BEFORE THE UNITED STATES DEPARTMENT OF THE INTERIOR

PETITION TO REDUCE THE RATE OF OIL AND GAS PRODUCTION ON PUBLIC LANDS AND WATERS TO NEAR ZERO BY 2035

December XX, 2021

Submitted By

CONSERVATION, ENVIRONMENTAL JUSTICE, PUBLIC HEALTH, INDIGENOUS, CLIMATE, FAITH-BASED, AND COMMUNITY NON-GOVERNMENTAL ORGANIZATIONS

"No more drilling on federal lands.

No more drilling including offshore.

No ability for the oil industry to continue to drill, period, ends."

-President Joe Biden

Biden-Sanders Debate, March 15, 2020

The Honorable Joseph R. Biden
President of the United States
The White House
1600 Pennsylvania Ave., N.W.
Washington, DC 20500

The Honorable Deb Haaland
Secretary
U.S. Department of the Interior
1849 C Street, N.W.
Washington, DC 20240

Dear President Biden and Secretary Haaland,

We hereby petition you to use your inherent authority to implement a steady and managed decline of all onshore and offshore oil and gas production on public lands and waters such that oil and gas production is reduced by 98% of current levels by the year 2035 in order to avoid disastrous climate change driven by fossil fuels.

Decades ago Congress gave the Secretary of the Interior authority to set the "quantity and rate of production" of oil and gas production on public lands under the Mineral Leasing Act of 1920. Similarly, it gave the President authority, under the Outer Continental Shelf Lands Act of 1953, to set the rate of production for oil and gas production on offshore waters. Using these authorities now to reduce the production of oil and gas is absolutely necessary to address the climate crisis and fully aligns with your "whole of government" directive that every federal agency "avoid the most catastrophic impacts of that crisis and to seize the opportunity that tackling climate change presents."[1] These statutory provisions provide you with one of the most powerful tools to address the reckless and profoundly damaging environmental legacy of over 100 years of fossil fuel extraction on public lands and waters, and would finally put the public good above the profits of the oil and gas industries.

Implementing this managed decline now is absolutely imperative to finally stem the relentless and ever-increasing production of oil and gas on public lands and waters. Over the past 15 years, production of oil from public lands and waters has inexorably increased 57% to over 937 million barrels per year in 2020 and now accounts for 23% of total oil production in the United States.[2] Even worse, during the first six months of 2021 alone, the Department of the Interior approved more than 2,100 oil and gas permits to drill, a level of permit approvals not seen since the George W. Bush administration.[3] If these approvals continue, it will be virtually impossible for the United States to meet its pledge under the Paris Agreement to limit global temperature rise to 1.5 degrees Celsius (°C) and avoid catastrophic damages from the climate emergency.

An overwhelming scientific consensus makes clear that limiting global temperature rise to 1.5°C requires governments to halt approval of new fossil fuel production and infrastructure *and* phase out existing fossil fuel production and infrastructure in developed fields and mines. Already developed oil and gas fields and coal mines contain enough carbon to exceed a 1.5°C limit, meaning that extraction in existing fields and mines must be shut down before their reserves are fully depleted. Globally at least 58% of oil reserves and 59% of gas reserves must be kept in the ground in order even to have a 50-50 chance of meeting a 1.5°C limit. Yet, as detailed in the

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[1] *Tackling the Climate Crisis at Home and Abroad*, 86 Fed. Reg. 7,619 (Jan. 27, 2021).
[2] *Crude Oil Production*, Energy Information Administration (June 30, 2021); *see also*, Office of Natural Resources Revenue (2006 - 2020), https://revenuedata.doi.gov/explore/ (last visited Oct. 21, 2021).
[3] Matthew Brown, *US drilling approvals increase despite Biden climate pledge*, AP (July 12, 2021).

landmark United Nations Production Gap Reports, fossil fuel producers are planning to extract *more than double* the amount of oil, gas and coal by 2030 than is consistent with limiting warming to 1.5°C,[4] with U.S. oil and gas production projected to increase twice as much as any other country.[5] Instead of increasing extraction, we must make steep reductions in fossil fuel production between 2020 and 2030 to limit warming to 1.5°C. The United States has a moral responsibility to lead the world in a rapid managed decline of fossil fuel production based on its role as the historic, dominant driver of the climate crisis, its capacity for a just transition to clean energy, and existing executive authority to accomplish this phaseout of fossil fuels.[6]

Four years after the signing of the Paris Agreement, the United Nations starkly warned that global emissions were still sharply higher than what is needed to achieve 2030 interim emission reduction targets.[7] The UN report concluded that limiting warming to 1.5°C requires countries to strengthen their climate pledges *fivefold* to cut emissions by at least 7.6% per year through 2030, concluding that the United States "in particular" must ramp up climate action to meet global climate limits under the Paris Agreement. In 2021 the World Meteorological Organization warned that there is roughly a 40% chance of the average global temperature reaching 1.5°C above preindustrial levels within at least one of the next five years. And in August of this year, the UN secretary-general stated the latest IPCC climate report is a "code red for humanity" and that all countries must "end all new fossil fuel exploration and production, and shift fossil-fuel subsidies into renewable energy."[8]

The extreme heat waves, hurricanes and megafires wreaking destruction across the United States, the deadly floods in Europe and Asia, record-breaking droughts across Africa and South America, and devastating fires in Australia and the Amazon rainforest just over the past two years provide more unequivocal proof that time has already run out. The climate emergency is here. Nearly every month of 2021 was the hottest in recorded history for the country. It is clear that the limited policy interventions by the Department of the Interior to address climate change have all been woefully inadequate to address the climate calamity unfolding now.

The extraction and burning of fossil fuels from public lands and waters is one of the main drivers of the climate crisis and continues to cause profound environmental injustice and burdens millions of people with debilitating health impacts. People who suffer from unhealthy levels of air pollution caused by fossil fuels are at risk of premature death, lung cancer, asthma attacks and cardiovascular problems, and face increased risks of stillbirths and developmental delays in children. In the United States, the burning of fossil fuels results in increased particulate matter, ground-level ozone, and smog causing over $820 billion per year in health costs.[9] While these

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[4] SEI, IISD, ODI, E3G, and UNEP, 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 (2020).
[5] Ploy Achakulwisut & Peter Erickson, Trends in fossil fuel extraction: Implications for a shared effort to align global fossil fuel production with climate limits, Stockholm Environment Institute Working Paper (April 2021).
[6] Greg Muttitt & Sivan Kartha, Equity, climate justice and fossil fuel extraction: principles for a managed phase out, 20 Climate Policy 1024 (2020).
[7] *Emissions Gap Report 2019,* United Nations Environment Programme at xviii (2019).
[8] *Secretary-General Calls Latest IPCC Climate Report 'Code Red for Humanity', Stressing 'Irrefutable' Evidence of Human Influence*, United Nations (Aug. 9, 2021), https://www.un.org/press/en/2021/sgsm20847.doc.htm.
[9] *The Costs of Inaction: The Economic Burden of Fossil Fuels and Climate Change on Health in the United States*, Medical Society Consortium on Climate and Health at 5 (2021).

costs are shared by everyone across the United States, affected communities including children, low-wealth communities, and people of color bear a significantly higher burden.

Fortunately, implementing a managed decline of oil and gas on public lands can be accomplished quickly and effectively. First, the fossil fuel industry has already consented to the Department of the Interior's use of this authority. *Every single onshore lease* application form already required each company to abide by the inherent authority of the secretary "to alter or modify…the quantity and rate of production under" any lease. Likewise, for all offshore oil and gas operations, every fossil fuel company has already consented in each signed lease to only produce oil and gas only "at rates consistent with any rule or order issued" by the president.[10]

Second, the oil and gas industry has shown that it can alter its own rate of production when it wants to, as all it has to do is turn off the valves from producing wells — an exercise that occurs regularly every time a climate-change supercharged hurricane hits the Gulf of Mexico. Likewise, when oil and gas demand collapsed due to the Covid-19 pandemic, the fossil fuel industry slashed production by 9.7 million barrels per day, the largest decrease in production in history.[11] Likewise, when oil prices fell by over 55% in 2008, the Organization of the Petroleum Exporting Countries cut production by 1.5 million barrels per day.[12] These examples show that the oil and gas industry can easily adjust its rate of production to protect its profits. And it illustrates that industry could be required to steadily ratchet down its production to protect our climate for the public good and the survival of our planet.

During the 2020 presidential election, then-candidate Joe Biden promised "[n]o more drilling on federal lands. No more drilling, including offshore. No ability for the oil industry to continue to drill, period, ends, number one."[13] It is now time for the Department of the Interior to make real the administration's promise and vision by implementing a program to reduce the rate of production of oil and gas on public lands and waters.

To make substantive progress toward the administration's vision and U.S. goals under the Paris Agreement, the proposed regulation will implement a controlled phasedown of oil and gas production on public lands. Using 2020 as a baseline, beginning in 2022 the total maximum rates of oil and gas production will decrease by 10% annually for 8 years and then 3% annually for each year thereafter. These reductions will apply across the oil and gas sector, gradually decreasing the maximum production rates for every oil and gas lease on public lands until production is reduced 98% by 2035.

Implementing a managed decline of oil and gas production through control of the rate of production represents the most significant action you could take to protect our climate, protect our wildlife, protect frontline communities, and ensure that the planet remains livable for future generations. This managed decline should be taken in conjunction with other critical policy actions, including permanently ending new federal fossil fuel leasing and ending the approval of

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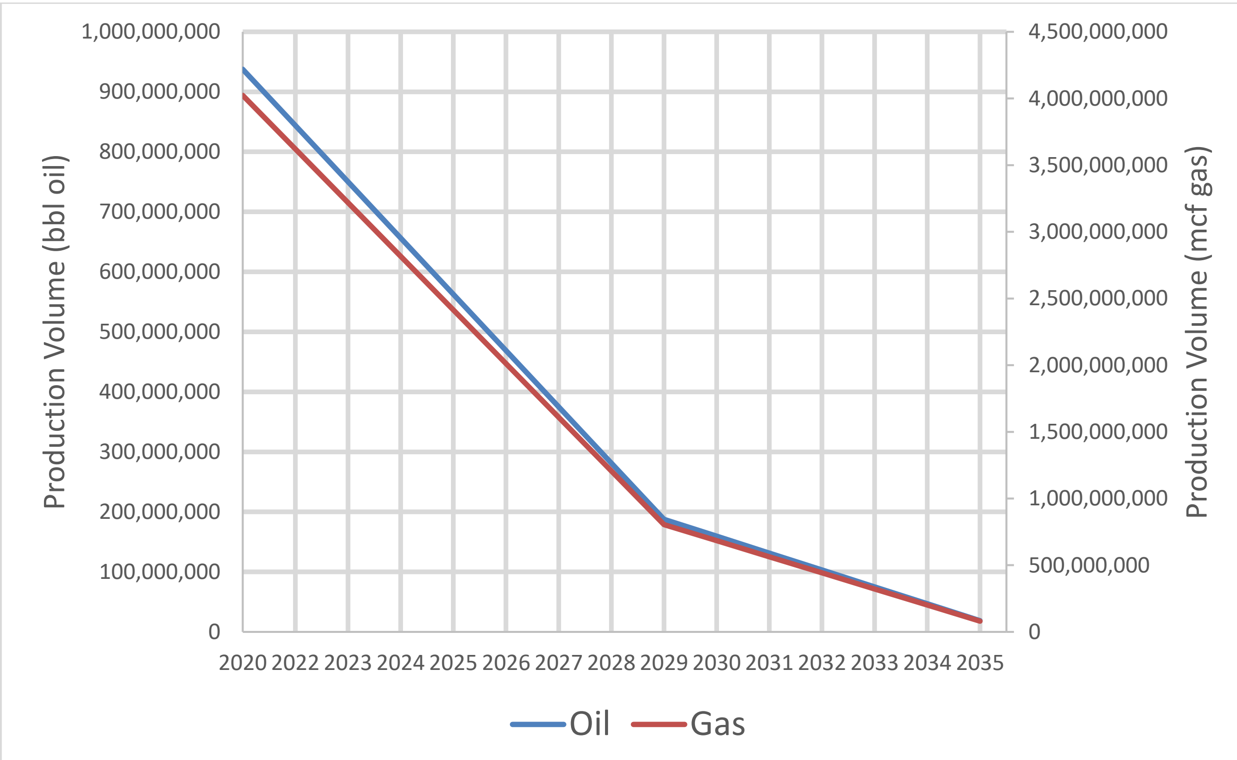
[10] *See* Appendix.
[11] *OPEC and allies finalize record oil production cut after days of discussion*, CNBC (Apr. 12, 2020), https://www.cnbc.com/2020/04/12/opec-and-allies-finalize-record-oil-production-cut-after-days-of-discussion.html.
[12] Nelson D. Schwartz and Jad Mouawad, *OPEC Says It Will Cut Oil Output*, N.Y. Times (Oct. 24, 2008).
[13] *CNN Democratic Presidential Primary Debate*, CNN (Mar. 15, 2020).

new fossil fuel infrastructure projects on all lands managed by the Department of the Interior. These efforts should align with a larger set of actions by the Biden administration to tackle the climate crisis, including declaring a climate emergency, reinstating the crude oil export ban, and limiting gas exports to the full extent allowed by the Natural Gas Act.

