that 1.5 °C would be attainable to below 50 percent, even if the rate of fossil fuel retirement were accelerated. In other words, every year of delay in phasing out fossil fuel infrastructure makes "lock-in" more difficult to escape and the possibility of keeping global temperature rise below 1.5°C less likely. The study concluded that although difficult, "1.5 °C remains possible and is attainable with ambitious and immediate emission reduction across all sectors."

COUPLED WITH ENDING FOSSIL FUEL LEASING, THE SECRETARY MUST ENSURE THE SECURITY AND LIVELIHOODS OF IMPACTED FAMILIES

To accompany the urgent need to end offshore oil leasing, the Secretary must also ensure secure livelihoods of communities impacted by fossil fuels. The federal government has a responsibility to safeguard communities on the front lines of climate change, families who depend on the fossil fuel industry, and communities harmed by fossil fuel pollution. Indeed, it is the policy of this

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[275] Davis, Steven J. and Robert H. Socolow, Commitment accounting of CO_2 emissions, 9 Environmental Research Letters 084018 (2014); Erickson, Peter et al., Assessing carbon lock-in, 10 Environmental Research Letters 084023 (2015); Erickson, Peter et al., Carbon lock-in from fossil fuel supply infrastructure, Stockholm Environment Institute, Discussion Brief (2015); Seto, Karen C. et al., Carbon Lock-In: Types, Causes, and Policy Implications, 41 Annual Review of Environmental Resources 425 (2016); Green, Fergus and Richard Denniss, Cutting with both arms of the scissors: the economic and political case for restrictive supply-side climate policies, 150 Climatic Change 73 (2018).
[276] Green, Fergus and Richard Denniss, Cutting with both arms of the scissors: the economic and political case for restrictive supply-side climate policies, 150 Climatic Change 73 (2018) at 78.
[277] Smith, Christopher J. et al., Current fossil fuel infrastructure does not yet commit us to 1.5°C warming, Nature Communications, doi.org/10.1038/s41467-018-07999-w (2019).

administration to spur well-paying jobs, deliver environmental justice, and hold polluters accountable for their actions.[278]

Specifically, the Secretary should create a commission with a deadline of six months to create a comprehensive program that guarantees support and protection for affected communities and workers. In developing the program, the task force shall consult with communities impacted by offshore oil and gas development — including meaningful consultation with labor, unions, Indigenous, Black, and other communities of color.

Additionally, the Secretary should act within her power to ensure the implementation and funding of such a program. The Secretary should work with the Department of Justice to investigate and, as appropriate, seek damages and restoration from fossil fuel industry responsible for damages to public welfare, lands and waters — including the Gulf of Mexico, Southern California Bight, and Cook Inlet.

The Secretary has authority and a duty to mitigate the adverse human effects of its leasing program, past and present. In enacting OCSLA, Congress recognized that areas affected by adverse effects from offshore drilling would require assistance.[279] Accordingly, OCSLA seeks to provide affected States and localities "funds which may be used for the mitigation of adverse economic and environmental effects."[280] Congress also recognized the need for participation of affected areas in planning and the "rights and responsibilities" of states and local governments to "preserve and protect their marine, human, and coastal environments."[281]

President Biden's Executive Order Advancing Racial Equity mandates that "agencies shall consult with members of communities that have been historically underrepresented in the Federal Government and underserved by, or subject to discrimination in, Federal policies and programs."[282] Additionally, Executive Order 12898 requires "[t]o the greatest extent practicable and permitted by law," that the Department of the Interior "make achieving environmental justice part of its mission by identifying and addressing . . . disproportionately high and adverse human health or environmental effects of [its] activities on minority populations and low-income populations."[283]

The Secretary should prioritize a swift and just transition for communities that have grown dependent on the fossil fuel industry. Our nation's move away from fossil fuels must not come at the expense of families and their livelihoods. The fossil fuel industry, characterized by boom and bust cycles, often leaves families and communities suffering. Jobs stemming from offshore oil and gas is a small portion of the energy sector — estimated between 62,500 to 315,000 direct

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278 *See, e.g.*, Biden Executive Order, Secs. 201, 217.
279 43 U.S.C. § 1332(4)(A).
280 *Id*.
281 *Id*.
282 Executive Order On Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (Jan. 20, 2021), Sec. 8.
283 59 Fed. Reg. 7629, at § 1-101 (Feb 11, 1994).

and support jobs.[284] Despite the attempts of the Trump administration to bolster offshore development, the workforce has nonetheless dwindled.[285] Even with economic recovery on the horizon, "the jobs outlook for oil and gas production is bleak" in the Gulf of Mexico.[286] These workers depend on an unstable job market; and the shift away from a federal fossil fuel leasing must be accompanied by a federal program to ensure well-paying jobs, healthcare, and housing for their families.