Figure 1. Managed Phaseout of Oil and Gas on Public Lands and Waters



Accordingly, pursuant to the right to petition provided in the First Amendment to the U.S. Constitution and the Administrative Procedure Act,[14] we hereby petition you, as Secretary of the Interior,[15] to promulgate regulations that (1) establish the maximum production rate and phasedown of existing onshore oil and gas wells under Section 17 of the Mineral Leasing Act and (2) establish the maximum production rate and phasedown of existing offshore oil and gas wells under Section 107 of the Naval Petroleum Reserves Production Act.

Additionally, pursuant to Section 5 of the Outer Continental Shelf Lands Act, the commitments made by the United States under the Paris Agreement and the authority within the National Emergencies Act, we hereby petition you, as the President of the United States, to promulgate an executive order or rule that establish the maximum production rate and phasedown of existing offshore oil and gas wells. For both requests, we petition that any existing regulations under the Mineral Leasing Act, the Naval Petroleum Reserves Production Act and the Outer Continental Shelf Lands Act that conflict with the objectives and text of our proposed regulations be rescinded.

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[14] Our organizations and their members are "interested persons" within the meaning of the APA. 5 U.S.C. § 553(e).
[15] *See* 43 C.F.R. § 14.2.

Text of Proposed Regulations:[16]

PHASE-DOWN OF OIL AND GAS PRODUCTION UNDER THE MINERAL LEASING ACT, THE OUTER CONTINENTAL SHELF LANDS ACT, AND OTHER AUTHORITIES

Subpart A – Setting Rates of Production Through Establishment of a Program to Reduce the Rate of Production of Fossil Fuels.

§ 101.1 Policy and Purpose.

(a) Policy. The policy objective of this part is to establish a rate of production of oil and gas that is compatible with maintaining a stable climate below 1.5°C.

(b) Purpose. The purpose of this part is to establish a Program to Reduce the Rate of Production of Fossil Fuel on lands and waters under the jurisdiction of the Department of the Interior. The regulations set forth in this part establish the requirements and procedures for allocating the share of production for each covered lease that is producing oil or gas or both, the establishment of an anti-backsliding requirement to further reduce the rate of production to address any excess production, and the establishment of a system to track each share of production including the transfer of shares.

§ 101.2 Establishment of Baseline Year and Rate of Production.

(a) The baseline year for all federal onshore and offshore oil and gas shall be calendar year 2020.

(b) For calendar year 2020, the nationwide onshore and offshore aggregate federal production was 937,722,926 bbl of oil and 4,023,455,328 mcf of gas.

(c) In setting the rate of production, total production of onshore and offshore aggregate federal production per year from all wells subject to federal leases, shall not exceed the limits set forth in Table 1.

Table 1. Maximum Rate of Production of Oil and Gas Per Year

Year	Oil Percentage of Baseline	Oil Production Limit (bbl)	Gas Percentage of Baseline	Gas Production Limit (mcf)
2022	90%	843,950,633	90%	3,621,109,795
2023	80%	750,178,341	80%	3,218,764,262
2024	70%	656,406,048	70%	2,816,418,730
2025	60%	562,633,756	60%	2,414,073,197
2026	50%	468,861,463	50%	2,011,727,664
2027	40%	375,089,170	40%	1,609,382,131

[16] Petitioners believe the text for the proposed regulations is applicable to both the onshore and National Petroleum Reserve in Alaska oil and gas programs, and that such language applies equally for submitting a petition under the APA. Furthermore, the proposed regulatory text is applicable to the offshore oil and gas programs when combined with the proposed Presidential rule beginning on page 14, but is similar for the onshore text.

2028	30%	281,316,878	30%	1,207,036,598
2029	20%	187,544,585	20%	804,691,066
2030	17%	159,412,897	17%	683,987,406
2031	14%	131,281,210	14%	563,283,746
2032	11%	103,149,522	11%	442,580,086
2033	8%	75,017,834	8%	321,876,426
2034	5%	46,886,146	5%	201,172,766
2035	2%	18,754,459	2%	80,469,107

§ 101.3 Federal Authority.

(a) The Secretary reserves all authority under subchapter IV of the Mineral Leasing Act, under chapter 7 of the Mineral Leasing Act for Acquired Lands, and under the Naval Petroleum Reserves Production Act including but not limited to, the authority, at the Secretary's discretion, to alter or modify from time to time the quantity and rate of production of oil and gas leases on lands owned by the United States.

(b) The President reserves all authority under subchapter III of the Outer Continental Shelf Lands Act including but not limited to, the authority, at the President's discretion, to alter or modify from time to time the quantity and rate of production of oil and gas leases on lands owned by the United States.

(c) The Secretary reserves the right under subchapter IV of the Mineral Leasing Act and under the Naval Petroleum Reserves Production Act to take any action necessary to protect the orderly and competitive functioning of the allocation system, including actions to prevent fraud and misrepresentation.

(d) The President reserves the right under subchapter III of the Outer Continental Shelf Lands Act to take any action necessary to protect the orderly and competitive functioning of the allocation system, including actions to prevent fraud and misrepresentation.

§ 101.4 Definitions.

Act means the Mineral Lands Leasing Act of 1920, as amended and supplemented (30 U.S.C. 181 et seq.) and the Mineral Leasing Act for Acquired Lands of 1947, as amended (30 U.S.C. 351-359).

Allocation means an authorization by the President or Secretary under the Program to produce up to one barrel of oil or 1,000 cubic feet of gas during or after a specified calendar year. Allocations shall be rounded down for decimals less than 0.500 and up for decimals of 0.500 or greater.

Allocation Tracking System means the Program system by which the President or Secretary allocates, records, deducts, and tracks allocations.

Allocation Tracking System account means an account in the Allocation Tracking System established by the President or Secretary for purposes of allocating, holding, transferring, and using allocations.

Barrel or *bbl* means a barrel of oil or 42 U.S. gallons. All measurements of crude oil and natural gas liquids under this section shall be at 60 degrees Fahrenheit.

Covered lease means a lease that is subject to the Program pursuant to §101.5.

Gas means any fluid, either combustible or noncombustible, which is produced in a natural state from the earth and which maintains a gaseous or rarefied state at ordinary temperatures and pressure conditions.

Lease means any contract, profit-share arrangement, joint venture or other agreement issued or approved by the United States under law that authorizes on any lands, including the surface of a severed mineral estate, exploration for, extraction of or removal of oil or gas.

Lessee means any person holding record title or owning operating rights in a lease issued or approved by the United States. The lessee of a covered lease shall be subject to the provisions of this part pursuant to the Act, OCSLA, or NPRPA and may authorize a responsible natural person which shall represent and, by his or her representations, actions, inactions, or submissions, legally bind each lessee of the covered lease represented, as a matter of Federal Law, in matters pertaining to the Program.

Lessor means the party to a lease who holds legal or beneficial title to the mineral estate in the leased lands.

mcf means one thousand cubic feet or one thousand cubic feet of gas.

NPRPA means the Naval Petroleum Reserves Production Act, as amended (42 U.S.C. § 6501 et seq.).

Outer Continental Shelf or *OCS* means all submerged lands lying seaward and outside of the area of lands beneath navigable waters as defined in 43 U.S.C. 1301(a).

OCSLA means the Outer Continental Shelf Lands Act, as amended (43 U.S.C. 1331 et seq.).

Oil means all nongaseous hydrocarbon substances other than those substances leasable as coal, oil shale or gilsonite (including all vein-type solid hydrocarbons).

President means the President of the United States.

Recordation, record, or recorded means, with regard to allocations, the transfer of allocations by the President or Secretary from one Allocation Tracking System account to another.

Secretary means the Secretary of the Interior.

§ 101.5 Applicability.

The following shall be included as a covered lease subject to the provisions of the Program to Reduce the Rate of Production of Fossil Fuel:

(a) Any leases granted before the date of enactment of this final rule in which the lessor assented to inclusion cooperative or unit plan for the proper development and operation of the area, field, or pool, or any other restriction on the development or production of such lease under any of the following authorities:

(1) the Mineral Lands Leasing Act of 1920, as amended and supplemented (30 U.S.C. 181 et seq.);

(2) the Mineral Leasing Act for Acquired Lands of 1947, as amended (30 U.S.C. 351-359);

(3) the Naval Petroleum Reserves Production Act, as amended (42 U.S.C. § 6501 et seq.); or

(4) the Outer Continental Shelf Lands Act, as amended (43 U.S.C. 1331 et seq.).

(b) Any leases granted after the date of enactment of this final rule under any provision of law.

Subpart B - Inclusion in a Cooperative or Unit Plan, Allocations, Excess Production of Oil and Gas, Penalties for Overproduction, and Anti-backsliding

§ 102.1 Inclusion in Cooperative or Unit Plan.

(a) Within 30 days after the enactment of the final rule, the Secretary shall identify each shared area, field or pool of oil and/or gas within the United States in which at least one lease has been issued for by the Secretary. No later than every three years, the Secretary shall review each shared area, field or pool and assess whether additional designations are required.

(b) Within 60 days after the enactment of the final rule, the Secretary shall notify each covered lease that is operating within a shared area, field, or pool of oil or gas and enroll such covered lease in a common pool or unit plan.

§ 102.2 Setting Initial Production Allocations for Calendar Year 2022.

(a) The President and the Secretary shall identify each covered lease operating pursuant to the Act, OCSLA, or NPRPA in calendar year 2021.

(b) No later than February 1, 2022, the President and the Secretary shall calculate the pro-rata share allocation for each covered lease enrolled in a common pool or unit plan identified in subsection (a). The pro-rata share for calendar year 2022 shall be the production volume of oil or gas from a covered lease in year 2021 divided by the total production volume of oil or gas on all covered leases in year 2021 multiplied by the Table 1 production limit (in bbl or mcf) for 2022. The formula for the pro-rata share can be expressed as the following:

> Pro-rata Oil Share $_{2022}$ = (production volume on a covered lease $_{2021}$ (in bbl) / Σ production volume on all covered leases $_{2021}$ (in bbl)) x Table 1 production limit (in bbl) $_{2022}$
>
> Pro-rata Gas Share $_{2022}$ = (production volume on a covered lease $_{2021}$ (in mcf) / Σ production volume on all covered leases $_{2021}$ (in mcf)) x Table 1 production limit (in mcf) $_{2022}$

§ 102.3 Setting Production Allocations for Subsequent Years.

(a) The President and the Secretary shall obtain from each lessee the production volume of barrels of oil and gas from each lease to determine the total volume of oil and gas produced on all public lands and waters each calendar year.

(b) Each lessee shall provide to the President and the Secretary the total volume of oil and gas produced from each covered lease no later than January 15 of each year.

(c) No later than February 1st of each year, the President and the Secretary shall calculate the pro-rata share for each covered lease that produced oil or gas or both and provide a report for the previous calendar year as required by subsection (b).

(d) The pro-rata share allocation shall be no greater than the production volume of oil or gas from a covered lease in the previous calendar year divided by the total production limit of oil or gas on all covered leases in the previous calendar year as set by Table 1, multiplied by the production limit for the current calendar year as set forth in Table 1. The formula for the pro-rata share can be expressed as the following:

> Pro-rata Oil Share $_{\text{current year}}$ = (production volume on a covered lease $_{\text{previous year}}$ (in bbl) / Σ production volume on all covered leases $_{\text{previous year}}$ (in bbl)) x Table 1 production limit (in bbl) $_{\text{current year}}$
>
> Pro-rata Gas Share $_{\text{current year}}$ = (production volume on a covered lease $_{\text{previous year}}$ (in mcf) / Σ production volume on all covered leases $_{\text{previous year}}$ (in mcf)) x Table 1 production limit (in mcf) $_{\text{current year}}$

(e) In the case where the production volume of a covered lease in any calendar year exceeds its allocation, the pro-rata share for the covered lease in subsequent years and the total production limit in subsequent years shall be adjusted as set forth in subsection 102.7(c). In the case where the production volume of a covered lease decreases more than 5% in any calendar year, the pro-rata share for the covered lease in subsequent years and the total production limit in subsequent years shall be adjusted as set forth in subsection 102.7(d).

(f) No later than February 15th of each year, the President and the Secretary shall provide each covered lease the information regarding its share of production established in subsection (d).

§ 102.4 Excess Production of Oil and Gas Prohibited.

(a) A lessee or covered lease shall not exceed its pro-rata share of production as set forth by the President and the Secretary under subsection 102.2 or subsection 102.3 for the current calendar year.

(b) Where a covered lease exceeds its annual pro-rata share as established under subsection 102.2 or subsection 102.3 for the respective calendar year by more than 1% of its total share, the President and the Secretary shall reduce the pro-rata share of such lease in the current year by an amount equivalent to the level of production in excess of its share.

§ 102.5 Penalties for Excess Production of Oil and Gas.

(a) First violation. Where a lessee or covered lease exceeds its share for the current calendar year, the lessee shall pay, without demand, an excess production penalty, as calculated under paragraph (b) of this subsection.

(b) Penalty formula. The following formulas shall be used to determine the excess production penalty:

Penalty for excess production of oil = profit/bbl × bbl of excess production of oil x 1.30

Penalty for excess production of gas = profit/mcf × mcf of excess production of gas x 1.30

(c) Subsequent violations. Where a lessee or covered lease exceeds its share for the current calendar year and the violation is not the first violation, the lessee shall pay, without demand, an excess production penalty of no less than $1,000/bbl for each barrel by which it exceeded its share, and no less than $1,000/mcf for each mcf by which it exceeded its share.

(d) If an excess production penalty due under this part is not paid within 180 days, the penalty shall be subject to interest charges in accordance with the Debt Collection Act (31 U.S.C. 3717). Interest shall begin to accrue on the date on which the President or the Secretary notifies the lessee of a covered lease with excess production, a demand notice for the payment.

§ 102.6 Allocations for New Leases Set at Zero.

(a) Any lease issued after 2021 shall receive a zero pro-rata share and may only produce oil and gas in a manner consistent with the procedures set forth in this chapter.

(b) Acquisition of allocation. A new lease that meets the requirements under this subpart, shall only start production of oil or gas after successful receipt of allocations from an existing lease's Allocation Tracking System account made pursuant to subpart C. For each calendar year, the share allocation is equal to: allocation received by the new lease(s) times the percentage in Table 1 for the current year.

§ 102.7 Anti-backsliding and Reduction of Allocations.

(a) National Progress in Reducing Production. In the case of the limitations established in subsection 101.2 and this subsection, an allocation may not be issued unless the allocation is reduced by the amount set forth in Table 1.

(b) Excess Production Requirement. The lessee of a covered lease that has excess production greater than 2% in any calendar year shall pay without demand the penalty required, and pay upon demand the interest on that penalty under subsection 102.5.

(c) Excess production. In the case of excess production volume of oil or gas for a given calendar year, the President or the Secretary, after determining the allocation set forth in Table 1 for the subsequent year, shall reduce the allocation for that subsequent year (and each subsequent year thereafter) by the excess production in the prior calendar year, as illustrated in Table 2. If there are additional instances of excess production, all instances of excess production shall be summed and the President or the Secretary shall reduce allocation for each subsequent year thereafter by the summed excess production in all prior years. The total production limit for each subsequent year as set forth in Table 1 shall also be reduced by the summed excess production in all prior years. Under no circumstances, may the sum of the volume of oil or gas produced during a year of excess production and the following subsequent year, exceed the sum over the same period (after subtracting any adjustments) as set forth in Table 1.

Table 2. Example of Excess Production

Year	Oil Production Limit (bbl)	Excess production	Adjustment	Actually Produced (bbl)
2022	17,400,000	+2,000,000	0	19,400,000
2023	15,500,000	0	-2,000,000	13,500,000
2024	13,600,000	0	-2,000,000	11,600,000
2025	11,600,000	+5,000,000	-2,000,000	14,600,000
2026	9,700,000	0	-7,000,000	2,700,000
2027	7,800,000	0	-7,000,000	800,000
Total	75,600,000	+7,000,000	-20,000,000	62,600,000

(d) Decrease in production. If a lessee of a covered lease has a decrease in production volume of oil or gas greater than 5% in any calendar year, the President or the Secretary shall set a new maximum production limit for that covered lease equal to the reduction in that particular calendar year by subtracting the difference in production from all subsequent years accordingly, as illustrated in Table 3. If there are additional instances of a decrease in production that are greater than the prior decrease in production that resulted in establishing a new maximum production limit, the President or the Secretary shall again establish a new maximum production limit by subtracting the difference in production from all subsequent years accordingly.

Table 3. Example of a Decrease in Production

Year	Oil Production Limit (bbl)	Actual Production	Percent Actually Produced	Adjustment	Adjusted Oil Production Limit (bbl)
2024	13,600,000	13,100,000	96%	0	n/a
2025	11,600,000	*10,100,000**	*87%†*	0	n/a
2026	~~9,700,000~~	8,100,000	99%	-1,500,000	8,200,000*
2027	~~7,800,000~~	6,150,000	98%	-1,500,000	6,300,000*
2028	~~5,800,000~~	*2,600,000***	*60%†*	-1,500,000	4,300,000*
2029	~~3,900,000~~	675,000	6%	-3,200,000	700,000**

* first adjustment of -1,500,000 bbl
** second adjustment of -3,200,000 bbl
† decrease in production volume greater than 5%

§ 102.8 Procedures for Submittals and Appeals.

(a) Electronic submittal. All submittals under this subpart shall be made by the lessee electronically to the President or the Secretary, via an online portal administered by the President or the Secretary.

(b) Determinations regarding a lessee's share may be appealed to the President or the Secretary within 30 days of receiving its share for the current calendar year. A lessee may only appeal calculations regarding its prior year production level or its current year allocation.

(c) The President or the Secretary shall resolve an appeal within 90 days of receiving an appeal by a lessee. Any finding by the President or the Secretary shall be subject to judicial review.

(d) Production limit pending appeal. The President or the Secretary's initial determination of a lessee's share shall remain in effect until and unless such decision is reversed or revised at the conclusion of the appeal process.

Subpart C – Transfers of Allocations and Constructive Abandonment of Oil and Gas Leases

§ 103.1 Allocation Tracking System Accounts.

The President or the Secretary will establish accounts for all covered leases pursuant to this subpart. All allocations, transfers, changes, and deductions pursuant to subparts A, B, and C shall be recorded in the lease's Allocation Tracking System account.

§ 103.2 Establishment of Accounts and Recordation.

(a) Establishing of accounts. The President or the Secretary will establish an Allocation Tracking System account and allocate allocations for each lease that is, or will become, a covered lease.

(b) Recordation of accounts. In 2022 and each year thereafter, the President or the Secretary will record, in the Allocation Tracking System account, all allocations, transfers, changes, and deductions. The total allocations deducted for oil or gas is equal to the production volume on a covered lease for the current year in either bbl or mcf.

§ 103.3 Scope and Submission of Transfers.

A lessee may transfer all or part of a lease's allocation held to a different lease(s) held by the same lessee or to another lessee, so long as:

(a) the transferor and transferee provide no less than 30 days' notice of such transfer to the President or the Secretary or by the allocation transfer deadline;

(b) the total oil or gas produced by the transferee shall be no greater than the allocation transferred by the transferor; and

(c) the bonding requirements in subsection 103.4 have been met by the transferor.

§ 103.4 Bonding Required.

(a) In General. For any transfer of allocations allocated for either oil or gas for a specific covered lease, the President or the Secretary shall require the submission of reclamation plans as provided in paragraph (b) of this subsection and that an adequate bond, surety, or other financial arrangement be established as provided in paragraph (c) of this subsection prior to transfer of allocations for either oil or gas by the lessee of the transferor.

(b) Reclamation Plans Required. No approval of the transfer of allocations may be granted without the analysis and approval by the President or the Secretary of the reclamation plan covering proposed surface-disturbing activities within the lease area.

(c) Bonding. No approval of the transfer of allocations may be granted until the President or the Secretary reviews and approves the adequacy of a bond, surety, or other financial instrument. A bond, surety, or other financial arrangement shall not be adequate unless it is demonstrated to fully cover the full costs of plugging, remediating, and fully restoring each well site and associated facilities, or for $150,000 per covered well, whichever is greater.

Text of Proposed Presidential Rule[17]

PRESIDENTIAL RULE TO PHASE-DOWN OIL AND GAS PRODUCTION UNDER THE OUTER CONTINENTAL SHELF LANDS ACT

By the authority vested in me as the President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

Section 1. Policy and Purpose.

The overwhelming scientific consensus has definitively concluded that without deep and rapid emissions reductions, warming will exceed 1.5 degrees Celsius, the target of the 2015 Paris Agreement, and will result in catastrophic damage around the world. Every fraction of additional warming above 1.5 degrees Celsius will worsen these harms, threatening lives, health and safety, livelihoods, the environment, economy, and national security for this and future generations. In addition, warming temperatures are already causing harms to the critical importance of the Outer Continental Shelf areas for marine mammals, other wildlife, wildlife habitat, and we must ensure that the unique resources of these areas remain available for future generations.

Global emissions must be reduced by half over the next decade to limit warming to below 1.5 degrees Celsius. Accordingly, it is in the national interest for the United States, based on our cumulative emissions and respective capabilities, to establish a rate of production of oil and gas production on public lands and waters that is compatible with maintaining a stable climate below 1.5 degrees Celsius. Using 2020 as a baseline, beginning in 2022 the total maximum rates of oil and gas production will decrease by 10% annually for 8 years and then 3% annually for each year thereafter. These reductions will apply across the oil and gas sector, gradually decreasing the maximum production rates for every oil and gas lease on public lands until production is reduced 98% by 2035.

Sec. 2. Declaration of a National Climate Emergency.

I, JOSEPH BIDEN, President of the United States of America, find that the climate crisis, caused primarily by fossil fuels, poses an existential threat to every aspect of society. Therefore, by the authority vested in me by the Constitution and the laws of the United States, including sections 201 and 301 of the National Emergencies Act, 50 U.S.C. § 1601 *et seq*., I hereby declare that climate change is a national emergency.

Sec. 3. Utilizing the Outer Continental Shelf Lands Act to Phase-Down Oil and Gas Production.

(a) The Outer Continental Shelf Lands Act ("OCSLA"), 43 U.S.C. 1331 *et seq*., provides the President and the Secretary of the Interior with numerous authorities.

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[17] We hereby petition the President of the United States for an executive order or rule that would order the Secretary of the Interior to promulgate regulations for offshore oil and gas production under Section 5 of OCSLA, 43 U.S.C. § 1334, to be added to 30 CFR Part 256. Petitioners believe the text starting on page 6 for the proposed regulations is appropriate for offshore oil and gas programs.

(b) Section 3 of OCSLA provides that it is the policy of the United States to protect the environment from the exploration and development of oil and gas deposits by directing that offshore oil and gas operations shall be "subject to environmental safeguards," consistent with "national needs," and be conducted so as to "prevent or minimize . . . damage to the environment," 43 U.S.C. §§ 1332(3), 1332(6).

(c) Section 5(a)(1) of OCSLA provides the Secretary with the authority "for the suspension or temporary prohibition of any operation or activity, including production, pursuant to any lease or permit . . . in the national interest . . . [or] if there is a threat of serious, irreparable, or immediate harm or damage to life (including fish and other aquatic life) . . . or to the marine, coastal, or human environment," 43 U.S.C. § 1334(a)(1).

(d) Section 5(g) of OCSLA states that a lessee "shall produce any oil or gas, or both, obtained pursuant to an approved development and production plan, at rates consistent with any rule or order issued by the President in accordance with any provision of law," 43 U.S.C. § 1334(g).

(e) Section 12(c) of OCSLA contains a "[n]ational security clause," which specifies that any offshore oil and gas lease issued under OCSLA "shall contain or be construed to contain a provision whereby authority is vested in the Secretary [of the Interior], upon a recommendation of the Secretary of Defense, during a state of war or national emergency declared by the Congress or the President of the United States . . . to suspend operations under any lease," 43 U.S.C. § 1341(c).

(f) Section 20 of OCSLA specifically requires that offshore oil development be balanced "with protection of the human, marine, and coastal environments," 43 U.S.C § 1351(i).

Sec. 4. President Transfers Authority to the Secretary of the Interior.

I hereby delegate, to the Secretary of the Interior, authority under subchapter III of the Outer Continental Shelf Lands Act including but not limited to, the authority, at the President's discretion, to alter or modify from time to time the quantity and rate of production of oil and gas leases on lands owned by the United States.

Sec. 5. Regulations and Implementation.

(a) Pursuant to the transfer of authority in section 4, the Secretary of the Interior, to the extent permitted by law, shall promulgate regulations that would apply for offshore oil and gas production under Section 5 of OCSLA, 43 U.S.C. § 1334, to be added to 30 C.F.R. Part 256.

(b) Using 2020 as a baseline and beginning in 2022, the Secretary of the Interior is ordered to establish the maximum production rate and phase-down of existing offshore oil and gas wells, which will decrease by 10% annually for 8 years and then 3% annually for each year thereafter. These reductions shall apply across the oil and gas sector, gradually decreasing the maximum production rates for every oil and gas lease on public lands until production is reduced 98% by 2035.