The Secretary should also prioritize the wellbeing of communities most severely harmed by the nation's dependence on offshore oil. The entire process of drilling and refining fossil fuels is dangerous and dirty. Indigenous, Black, and other communities of color have been disproportionately burdened by offshore oil development. There is an urgent need to dismantle the systemic racism that has harmed these communities and ensure restitution.

Refineries and petrochemical plants are more likely to be in low-income and communities of color.[287] African Americans are 75 percent more likely to live near toxic pollution than the rest of Americans and are exposed to 38 percent more air pollution than white people.[288]

The coastal areas affected by drilling include some of the most important cultural resources for Indigenous nations. Tribal lands in coastal Louisiana are suffering severe land loss from pipeline canals while Native Villages in Alaska are being swallowed by rising seas — both displacing people from their ancestral lands.[289] Alaskan subsistence is at risk from the impacts of offshore drilling, and many Alaska Native's livelihoods are permanently scarred from the Exxon Valdez oil spill.[290] Disastrous oil spills in 1969 and 2015 off Santa Barbara harmed Chumash sacred sites and animals.[291] Moreover, hurricane disasters have highlighted the vulnerabilities of communities of color to the oil industry. Severe storms — exacerbated by climate change and

[284] LaRocco, Lori Ann, How Many Jobs Does Gulf Drilling Really Employ? Fact vs. Fiction, CNBC (Feb. 10, 2011), https://www.cnbc.com/2011/02/10/how-many-jobs-does-gulf-drilling-really-employ-fact-vs-fiction.html; Bureau of Ocean Energy Management, Offshore Oil and Gas Economic Contributions (2018).
[285] Heather Richards, Trump promised offshore jobs. That's not happening, E&E News (Aug. 1, 2019), https://www.eenews.net/energywire/2019/08/01/stories/1060820411.
[286] Kristen Mosbrucker, Louisiana may have 'modest' oil and gas jobs growth by end of 2021, The Advocate (Nov. 18, 2020), https://www.theadvocate.com/baton_rouge/news/business/article_7c00d1d6-28f2-11eb-a601-171505ce9e56.html.
[287] Johnston, J., & Cushing, L, Chemical Exposures, Health, and Environmental Justice in Communities Living on the Fenceline of Industry, 7 Current Environmental Health Reports 48 (2020).
[288] Fleischman, L. et al. Fumes Across the Fence-Line: The Health Impacts of Air Pollution from Oil and Gas Facilities on African American Communities (2017).
[289] Palinkas, Lawrence A., Fleeing Coastal Erosion: Kivalina and Isle de Jean Charles, Global Climate Change, Population Displacement, and Public Health 127 (2020).
[290] Gill, Duane, Considering Cumulative Social Effects of Technological Hazards and Disasters, 64 American Behavioral Scientist 1145 (2020).
[291] Ben-Hur, Arielle, The Chumash Heritage National Marine Sanctuary: An Exploration of Changing the Discourse on Conservation" 105 Pitzer Senior Theses. 45-50 (2020).

land loss from offshore oil activities — have destroyed homes, displaced families, and triggered toxic spills.[292]

A new offshore oil and gas leasing plan that ends fossil fuel leasing coupled with a bold plan to safeguard affected families is urgently needed.[293] This petition seeks to transform reliance on and the burden of the fossil fuel industry to clean, healthy jobs and livelihoods for families on the front lines of offshore drilling.

CONCLUSION

President Biden took an important step by pausing federal oil and gas leasing on public lands and offshore. Ending new offshore oil and gas leasing is an essential piece of the global effort to keep fossil fuels in the ground to avert the most catastrophic impacts of the climate crisis. We support the pause on new oil and gas leasing and urge the Secretary to conduct a robust and meaningful review of the federal fossil fuel leasing program. At the conclusion of that review, it should be untenable to take any other course than ensure no new leases for the long-term health of the planet and our nation's energy needs. Accordingly, through this petition, the Center for Biological Diversity, Cook Inletkeeper, Healthy Gulf, and Wishtoyo Chumash Foundation request issuance of a new five-year OCS oil and gas leasing program that would contain no new leases in any OCS region.

Doing so would help protect our climate, wildlife, and frontline communicates while the administration develops a plan to phase out fossil fuel extraction from federal waters and transforms our extractive economy to a regenerative and inclusive one, in a manner that dismantles systemic racism and advances environmental, racial, and economic justice.

Respectfully submitted this 16th day of March, 2021,

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[292] Flores, Aaron, et al., Petrochemical releases disproportionately affected socially vulnerable populations along the Texas Gulf Coast after Hurricane Harvey, Population and Environment (2020); Day, J. W., et al., Restoration of the Mississippi Delta: Lessons from Hurricanes Katrina and Rita, 315 Science 1679–1684 (2007).

[293] *See e.g.,* Gulf South for a Green New Deal Policy Platform (2019).

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