(c) Pursuant to the declaration of a national climate emergency in section 2, and upon recommendation from the Secretary of Defense, the Secretary of the Interior is ordered to commence the process to suspend operations on any offshore lease during the period of the national climate emergency as the Secretary deems necessary to ensure the maximum rate of production of oil and gas per year through 2035.

Sec. 6. General Provisions.

Nothing in this Order shall be construed to impair or otherwise affect the authority granted by law to an executive department or agency, or the head thereof. This order shall be implemented consistent with applicable law and subject to the availability of appropriations. This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

LEGAL AND SCIENTIFIC SUPPORT FOR PETITIONED ACTION

I. Both The Mineral Leasing Act And Outer Continental Shelf Lands Act Provide The President and the Secretary With The Authority To Grant The Petitioned Action

As discussed below, the President and the Secretary can clearly set — and therefore decrease — the rate of oil and gas production. First, the President and the Department of the Interior has always been charged with managing all public lands for the public good and the long-term well-being of the nation. Thus, it makes no sense to read the statutory authorities regarding fossil fuel extraction in such a manner that the President and the Department must always allow fossil fuel extraction at rates that cause extreme climate change to the detriment of public lands, the national interest, and global climate stability. Second, as a straightforward statutory matter, Congress has unambiguously authorized the President and the Department of the Interior to set rates of oil and gas production under the law. Third, setting the rate of production for existing and new fossil fuel production does not represent a breach of existing contracts under the clear lease terms already in place for all fossil fuel leases on public lands and waters, nor does it represent a taking of private property.

A. The Department of the Interior is Charged by Law with Advancing the Public Interest and the Common Good

The Department of the Interior is charged with implementing a myriad of laws across numerous agencies and different types of public lands with the goal of managing this nation's natural resources and cultural heritage. A common theme that motivates these laws — even those that directly authorize the extraction of natural resources — is to do so in a manner that is consistent with meeting the nation's needs and safeguarding the public interest. For example, the Federal Land Policy and Management Act ("FLPMA") requires that "public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values."[18] In accomplishing this multiple use mandate, FLPMA requires the Department of the Interior to "take[] into account the long-term needs of future generations."[19]

Likewise, the National Park System Organic Act directs the Department to "conserve the scenery, natural and historic objects, and wildlife . . . by such means as will leave them unimpaired for the enjoyment of future generations."[20] And the laws governing the National Wildlife Refuge System requires that the Secretary administer wildlife refuges "for the benefit of present and future generations."[21] In all of these statutes, the Department of the Interior is charged with administering the lands and waters it manages in a manner that promotes the long-term good of the nation, including for the benefit of future generations. It would be nonsensical to argue that the Department must allow fossil fuel production at rates and quantities that not

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[18] 43 U.S.C. § 1701(a)(8).
[19] 43 U.S.C. § 1702(c).
[20] 54 U.S.C. § 100101(a).
[21] 16 U.S.C. § 668dd(a)(2).

only undermine, but affirmatively prevent, the ability of the Department to meet its obligations to current and future generations under all of its other statutory mandates.

Fortunately, the Mineral Leasing Act ("MLA") and Outer Continental Shelf Lands Act ("OCSLA") make clear that the President and the Secretary of the Interior can — and indeed must — consider the public good when setting rates of production of oil and gas on public lands and waters. The MLA broadly charges the Secretary with overseeing the development of fossil fuels "for the protection of the interests of the United States . . . and for the safeguarding of the public welfare."[22] Similarly, the OCSLA charges the President 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."[23] The President and the Secretary of the Interior cannot safeguard the public welfare or address the needs of the nation if oil and gas production on public lands and waters continues in this fashion.

B. Congress Provided Clear Statutory Authority to Set the Rate of Production for Oil and Gas

The MLA provides that the Secretary may "alter or modify from time to time the rate of prospecting and development and the *quantity and rate of production under such plan*."[24] Similarly, the OCSLA states that "[t]he lessee shall produce any oil or gas, or both, obtained pursuant to an approved development and production plan, *at rates consistent with any rule or order issued by the President in accordance with any provision of law*."[25] These statutory provisions are unambiguous and express clear intent by Congress that the President and the Secretary can and should set the rate of production on public lands and waters.[26] Accordingly, the regulatory language sought in this petition fully accords with the plain meaning of both the MLA and OCSLA.

Even if the MLA or OCSLA provisions above were viewed to be ambiguous, the regulatory language within this petition is not only a reasonable interpretation of these statutes, but accords with the canon of construction that a "statute should be construed so that effect is given to all its provisions, so that no part will be inoperative or superfluous, void or insignificant . . . ."[27] Since the President and the Department of the Interior has never enacted or given effect to these provisions of law, doing so here in this manner would further clarify congressional intent.

Under Supreme Court precedent, if a statute is "silent or ambiguous with respect to the specific issue," then an agency's interpretation must be "based on a permissible construction of the statute."[28] Here, Congress did not expressly define "rate" or "quantity" in either the MLA or the OCSLA. However, dictionaries define both terms in a consistent clear manner. "Rate" is generally defined as "a quantity, amount, or degree of something measured per unit of something

[22] 30 U.S.C. § 187.
[23] 43 U.S.C. § 1332(3).
[24] 30 U.S.C. § 226(m) (emphasis added).
[25] 43 U.S.C. § 1334(g)(1) (emphasis added).
[26] *Chevron U.S.A. Inc. v. Nat. Res. Def. Council, Inc.*, 467 U.S. 837, 842 (1984).
[27] *Corley v. United States*, 556 U.S. 303, 314 (2009).
[28] *Chevron*, 467 U.S. at 843.

else."[29] While "quantity" is generally defined as "an indefinite amount or number."[30] Using common definitions, it is a reasonable interpretation that setting the rate of production means exactly what it says — determining the quantity or amount that can be produced over a given period of time of whatever resource is being extracted from public lands or waters. Since the aggregate of definitions from multiple dictionaries coalesce on a plain meaning,[31] these terms can be reasonably read to allow the President and the Secretary to promulgate rules to either increase or decrease the rate or quantity of production.[32]

Importantly, the legislative history for the MLA does not provide any guidance or disagreement with the interpretation of the law in this petition, and is generally silent on how such rates of production should be set, or if this provision could only be used to set — as an example, a minimum rate of production. In other sections of the MLA, Congress was quite specific and prescriptive in articulating maximums and minimums by law. The MLA establishes a maximum number of acres leased per unit of land,[33] and establishes minimum royalty rates.[34] In light of these provisions, Congress could have been prescriptive with the rate and quantity of oil or gas production by establishing minimum or maximum requirements, but it chose not to do so. Since Congress did not limit the President or Secretary of the Interior, they have the inherent discretion to interpret this provision in a reasonable way and set a rate of production that declines to near zero. Congress knew that rates and quantities of production might change based on local, national, and global concerns and thus deferred to the agency's expertise.

C. No Breach-of-Contract Will Occur from the Phase-Down of Oil and Gas Production on Public Lands and Waters

Generally, a lease to explore and extract oil and gas from public lands and waters is a contract agreement between the federal government and private parties. Private parties may then attempt to bring breach-of-contract claims against the federal government. However, these claims would fail as the President and the Department of the Interior has nearly always reserved the right — in the lease itself — to set the rate of production.

For onshore production under the MLA, the standard onshore leasing regulations and lease form itself specify separately that lessees are subject to certain future regulations and to "all other applicable statutes and regulations" and most critically the "lessor reserves [the] right to specify

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[29] *Rate*, Merriam-Webster, https://www.merriam-webster.com/dictionary/rate (last visited Aug. 19, 2021); *Rate*, Lexico.com ("a measure, quantity, or frequency, typically one measured against some other quantity or measure"), https://www.lexico.com/en/definition/rate (last visited Aug. 19, 2021).

[30] *Quantity*, Merriam-Webster, https://www.merriam-webster.com/dictionary/quantity (last visited Aug. 19, 2021); *Quantity*, Lexico.com ("the amount or number of a material or immaterial thing not usually estimated by spatial measurement"), https://www.lexico.com/en/definition/quantity (last visited Aug. 19, 2021),

[31] *Caminetti v. United States*, 242 U.S. 470, 485 (1917) (noting "[i]t is elementary that the meaning of a statute must, in the first instance, be sought in the language in which the act is framed, and if that is plain . . . the sole function of the courts is to enforce it according to its terms" and if the statute's language is clear "[w]here the language is plain and admits of no more than one meaning the duty of interpretation does not arise and the rules which are to aid doubtful meanings need no discussion").

[32] *Nat'l Cable & Telecomms. Ass'n v. Brand X Internet Servs.*, 545 U.S. 967, 973 (2005).

[33] 30 U.S.C. § 226(b)(1)(A) ("shall be leased . . . in units of not more than 2,560 acres").

[34] 30 U.S.C. § 226(b)(1)(A) ("a royalty at a rate of not less than 12.5 percent").

rates of development and production in the public interest."[35] Similarly, the leasing regulations that apply to the Naval Petroleum Reserves Production Act state that every National Petroleum Reserve in Alaska unit agreement must include "a provision that acknowledges BLM's authority to set or modify the quantity, rate, and location of development and production."[36]

For offshore waters, the OCSLA states a lessee must consent to only produce oil and gas "at rates consistent with any rule or order issued" by the President.[37] The offshore lease form contains language that specifies that the lease is subject to changes which reflect new or amended regulations, statutes and rules, even when those changes may increase or decrease the lessee's contractual obligations.[38] And the lease form states "Assignee(s) is (are) subject to, and shall fully comply with, all applicable regulations now or to be issued under the Act."[39]

And while the Supreme Court in *Mobil Oil Exploration* held that legislation passed after the issuance of a lease can constitute a breach-of-contract amounting to repudiation,[40] that case has no bearing here. In *Mobil Oil*, the Court found, based on unique facts whereby the Interior Department refused to consider an exploration plan based solely on newly created statutory authority outside those statutes incorporated into the lease, that the government had repudiated the contract. Here, because *both* the MLA and the OCSLA *already* contain language that explicitly gives the President and the Secretary the authority to change the rate of production, there would be no breach of contract. For the President and the Secretary to exercise their existing authority here through the promulgation of additional regulations consistent with an existing statute is not outside the scope of the lease and would cause no breach of contract.

D. Reducing the Rate of Production will not Take Private Property in Violation of the Constitution

[35] *See* 43 C.F.R. § 3101.1-2; BLM Form 3100-11.
[36] 43 CFR § 3137.21(a)(4).
[37] 43 U.S.C. § 1334 (g)(1).
[38] "[t]his lease is subject to the [OCSLA], regulations promulgated pursuant thereto, and other statutes and regulations in existence upon the Effective Date of the lease, and those statutes enacted (including amendments to the Act or other statutes) and regulations promulgated thereafter, except to the extent they explicitly conflict with an express provision of this lease. It is expressly understood that amendments to existing statutes and regulations, including but not limited to the [OCSLA], as well as the enactment of new statutes and promulgation of new regulations, which do not explicitly conflict with an express provision of this lease may be made and that the Lessee bears the risk that such may increase or decrease the Lessee's obligations under the lease." *Oil And Gas Lease Of Submerged Lands Under The Outer Continental Shelf Lands Act*, Form BOEM-2005, BOEM at 1 (Feb. 2017), https://www.boem.gov/sites/default/files/about-boem/Procurement-Business-Opportunities/BOEM-OCS-Operation-Forms/BOEM-2005.pdf.
[39] *Assignment Of Record Title Interest In Federal OCS Oil And Gas Lease*, Form BOEM-0150, BOEM at 2 (Jan. 2020), https://www.boem.gov/BOEM-0150/; *Assignment Of Operating Rights Interest In Federal OCS Oil And Gas Lease*, Form BOEM-0151, BOEM at 2 (Jan. 2020), https://www.boem.gov/BOEM-0151/.
[40] *See Mobil Oil Exploration & Producing Southeast v. United States*, 530 U.S. 604 (2000); *see also Century Exploration New Orleans, LLC v. United States*, 745 F.3d 1168, 1177–78 (Fed. Cir. 2014) (noting that in reaching its decision in *Mobil Oil*, "the Supreme Court emphasized the government's chosen source of authority: the government cited the Outer Banks Protection Act, not OCSLA regulations" and holding that "[a] change to an OCSLA regulation does not breach the express terms of the lease language as interpreted by the Supreme Court in *Mobil Oil*[.]"); *see also Taylor Energy v. United States*, 975 F.3d 1303, 1317 (Fed. Cir. 2020) (holding "*Mobil Oil* has little relevance" where "BSEE's refusal to grant Taylor's departure request is in compliance with the OCSLA, and the Trust Agreement specifically references the OCSLA regulations that govern the parties' contractual duties.").

The phase down of existing oil and gas production also would not take private property in violation of the Fifth Amendment to the U.S. Constitution. There are generally two types of regulatory takings: (1) categorical, or "*per se*" takings, in which a regulation destroys all economic value of a property, and (2) all other takings, which a court can determine through a fact-intensive, multi-factor test known as the *Penn Central* test. While evaluating a takings claim requires a fact-specific analysis, it is clear that in the vast majority of instances, setting a declining rate of oil and gas production would not lead to meritorious takings claims.

In a *per se* taking, a regulatory action results in a taking "when the owner of real property has been called upon to sacrifice all economically beneficial uses in the name of the common good, that is, to leave his property economically idle . . . ."[41] A court will find a regulatory taking when the property valuation drops to zero as a result of regulation, and deprives the property of all economically viable uses. The retention of a small economic benefit in the property is not considered a *per se* taking, however the rule cannot be circumvented by leaving a small economically viable "token interest."[42] The Supreme Court reaffirmed this in *Tahoe-Sierra Preservation Council v. Tahoe Reg'l Planning Agency* when it stated that the categorical rule would not apply "if the diminution in value were 95% instead of 100%."[43] And further acknowledged that a regulation that temporarily restricts the economic use of a property is not considered a *per se* taking, and thus still required *Penn Central* analysis.

The petitioned regulations, if enacted, would not result in a *per se* taking. A gradual reduction in the amount of production over a 14-year time frame would still allow every lease holder to extract a significant amount of oil or gas during this time frame, and around 2035 extraction could still occur at 2% percent of 2020 levels. We note that this holds true for both main categories of covered leases – producing and nonproducing. While the holders of nonproducing leases would not receive an initial allocation, they would be able to purchase or otherwise acquire one from the holder of a producing lease. Thus, the phase down would not result in a total deprivation of economic value — particularly for the richest and most profitable industry in the history of the world, where many of the leaseholders have already reaped uncounted billions by extracting resources from publicly owned lands and waters.

Because no *per se* takings would occur, the *Penn Central* test would properly be applied to any takings claims. Three factors are balanced under the *Penn Central* test: (1) the "economic impact of the regulation on the claimant," (2) the "extent to which the regulation has interfered with distinct investment-backed expectations," and (3) "the character of the governmental action."[44]

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[41] *Tahoe-Sierra Pres. Council v. Tahoe Reg'l Planning Agency*, 535 U.S. 302, 331 (2002); *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1019 (1992).

[42] *Maritrans, Inc. v. United States* 51 Fed.Cl. 277, 281 (Fed.Cl. 2001) *aff'd*, 342 F.3d 1344 (Fed.Cir. 2003) (noting that federal law that required owner of single-hulled tanker vessels to retire them within 15 years did not effect a taking as the law "does not permit [a property owner] to separate the years that it used the [property] profitably from the time when the [property] must be retired, to claim a categorical taking"); *see also Rith Energy v. United States*, 270 F.3d 1347 (Fed. Cir. 2001);
Palazzolo v. Rhode Island, 533 U.S. 606 (2001) ("Assuming a taking is otherwise established, a State may not evade the duty to compensate on the premise that the landowner is left with a token interest.").

[43] *Tahoe-Sierra Pres. Council v. Tahoe Reg'l Planning Agency*, 535 U.S. 302, 331 (2002).

[44] *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 124 (1978).

Under the first factor, any economic impacts experienced by the lessees would be spread over 14 years, but under existing precedent, because such impacts are not immediately substantial, would weigh against a finding that a regulatory taking has occurred.[45]

The second factor, addresses "investment-backed expectations." Courts consider three mitigating questions to determine the extent of investment-back expectations: "was the company operating in a highly regulated industry," "did the company know of the problem at the time it engaged in the activity," and "in the light of the regulatory environment at the time of the activities, could the possibility of the assessments have been reasonably anticipated?"[46] In this instance, all three mitigating questions can be affirmatively answered without hesitation. The fossil fuel industry is highly regulated. In part because of this substantial regulation and the worldwide efforts to combat climate change, the industry has been aware of its contribution to the climate crisis for decades.[47] Perhaps most importantly, given that every lease signed by the fossil fuel industry already includes language allowing the Secretary of the Interior to set the rate of production, there is simply no argument that enacting regulations to implement these restrictions was not something that could be anticipated. More generally, given the overwhelming scientific information that unequivocally concludes that a fossil fuel ramp-down must occur, any industry entering the field of fossil fuel production must do so against a backdrop of more and more stringent restrictions on the extraction, production, and use of fossil fuels.

When addressing the third factor, the "character of the governmental action," a court will look at whether the government was acting to protect the public health and whether the regulation singled out a particular individual or entity.[48] In this instance, the Secretary would clearly be acting to protect all aspects of public health and welfare from the climate crisis. As outlined below, continued fossil fuel production literally threatens the continuation of our civilization and life on Earth as we know it. Avoiding ever more catastrophic harms from the climate crisis is clearly the type of regulatory action least likely to trigger a successful takings claim. Additionally, the Secretary would not be seen as singling out a particular individual or entity. The regulation would be tied to addressing the climate crisis and as such help to meet climate emissions targets. These changes would impact the fossil fuel industry as a whole and would not unfairly target a particular entity or individual.

[45] *CCA Assocs. v. United States*, 667 F.3d 1239, 1246 (Fed. Cir. 2011) (finding that "[i]n light of the facts of this case, we cannot conclude that an 18% economic impact qualifies as sufficiently substantial to favor a taking" and this court is "aware of no case in which a court has found a taking where diminution in value was less than 50 percent.").
[46] *Commonwealth Edison Co. v. United States*, 271 F.3d 1327, 1348 (Fed. Cir. 2001).
[47] *New Documents Reveal Oil Industry Knew of Climate Risks Decades Earlier Than Suspected; Suggest Coordinated Efforts to Foster Skepticism*, Center for International Environmental Law (CIEL) (April 13, 2016), https://www.ciel.org/news/smoke-and-fumes/.
[48] *Rose Acre Farms, Inc. v. U.S.*, 559 F.3d 1260, 1279–1281 (Fed. Cir. 2009) (noting "restrictions were directed at the protection of public health and safety" and that "is the type of regulation in which the private interest has traditionally been most confined and governments are given the greatest leeway to act without the need to compensate those affected by their actions."); *Penn Cent*. 438 U.S. at 125 (stating compensation need not accompany prohibition when the government "reasonably concludes that the health, safety, morals, or general welfare would be promoted by prohibiting particular contemplated uses of land").

Thus, under the *Penn Central* balancing test, all three factors overwhelmingly favor a finding that no regulatory takings has occurred, and in such situations a reviewing court should not find a regulatory takings.

Furthermore, lessees lack any reasonable expectation of future return on investment from, at the very least, a substantial subset of leases issued since 2007. Under the MLA, case law and BLM regulations provide that onshore oil and gas leases "shall be subject to cancelation if improperly issued."[49] OCSLA provides even broader authority for offshore lease cancelation, including suspension and subsequent cancelation based on environmental risks.[50] "Improperly issued" leases clearly include leases issued not only based on fraud or misrepresentation by the lessee, but those issued based on statutory violations by the issuing agency, including, relevantly, leases issued based on procedural violations of the National Environmental Policy Act ("NEPA"). Oil and gas leases issued contrary to NEPA are voidable at the Secretary of the Interior's discretion.[51]

Since at least 2007, it has been clear that NEPA requires evaluation of the climate consequences of federal agency actions.[52] A substantial and consistent line of recent judicial decisions have found federal agency fossil fuel leasing and other actions in recent years failed to comply with that NEPA requirement.[53] Although the Department of the Interior has not, to date, pursued systematic cancelation of improperly-issued leases either through administrative action or the courts, it is well within its authority under *Boesche v. Udall* and its own regulations to do so. As a result, lessees lack any reasonable expectation of future operations on leases issued subsequent to 2007, if not earlier.

Finally, we note that even in the exceptional instance where a law or regulation deprives a property owner of all value, courts will still decline to find a categorical taking if the restricted

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[49] 43 C.F.R. § 3108.3(d); *see also Boesche v. Udall*, 373 U.S. 472, 475-76 (1963)

[50] *See* 43 U.S.C. § 1334(a)(2)(i).

[51] *See Boesche v. Udall*, 373 U.S. 472, 481-83 (1963); Winkler v. Andrus, 614 F.2d 707, 711 (10th Cir. 1980); see also Grynberg v. Kempthorne, 2008 WL 2445564 (D. Colo. June 16, 2008) (affirming BLM's cancellation of an oil and gas lease issued in violation of regulation); High Plains Petroleum Corp., 125 IBLA 24, 26 (1992) ("It is well settled that the Secretary has the authority to cancel any oil and gas lease issued contrary to law or regulation because of the inadvertence of his subordinates."). In the specific context of a lease issued in violation of NEPA, the IBLA has held that such a legal error renders the lease voidable. St. James Village, Inc., 154 IBLA 150, 158 (2001) (vacating BLM's decision to issue a geothermal lease for NEPA violation); Clayton W. Williams, Jr., 103 IBLA 192, 210 (1988) (lease issued in violation of NEPA is voidable).

[52] *See Center for Biological Diversity v. Nat'l Highway Transp. Safety Admin*., 508 F.3d 508 (9th Cir. 2007).

[53] *See Citizens for a Healthy Community v. BLM*, No. 1:17-cv-2519 (D. Colo. March 27, 2019) (holding that "Defendants acted in an arbitrary and capricious manner and violated NEPA by not taking a hard look at the foreseeable indirect effects resulting from the combustion of oil and gas in the EIS and EA. Defendants must quantify and reanalyze the foreseeable indirect effects the emissions."). *See also WildEarth Guardians v. Zinke*, No. CV 16-1724 (RC), 2019 WL 1273181 (D.D.C. Mar. 19, 2019) (invalidating nine BLM NEPA analyses in support of oil and gas lease sales because "BLM did not take a hard look at drilling-related and downstream [greenhouse gas] emissions from the leased parcels and, it failed to sufficiently compare those emissions to regional and national emissions."); *San Juan Citizens All.*, 326 F. Supp. 3d at 1242–43 (collecting cases and requiring assessment of greenhouse gas emissions at the lease sale stage); *Western Org. of Res. Councils v. U.S. Bureau of Land Mgmt.*, CV 16-21-GF-BMM, 2018 WL 1475470 (D. Mont. Mar. 26, 2018) (requiring consideration of climate change at the RMP stage); *Sierra Club v. Fed. Energy Regulatory Comm'n*, 867 F.3d 1357, 1374 (D.C. Cir. 2017) (requiring quantification of indirect greenhouse gas emissions).

activity is a nuisance.[54] Here, the scientific consensus about the fossil fuel industry's effect on the climate, together with countless studies linking fossil fuel production with other adverse environmental and public health harm, makes oil and gas production a clear nuisance and suggests that industry takings claims are doomed to failure on this basis as well.[55]

Multiple states and municipalities are currently suing fossil fuel producers to recover damages from climate change, because their fossil fuel extraction constitutes a public nuisance.[56] These harms are in addition to the local adverse impacts to air, water, and health from oil and gas production. Oil and gas companies pursuing takings claims will be forced to confront this evidence, and cannot prevail absent a court finding that their operations do *not* constitute a nuisance. Given the well documented and wide-ranging climate and other damage caused by oil and gas development, it is increasingly unlikely that oil and gas entities will win this fight, and highly unlikely that takings claims against agency actions phasing out or restricting oil and gas production will succeed. Moreover, like paint companies that were recently found liable in California state court for the harm from the lead in their paint, fossil fuel companies have known for decades that their products cause harm, yet actively concealed the impacts while affirmatively promoting their product—behavior that further evinces a public nuisance.[57]

This analysis demonstrates that the President and the Secretary are clearly within their Constitutional and statutory authority to implement regulations in furtherance of aiding in the fight against climate change.

II. The Fossil Fuel Industry Is Responsible For The Majority Of Greenhouse Gas Emissions And Global Warming

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% of global industrial CO_2 and methane emissions between 1751 and 2010 came from just 90 international entities — 56 crude oil and 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 $GtCO_2e$.[58]

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[54] In *Lucas*, the Supreme Court confirmed once again that all property is subject to "background principles of the State's law of property and nuisance[.]" 505 U.S. 1003, 1029.

[55] The Supreme Court has stated explicitly that certain legal activities could *become* a nuisance if new information shows the activity to be a danger. *Lucas*, 505 U.S. at 1029 (stating that if a fault line were newly discovered under an existing nuclear power plant, the plant would become a nuisance and shuttering the plant would not be a compensable taking).

[56] *See* cases collected at https://payupclimatepolluters.org/cases.

[57] *See e.g., People v. ConAgra Grocery Products Co. et al.* (2017) 17 Cal.App.5th 51 (finding lead paint manufacturers liable for public nuisance and ordering them to pay into an abatement fund, because they knew the danger lead paint posed to children, yet concealed the impacts and affirmatively promoted it).

[58] Heede, Richard, Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854-2010, 122 Climatic Change 229 (2014).

Based on historical data and climate modeling, emissions from these 90 fossil fuel "majors" have contributed an estimated 57% to the observed rise in atmospheric CO_2, approximately 50% to the rise in global mean surface temperature, and approximately 32% to global mean sea level rise between 1751 and 2010.[59] A separate study attributed 71% of global industrial greenhouse gas emissions since 1988 to just 100 fossil fuel producers, with 51% of emissions since 1988 attributable to just 25 corporate and state producers, including ExxonMobil, Shell, BP, Chevron, and Peabody.[60]

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.[61] Cumulative emissions from the 20 largest investor-owned and state-owned energy companies alone account for 30% of the global industrial emissions between 1751 and 2010. Emissions from the top 20 contributed approximately 27% of the increase in atmospheric CO_2, approximately 24% of the increase in warming, and approximately 13 to 16% of the increase in global sea level rise.[62]

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 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.

James Hansen first testified in the U.S. Congress that the human signal of climate change had been detected in 1998. The same year, the Intergovernmental Panel on Climate Change was formed to provide a scientific basis for policy action on climate change.[63] 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,

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[59] 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).
[60] 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.
[61] Heede, Richard, Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854-2010, 122 Climatic Change 229 (2014).
[62] 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).
[63] 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).

fossil fuel producers failed to reduce their emissions or disclose climate risks,[64] and instead often worked in direct contradiction to emissions reduction goals and spread climate misinformation.[65]

For instance, between 1988 and 2005, ExxonMobil invested over $16 million into front groups that spread misleading claims about climate science.[66] 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.[67] 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.[68] In October 2018, the New York Attorney General sued Exxon for lying to its investors about climate change.[69] Fossil fuel companies have not even begun to pay their fair share of the costs for climate damages and adaptation.[70]

III. 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 limits and avoid catastrophic climate damages. 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 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

[64] Frumhoff, Peter et al., The climate responsibilities of industrial carbon producers, 132 Climatic Change 157 (2015).
[65] Union of Concerned Scientists, The Climate Accountability Scorecard: Ranking Major Fossil Fuel Companies on Climate Deception, Disclosure, and Action (2016).
[66] 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).
[67] Frumhoff, Peter et al., The climate responsibilities of industrial carbon producers, 132 Climatic Change 157 (2015).
[68] Supran, Geoffrey and Oreskes, Naomi, Assessing ExxonMobil's climate change communications (1977-2014), 12 Environ. Res. Lett. 084019 (2017).
[69] 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.
[70] Union of Concerned Scientists, The Climate Accountability Scorecard: Ranking Major Fossil Fuel Companies on Climate Deception, Disclosure, and Action (2016).

to 1.5°C above pre-industrial levels."[71] The Paris Agreement established the 1.5°C climate limit given the evidence that 2°C of warming would lead to catastrophic climate harms.[72]

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 limits, providing clear benchmarks for United States and global climate action.[73] The Intergovernmental Panel on Climate Change ("IPCC") Sixth Assessment updated the remaining carbon budget from the beginning of 2020 at 400 $GtCO_2$ for a 67% probability of meeting the 1.5°C limit and 500 $GtCO_2$ for a 50% probability of 1.5°C.[74] At the current global emissions rate of 42 $GtCO_2$ per year, the entire global carbon budget would be used up in just 10 to 12 years. Notably, the U.S. carbon budget is far smaller than the global carbon budget. Most estimates of the remaining U.S. carbon budget consistent with keeping temperature rise below 1.5°C are negative or near zero, depending on the equity principles used to apportion the global budget across countries.[75]

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 global carbon budget consistent with staying below 1.5°C.[76] The reserves in currently operating oil and gas fields alone, even excluding coal mines, would likely lead to warming beyond 1.5°C.[77] An important conclusion of the analysis is that no new fossil fuel

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[71] 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.

[72] 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/.

[73] 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. *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.

[74] Intergovernmental Panel on Climate Change, Summary for Policymakers In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-38.

[75] Van den Berg, Nicole et al., Implications of various effort-sharing approaches for national carbon budgets and emission pathways, Climatic Change 162: 1805-1822 (2020), https://link.springer.com/article/10.1007%2Fs10584-019-02368-y; Dooley, Kate et al., Ethical choices behind quantifications of fair contributions under the Paris Agreement, 11 Nature Climate Change 300 (2021), https://www.nature.com/articles/s41558-021-01015-8.

[76] 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 $GtCO_2$.

[77] 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 $GtCO_2$.

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 warming to 1.5°C.[78] 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.[79]

Other studies issued since then reinforce these findings. The United Nations *Production Gap Reports* found that governments plan to produce more than twice the amount of fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C.[80] According to the U.N. analyses, fossil fuel producers are planning an average increase of 2% per year in production, which by 2030 would result in more than double the production consistent with the 1.5°C limit. Instead, to follow a 1.5°C-consistent pathway, the world's governments will need to decrease fossil fuel production by roughly 6% per year between 2020 and 2030, including annual production declines of 11% for coal, 4% for oil and 3% for gas.

The 2021 *Fossil Fuel Exit Strategy* analysis similarly confirms that ending fossil fuel expansion and the early phase-out of existing extraction is necessary to meet the 1.5°C limit.[81] The analysis concluded that even if all new fossil fuel extraction were halted, in 2030 emissions from existing fossil fuel production would be 66% higher than what is needed to limit temperature rise to 1.5°C. The report estimated that global fossil fuel production will need to decline by an average of 9.5% for coal, 8.5% for oil and 3.5% for gas per year between 2021 and 2030 to remain aligned with 1.5°C. The authors emphasized that "more fossil fuels are already being produced than what is needed, as the world has more than enough renewable energy resources that can be scaled up rapidly enough to meet the energy demands of every person in the world without any shortfall in global energy generation." As a result, many existing fossil fuel projects are already obsolete and risk becoming stranded assets as they simply are not needed to meet demand and cannot compete with renewable energy.

[78] 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.
[79] 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.
[80] SEI, IISD, ODI, E3G, and UNEP, 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 (2020), http://productiongap.org/; SEI, IISD, ODI, E3G, and UNEP, The Production Gap Report 2021 (2021), http://productiongap.org/2021report.
[81] Teske, Sven & Sarah Niklas, Fossil Fuel Exit Strategy: An orderly wind down of coal, oil and gas to meet the Paris Agreement (June 2021), https://fossilfueltreaty.org/exit-strategy.

In addition, a 2021 analysis concluded that globally at least 89% of coal reserves, 58% of oil reserves, and 59% of gas reserves must be kept in the ground in order to have even a 50-50 chance of meeting a 1.5°C limit.[82]

Scientific research makes clear that the United States, as a dominant driver in expanding global fossil production, must halt new fossil fuel extraction and infrastructure and rapidly phase out existing production and infrastructure to avoid jeopardizing our ability to meet the Paris climate limits.[83] A 2021 analysis concluded that U.S. oil and gas production is poised to expand by the largest absolute increase globally by 2030, more than twice as much as any other country.[84] A separate study found that the U.S. oil and gas industry is on track to account for 60% 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 limit.[85] 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% of the world's total allowance for oil and gas by 2030 and exhaust more than 90% by 2050. Additionally, if U.S. coal production is to be phased out over a timeframe consistent with equitably meeting the Paris goals, at least 70% of U.S. coal reserves in already-producing mines must stay in the ground. In short, if not curtailed, U.S. fossil fuel expansion will impede the world's ability to meet the Paris climate limits and preserve a livable planet.

Research on 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. One quarter of total U.S. greenhouse gas emissions comes from the extraction and end-use combustion of fossil fuels produced on federal lands alone—not including non-federal lands.[86] A 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.[87] Of that amount, already leased fossil fuels would release 30 to 43 $GtCO_2eq$ of emissions, while as yet unleased fossil fuels would emit 319 to 450 $GtCO_2eq$ of emissions. Thus, the carbon emissions from already leased fossil fuel resources on federal lands alone (30 to 43

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[82] Welsby, Dan et al., Unextractable fossil fuels in a 1.5 °C world, 597 Nature 230 (2021), https://doi.org/10.1038/s41586-021-03821-8.
[83] 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.
[84] Achakulwisut, Ploy & Peter Erickson, Trends in fossil fuel extraction: Implications for a shared effort to align global fossil fuel production with climate limits, Stockholm Environment Institute Working Paper (April 2021), www.sei.org/publications/trends-in-fossil-fuel-extraction/ at Figure 3.
[85] 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.
[86] 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.
[87] 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).

$GtCO_2eq$) would exceed any remaining U.S. carbon budget for a 1.5°C limit[88] and exhaust ~10% of the remaining *global* carbon budget for 1.5°C.[89] The potential carbon emissions from unleased federal fossil fuel resources (319 to 450 $GtCO_2eq$) would exhaust the entire global carbon budget for limiting warming to 1.5°C. 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. In contrast, a nationwide federal fossil fuel leasing ban would reduce carbon emissions by an estimated 280 million tons per year, ranking among the most ambitious U.S. federal climate policy proposals in recent years.[90]

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.[91] 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 highlight that the United States has an urgent responsibility to lead in the transition from fossil fuel production to 100% 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 second-largest coal producer.[92] The U.S. is also the world's largest historic emitter of greenhouse gas pollution, responsible for 25% of cumulative global CO_2 emissions since 1870, and is currently the world's second highest emitter on an annual basis and highest emitter on a per capita basis.[93] 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.[94]

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

[88] *See for example*, Van den Berg, Nicole et al., Implications of various effort-sharing approaches for national carbon budgets and emission pathways, Climatic Change 162: 1805-1822 (2020), https://link.springer.com/article/10.1007%2Fs10584-019-02368-y (showing a range for the U.S. carbon budget for 2010-2100 of ~10 $GtCO_2$ to -90 $GtCO_2$ for a 1.5°C limit at Figure 4).
[89] As noted above, the IPCC Sixth Assessment Report updated the remaining global carbon budget from the beginning of 2020 at 400 $GtCO_2$ for a 67% probability of meeting the 1.5°C limit.
[90] Erickson, Peter & Michael Lazarus, Would constraining U.S. fossil fuel production affect global CO_2 emissions? A case study of US leasing policy, 150 Climatic Change 29 (2018).
[91] 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.
[92] SEI, IISD, ODI, E3G, and UNEP, The Production Gap Report 2021 (2021), http://productiongap.org/2021report at Table 4.1.
[93] Le Quéré, Corinne et al., Global carbon budget 2018, 10 Earth System Science Data 2141 (2018) at 2163 and Figure 5, 2167; Global Carbon Project, Global Carbon Budget 2018 (Dec. 5 2018), https://www.globalcarbonproject.org/carbonbudget/18/files/GCP_CarbonBudget_2018.pdf at 19 (Historical cumulative fossil CO_2 emissions by country).
[94] 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/.

infrastructure — such as pipelines and marine and rail import and export terminals — require upfront investments that provide financial incentives for companies to continue production for decades into the future.[95] 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.'[96]

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.

Other research has separately demonstrated that construction of new fossil fuel infrastructure projects, including but not limited to pipelines, import and export terminals, storage facilities, refineries, power plants and petrochemical plants, is also inconsistent with meeting the 1.5°C limit.[97] This research shows that the committed carbon emissions from *existing* fossil fuel infrastructure in the energy and industrial sectors exceed the carbon budget for limiting warming to 1.5°C, meaning that no new fossil infrastructure can be built and much existing infrastructure must be *retired early* to avoid catastrophic climate harms.[98]

The climate emergency demands immediate action to establish the maximum production rate and phase-down the rates of oil and gas well production. Indeed, the best available science on climate change demonstrates that we not only need to end the federal fossil fuel leasing program, but phase-down 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 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

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[95] 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).

[96] 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.

[97] Tong, D. et al., Committed emissions from existing energy infrastructure jeopardize 1.5 °C climate target, 572 Nature 373 (2019); Smith, C.J. et al., Current fossil fuel infrastructure does not yet commit us to 1.5 °C warming, 10 Nature Communications 101 (2019); Pfeiffer, Alexander et al., Committed emissions from existing and planned power plants and asset stranding required to meet the Paris Agreement, 13 Environmental Research Letters 054019 (2018).

[98] Tong, D. et al., Committed emissions from existing energy infrastructure jeopardize 1.5 °C climate target, 572 Nature 373-377 (2019).

use."[99] In light of this reality, not taking the petitioned actions would constitute a gross dereliction of the Secretary's obligation to ensure our public lands and waters are managed consistent with protection of the environment and national energy needs.

IV. 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.[100] The climate crisis, caused primarily by fossil fuels, poses an existential threat to every aspect of society. Fossil fuel-driven climate change has already led to more frequent and intense heat waves, floods, and droughts; more destructive hurricanes and wildfires; rising seas and coastal erosion; increased spread of disease; food and water insecurity; acidifying oceans; and increasing species extinction risk and the collapse of ecosystems. The climate crisis is killing people across the nation and around the world, accelerating the extinction crisis, and costing the U.S. economy billions in damages every year.

The harms from the climate crisis and fossil fuel pollution are not felt equally, but instead fall first and worst on Black, Brown, Indigenous, and other communities of color, as well as low-wealth and other frontline communities, worsening the environmental justice crisis.[101] The vast scientific literature documenting these findings has been set forth in a series of authoritative reports from the Intergovernmental Panel on Climate Change (IPCC), U.S. Global Change Research Program, and other institutions,[102] which make clear that fossil-fuel driven climate change is a "code red for humanity."[103] Without limits on fossil fuel production and deep and

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[99] Bradshaw, C., et al. 2021. Understanding the Challenges of a Ghastly Future. Front. Conserv. Sci. Vol. 1, Article 615419.

[100] 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.

[101] Donaghy, Tim & Charlie Jiang for Greenpeace, Gulf Coast Center for Law & Policy, Red, Black & Green Movement, and Movement for Black Lives, Fossil Fuel Racism: How Phasing Out Oil, Gas, and Coal Can Protect Communities (2021), https://www.greenpeace.org/usa/wp-content/uploads/2021/04/Fossil-Fuel-Racism.pdf; U.S. Environmental Protection Agency, Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts, EPA 430-R-21-003 (2021), www.epa.gov/cira/social-vulnerability-report.

[102] The most recent of these reports includes: 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, Vol. II (2018), https://nca2018.globalchange.gov/; Intergovernmental Panel on Climate Change, Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (2018) [Masson-Delmotte, V. et al. (eds.)], https://www.ipcc.ch/sr15/; Intergovernmental Panel on Climate Change, Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i.

[103] United Nations Secretary-General, *Secretary-General's statement on the IPCC Working Group 1 Report on the Physical Science Basis of the Sixth Assessment*, Aug. 9, 2021, https://www.un.org/sg/en/content/secretary-generals-statement-the-ipcc-working-group-1-report-the-physical-science-basis-of-the-sixth-assessment.

rapid emissions reductions, global temperature rise will exceed 1.5°C and will result in catastrophic damage in the U.S. and around the world.[104]

The Intergovernmental Panel on Climate Change ("IPCC"), the international scientific body for the assessment of climate change, concluded in its *Climate Change 2021: The Physical Science Basis* report that:

> [i]t is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred," and further that "[t]he scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years.[105]

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. These scientific syntheses are 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)[106] and the 2018 *Impacts, Risks, and Adaptation in the United States* (Volume II),[107] concluded that "there is no convincing alternative explanation" for the observed warming of the climate over the last century other than human activities.[108] 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."[109]

In 2009 the Environmental Protection Agency ("EPA") found that the then-current and projected concentrations of greenhouse gas pollution endanger the public health and welfare of current and future generations, based on robust scientific evidence of the harms from climate change.[110] A 2018 study reviewed the scientific evidence that has emerged since 2009 and concluded that this

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[104] Intergovernmental Panel on Climate Change, Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (2018) [Masson-Delmotte, V. et al. (eds.)], https://www.ipcc.ch/sr15/.
[105] Intergovernmental Panel on Climate Change, Summary for Policymakers In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021) at SPM-5 and SPM-9.
[106] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/.
[107] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018).
[108] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 10.
[109] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018) at 36.
[110] 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).

evidence "lends increased support" for EPA's endangerment finding.[111] 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."[112] 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."[113] The Fourth National Climate Assessment reported that "fossil fuel combustion accounts for approximately 85% of total U.S. greenhouse gas emissions,"[114] 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."[115]

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."[116] 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.[117]

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.[118] As summarized by the National Research Council:

[111] 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.
[112] *Id.* at 1.
[113] 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."
[114] 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.
[115] *Id.* at 39.
[116] *Id.* at 34.
[117] *Id.* at 1347.
[118] 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.

> 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.[119]

V. The 2018 and 2021 IPCC Reports Make Clear That Greenhouse Gas Emissions Must Be Halved In This 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 temperature rise versus 1.5°C. This report highlighted the necessity of limiting warming to 1.5°C to avoid catastrophic impacts to people and life on Earth.[120] The IPCC 2018 *Special Report* provides overwhelming evidence that aggressive reductions in fossil fuel emissions within this decade are essential to avoiding the most devastating climate change harms.

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 stress; and up to several hundred million more people exposed to climate-related risks and susceptible to poverty by 2050.[121]

The IPCC *Special 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

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[119] National Research Council, Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia (2011) at 3.

[120] 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).

[121] *Id*. at SPM-8 to SPM-14.

GHGs and climate forcers."[122] In pathways consistent with limiting warming to 1.5°C, global anthropogenic CO_2 emissions must decline by about 45% below 2010 levels by 2030 and reach near zero around 2045 or 2050.[123]

The IPCC *Climate Change 2021* report concludes that global warming will exceed 1.5°C and 2°C by 2100 unless we make immediate, deep reductions in CO_2 and other greenhouse gas emissions.[124] Only the most stringent emissions reduction scenario—SSP1-1.9 in which global emissions fall steeply in the near-term, reach net zero in 2050, and become net negative afterward—is consistent with a 1.5°C climate target. In this low-emissions SSP1-1.9 scenario, global average surface temperature is projected to reach 1.5°C above pre-industrial in the near-term (2021-2040), overshoot and peak at 1.6°C in the mid-term (2041-2060), and drop down to 1.4°C in the long-term (2081-2100).[125]

In short, both the IPCC *Climate Change 2021* report and the 2018 IPCC *Special Report* provide 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 this crucial decade, in making these cuts.

VI. 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

The IPCC Assessment Reports, U.S. National Climate Assessments, and tens of thousands of studies make clear that fossil-fuel driven climate change is a "code red for humanity," and that every additional ton of CO_2 and fraction of a degree of temperature rise matters.[126] As warned by the IPCC, "every tonne of CO_2 emissions adds to global warming."[127] The widespread, intensifying, and often long-lived harms from climate change include soaring air and ocean temperatures; more frequent and intense heat waves, floods, and droughts; more destructive hurricanes and wildfires; coastal flooding from sea level rise and increasing storm surge;

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[122] Rogelj, Joeri et al., Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In: Global Warming of 1.5°C, An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (2018), https://www.ipcc.ch/sr15/ at 112.
[123] Rogelj, Joeri et al., Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In: Global Warming of 1.5°C, An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (2018), https://www.ipcc.ch/sr15/ at Figure 2.6; also at Summary for Policymakers at 12-14.
[124] Intergovernmental Panel on Climate Change, Summary for Policymakers In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021) at SPM-17.
[125] *Id*. at Table SPM.1.
[126] United Nations, Secretary-General's statement on the IPCC Working Group 1 Report on the Physical Science Basis of the Sixth Assessment, https://www.un.org/sg/en/content/secretary-generals-statement-the-ipcc-working-group-1-report-the-physical-science-basis-of-the-sixth-assessment (last accessed Sept. 24, 2021).
[127] IPCC, Climate Change 2021 (2021) at Summary for Policymakers SPM-37.

declining food and water security; accelerating species extinction risk; melting Arctic sea ice, glaciers, and ice sheets; the collapse of Antarctic ice shelves; ocean acidification; and the collapse of coral reefs.[128] 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.[129]

A. Environmental justice harms

The harms from climate change and fossil fuel pollution are not felt equally, but instead fall first and worst on Black, Brown, Indigenous, and low-wealth communities.[130] A 2021 EPA analysis concluded that communities of color are particularly vulnerable to the greatest impacts of climate change, including health harms, heat waves, poor air quality, and flooding.[131] For example, with 2°C (3.6°F) of global warming, Black Americans are 34% more likely to currently live in areas with the highest projected increases in childhood asthma diagnoses and 40% more likely to currently live in areas with the highest projected increases in extreme temperature-related deaths.[132] With 2°C (3.6°F) of global warming, Hispanic and Latino individuals are 43% more likely to currently live in areas with the highest projected reductions in labor hours due to extreme temperatures.[133]

The fossil fuel pollution driving the climate crisis similarly disproportionately harms communities of color and low-wealth communities, and perpetuates the systemic racism and energy violence entrenched in the nation's fossil fuel energy system.[134] Fossil fuel infrastructure including oil and gas wells, refineries, fossil fuel power plants, and processing, transmission and storage facilities are often concentrated in communities of color and low-wealth communities, causing serious health harms to residents exposed to hazardous air and water pollution from

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[128] 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/.

[129] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 10.

[130] Donaghy, Tim & Charlie Jiang for Greenpeace, Gulf Coast Center for Law & Policy, Red, Black & Green Movement, and Movement for Black Lives, Fossil Fuel Racism: How Phasing Out Oil, Gas, and Coal Can Protect Communities (2021), https://www.greenpeace.org/usa/wp-content/uploads/2021/04/Fossil-Fuel-Racism.pdf; U.S. Environmental Protection Agency, Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts, EPA 430-R-21-003 (2021), *available at* www.epa.gov/cira/social-vulnerability-report.

[131] U.S. Environmental Protection Agency, Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts, EPA 430-R-21-003 (2021), *available at* www.epa.gov/cira/social-vulnerability-report.

[132] *Id.*

[133] *Id.*

[134] Donaghy, Tim & Charlie Jiang for Greenpeace, Gulf Coast Center for Law & Policy, Red, Black & Green Movement, and Movement for Black Lives, Fossil Fuel Racism: How Phasing Out Oil, Gas, and Coal Can Protect Communities (2021), https://www.greenpeace.org/usa/wp-content/uploads/2021/04/Fossil-Fuel-Racism.pdf.

these facilities.[135] For example, research shows that people of color, particularly Black Americans, disproportionately live near toxic fracking wells,[136] and that the share of people of color living within three miles (five kilometers) of a coal- or oil-fired power plant is 12% larger than the national average.[137] As a result of this unequal siting of fossil fuel infrastructure, Black Americans have 1.54 times the exposure to particulate matter[138] compared to the overall population, while populations of color have 1.28 times higher burden than the general population.[139]

B. Rising temperatures

Global average surface temperature rose by 2°F (1.09°C) between 1850-1900 and 2011-2020, with larger increases over land than over the ocean.[140] Each of the last four decades has been successively hotter than any preceding decades since 1850.[141] Since 2012, global warming has been especially pronounced, with the past five years (2016-2020) being the hottest five-year period since 1850.[142] Global temperatures of the past decade are likely the hottest it has been on Earth in 125,000 years.[143]

Global surface temperature will continue to increase until at least mid-century under all scenarios considered in the IPCC *Climate Change 2021* report.[144] Global warming will exceed 1.5°C and

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[135] *See* Bullard, Robert D. et al., Toxic Wastes and Race at Twenty: 1987-2007 (March 2007), http://www.ejnet.org/ej/twart.pdf; Wilson, Adrian et al., Coal Blooded: Putting Profits Before People, NAACP, Indigenous Environmental Network & Little Village Environmental Justice Organization (2012), https://naacp.org/resources/coal-blooded-putting-profits-people; U.S. Environmental Protection Agency, EJ Screening Report for the Clean Power Plan (2015), https://archive.epa.gov/epa/sites/production/files/2016-04/documents/ejscreencpp.pdf; Massetti, Emanuele et al., Environmental Quality and the U.S. Power Sector: Air Quality, Water Quality, Land Use and Environmental Justice, ORNL/SPR-2016/772 (2017), https://info.ornl.gov/sites/publications/files/Pub60561.pdf; PSE Healthy Energy, Natural gas power plants in California's disadvantaged communities (April 2017), https://www.psehealthyenergy.org/wp-content/uploads/2017/04/CA.EJ_.Gas_.Plants.pdf.

[136] Zwickl, Klara., The demographics of fracking: A spatial analysis for four U.S. states, 161 Ecological Economics 202 (2019), https://www.sciencedirect.com/science/article/abs/pii/S092180091830661X.

[137] Massetti, Emanuele et al., Environmental Quality and the U.S. Power Sector: Air Quality, Water Quality, Land Use and Environmental Justice, ORNL/SPR-2016/772 (2017), https://info.ornl.gov/sites/publications/files/Pub60561.pdf.

[138] An air pollutant linked to a wide variety of health harms including respiratory conditions, heart attacks, and premature death. See U.S. Environmental Protection Agency, Health and Environmental Effects of Particulate Matter (PM), https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm (last visited Aug. 30, 2021).

[139] Mikati, Ihab et al., Disparities in distribution of particulate matter emission sources by race and poverty status, 108 American Journal of Public Health 480 (2018), https://ajph.aphapublications.org/doi/10.2105/AJPH.2017.304297.

[140] Intergovernmental Panel on Climate Change, Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-5 and SPM-6.

[141] *Id.* at SPM-5 and SPM-6.

[142] Intergovernmental Panel on Climate Change, Technical Summary. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at TS-8.

[143] *Id.* at SPM-9.

[144] *Id.* at SPM-17.

2°C by 2100 unless deep reductions in CO_2 and other greenhouse gas emissions occur in the coming decades.[145] Compared to 1850-1900, global surface temperature by 2100 is very likely to be higher by 1.8°F to 3.2°F (1.0°C to 1.8°C) under the very low GHG emissions scenario considered (SSP1-1.9; CO_2 emissions reach net zero around 2050), by 3.8°F to 6.3°F (2.1°C to 3.5°C) in the intermediate scenario (SSP2-4.5; CO_2 emissions remain around current levels until 2050) and by 5.9°F to 10.2°F (3.3°C to 5.7°C) under the very high GHG emissions scenario (SSP5-8.5; CO_2 emissions double by 2050).[146] It is believed that global surface temperature has not been at or above 4.5°F (2.5°C) higher than 1850-1900 in over 3 million years.[147]

In the United States average temperatures rose by 1.8°F (1.0°C) between 1901 and 2016, with the most rapid heating occurring after 1979.[148] U.S. temperatures are expected to rise 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.[149] By late century, much greater heating 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,[150] with the largest increases in the upper Midwest and Alaska.[151] 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.[152]

C. Increasing frequency of extreme weather events

Climate change is increasing the frequency and intensity of extreme weather events, particularly heat waves and heavy precipitation events.[153] 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 more days per year above 90°F by mid-century for most regions under a

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145 *Id.* at SPM-17.
146 *Id.* at SPM-17.
147 *Id.* at SPM-15 - SPM-17.
148 U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 17.
149 *Id.* at 11.
150 *Id.* at 17.
150 *Id.* at 17, 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).
151 *Id.* at Figure ES.4.
152 *Id.* at 17.
153 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), https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/; 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; Intergovernmental Panel on Climate Change, Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-10.

higher emissions scenario.[154] Heavy precipitation has become more frequent and intense in most regions of the U.S. since 1901,[155] as more water vapor is available to fuel extreme rain and snowstorms as the world warms.[156] 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.[157] Climate change is also projected to increase the frequency and severity of landfalling "atmospheric rivers" on the West Coast.[158]

Rising temperatures have exacerbated recent historic droughts by reducing soil moisture and contributing to earlier spring melt and reduced water storage in snowpack.[159] As conditions become hotter and drier, climate change is contributing to an increase in extreme fire weather, area burned by wildfire, and a lengthening of the wildfire season, particularly in the western United States.[160]

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.[161] 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.[162] The sequence of consecutive record-breaking temperatures in 2014–2016 had a negligible (<0.03%) likelihood of occurring in the absence of anthropogenic warming.[163]

Climate change-related weather extremes are also weakening the ability of the terrestrial biosphere (vegetation and soil) to uptake carbon, a significant development because the terrestrial biosphere absorbs about 25% of anthropogenic carbon dioxide emissions.[164] Droughts,

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[154] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 185, 199.
[155] *Id.* at 20.
[156] *Id.* at 214.
[157] *Id.* at 207, 218.
[158] 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.
[159] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 45, 236.
[160] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/.
[161] Herring, Stephanie C. et al., Explaining extreme events of 2016 from a climate perspective, 99 Bulletin of the American Meteorological Society S1 (2018). The Bulletin of the American Meteorological Society has published an annual attribution study compendium since 2011.
[162] Oliver, Eric C. et al., Anthropogenic and natural influences on record 2016 marine heat waves, 99 Bulletin of the American Meteorological Society S44 (2018); 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 (2018).
[163] Mann, Michael E. et al., Record temperature streak bears anthropogenic fingerprint, 44 Geophysical Research Letters 7936 (2017).
[164] Green, Julia K. et al., Large influence of soil moisture on long-term terrestrial carbon uptake, 565 Nature 476 (2019).

heat waves and other extreme climate-related events reduce soil moisture, lowering carbon uptake now and projected into the future.

D. More destructive hurricanes

Climate change is increasing the destructive power of hurricanes by increasing their intensity, rainfall, and storm surge. Because hurricanes are fueled by heat, hotter ocean temperatures are increasing the strength of Atlantic hurricanes[165] and allowing them to intensify more quickly.[166] During 2016 to 2019, the U.S. suffered the longest streak of Category 5 hurricanes on record. Hotter air also holds more moisture, causing heavier rainfall during hurricanes.[167] For example, global warming is estimated to have made Hurricane Harvey's record rainfall 3.5 times more likely and increased its total rainfall by 15 to 38%.[168] If emissions are not reduced, hurricane rainfall is projected to increase by 15 to 35%, with wind speeds rising by as much as 25 knots.[169] Rising sea levels due to climate change are also causing higher storm surge—the enormous walls of water pushed onto the coast by storms.[170] Large storm surge events of the magnitude of Hurricane Katrina have already doubled, and are projected to increase in frequency by twofold to sevenfold for each degree Celsius of temperature rise.[171] During 2017 and 2018 alone, five major hurricanes cost the United States at least 3,269 lost lives and $325 billion in damages.[172]As the climate crisis worsens, Atlantic hurricane intensity, rainfall and storm surge are projected to increase further, making hurricanes ever-more destructive.[173]

[165] Holland, G. & C.L. Bruyère, Recent intense hurricane response to global climate change, 42 Climate Dynamics 617 (2014); Fraza, Erik & James B. Elsner, A climatological study of the effect of sea-surface temperature on North Atlantic hurricane intensification, 36 Physical Geography 395 (2015); U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Volume 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, Vol. II (2018), https://nca2018.globalchange.gov/ at 74.

[166] Bhatia, Kieran T. et al., Recent increases in tropical cyclone intensification rates, 10 Nature Communication 635 (2019).

[167] Emanuel, Kerry, Assessing the present and future probability of Hurricane Harvey's rainfall, 114 PNAS 12681 (2017); Keellings, David & José J. Hernández Ayala, Extreme rainfall associated with Hurricane Maria over Puerto Rico and its connections to climate variability and change, 46 Geophysical Research Letters 2964 (2019).

[168] Risser, Mark D. & 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); Patricola, Christina M. & Michael F. Wehner, Anthropogenic influences on major tropical cyclone events, 563 Nature 339 (2018).

[169] Patricola, Christina M. & Michael F. Wehner, Anthropogenic influences on major tropical cyclone events, 563 Nature 339 (2018).

[170] 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).

[171] Grinsted, Aslak et al., Homogeneous record of Atlantic hurricane surge threat since 1923, 109 PNAS 19601 (2012); Grinsted, Aslak et al., Projected hurricane surge threat from rising temperatures, 110 PNAS 5369 (2013).

[172] National Oceanic and Atmospheric Administration, National Centers for Environmental Information (NCEI), U.S. Billion-Dollar Weather and Climate Disasters (2021), https://www.ncdc.noaa.gov/billions/.

[173] 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, 95.

E. Rising seas

Global average sea level has risen by seven to eight inches (0.2 m) since 1901 as the oceans have gotten hotter and land-based ice has melted.[174] Global average sea level has risen faster since 1900 than in any other century in at least the last 3,000 years.[175] Sea level rise is accelerating in pace: the recent rate of sea level rise is nearly triple the rate between 1901-1971 (3.7 mm per year from 2006-2018 versus 1.3 mm per year from 1901-1971).[176] 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 year 2000, with sea level rise of 8.2 feet possible.[177] 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.[178] The impacts of sea level rise will be long-lived: under all emissions scenarios, sea levels will continue to rise for many centuries.[179]

F. Coastal flooding from sea level rise and intensifying storm surge

Coastal regions are threatened by increasing flooding due to sea level rise and intensifying storm surge.[180] 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.[181] 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.[182] 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

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[174] Intergovernmental Panel on Climate Change, Summary for Policymakers In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-6.
[175] *Id.* at SPM-9.
[176] *Id.* at SPM-6.
[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 487, 758.
[178] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 344.
[179] Intergovernmental Panel on Climate Change, Summary for Policymakers In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-28.
[180] 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.
[181] 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).
[182] 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).

adaptation actions are taken, with Miami, New York and New Orleans suffering the highest current and projected economic losses in the U.S.[183]

Coastal flooding is becoming more damaging as Atlantic hurricanes and hurricane-generated storm surges grow more severe due to climate change.[184] Sea levels on the U.S. East Coast from Cape Hatteras to Boston are rising three to four times faster than the global average,[185] which when combined with intensifying hurricanes and storm surge, is greatly increasing the flooding risk along the East Coast.[186] Under a lower emissions RCP 4.5 scenario, storm surge is projected to increase by 25 to 47% along the U.S. Gulf and Florida coasts due to the combined effects of sea level rise and growing hurricane intensity.[187] The increasing frequency of extreme precipitation events is also compounding coastal flooding risk when storm surge and heavy rainfall occur together.[188]

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.[189] 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.[190] In Florida and Virginia, nuisance flooding due to sea level rise has already resulted in severe property damage and social disruption.[191] The frequency, depth, and extent of tidal flooding are expected to continue to increase in the future.[192]

As the Fourth National Climate Assessment warned, "Although storms, floods, and erosion have always been hazards, in combination with rising sea levels they now threaten approximately $1 trillion in national wealth held in coastal real estate and the continued viability of coastal communities that depend on coastal water, land, and other resources for economic health and cultural integrity."[193]

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183 Hallegatte, Stephane et al., Future flood losses in major coastal cities, 3 Nature Climate Change 802 (2013).
184 U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/,
at 99.
185 Sallenger, Asbury H. et al., Hotspot of accelerated sea-level rise on the Atlantic coast of North America, 2 Nature Climate Change 884 (2012).
186 Little, Christopher M. et al., Joint projections of US East Coast sea level and storm surge, 5 Nature Climate Change 1114 (2015).
187 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).
188 Wahl, T. et al., Increasing risk of compound flooding from storm surge and rainfall for major US cities, 5 Nature Climate Change 1093 (2015).
189 U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 98-99.
190 *Id.* at 99.
191 Atkinson, Larry P. et al., Sea level rise and flooding risk in Virginia, 5 Sea Grant Law and Policy Journal (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).
192 U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 75.
193 *Id.* at 324.

G. 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.[194] Arctic summer sea ice extent and thickness have decreased by 40% during the past several decades,[195] with each metric ton of CO_2 emissions causing a sustained loss of three square meters of summer sea ice area.[196] The Arctic lost 95% of its oldest and thickest sea ice during the past three decades, and the remaining thinner, younger ice is more vulnerable to melting.[197] Sea ice loss has accelerated since 2000, with Alaska's coast suffering some of the fastest losses.[198] The length of the sea ice season is shortening as ice melts earlier in spring and forms later in autumn.[199] Along Alaska's northern and western coasts, the sea ice season has already shortened by more than 90 days.[200] As sea ice continues to plummet, the Arctic is projected to be nearly ice-free in summer by 2040.[201] 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*)."[202]

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[194] *Id.* at 92.

[195] 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, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 29, 57, 303; U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 1192-1193. Intergovernmental Panel on Climate Change, Summary for Policymakers In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-6.

[196] Notz, Dirk & Julienne Stroeve, Observed Arctic sea-ice loss directly follows anthropogenic CO_2 emission, 354 Science 747 (2016), https://science.sciencemag.org/content/354/6313/747/tab-pdf.

[197] Osborne, Emily, et al. (eds.), Arctic Report Card 2018, NOAA (2018), https://www.arctic.noaa.gov/Report-Card/Report-Card-2018 at 2.

[198] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 305.

[199] Parkinson, Claire L., Spatially mapped reductions in the length of the Arctic sea ice season, 41 Geophysical Research Letters 4316 (2014).

[200] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 307.

[201] 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; Intergovernmental Panel on Climate Change, Summary for Policymakers In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-20.

[202] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 29, 303.

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."[203] Another study found that, over the past two decades, Greenland's ice sheets have been melting at a rate 50% higher than pre-industrial levels and 33% 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.[204]

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.[205] The rate of ice loss from the 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.[206] Glaciers are also rapidly melting and are committed to continue doing so for centuries, raising sea levels and threatening water supplies in many regions.[207] 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 significantly.[208]

H. Ocean temperature rise

U.S. and global oceans are being hard-hit by climate change. The world's oceans have absorbed more than 90% of the excess heat caused by greenhouse gas warming,[209] resulting in average sea surface warming of 1.6°F (0.88°C) from 1850-1900 to 2011-2020, and 1.1°F (0.60°C) from 1980 to 2020.[210] A 2019 study estimated that oceans are warming 40% faster than scientists projected,

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[203] Bevis, Michael et al., Accelerating changes in ice mass within Greenland and the ice sheet's sensitivity to atmospheric forcing, 116 PNAS 1934 (2019).
[204] Trusel, Luke D. et al., Nonlinear rise in Greenland runoff in response to post-industrial Arctic warming, 564 Nature 104 (2018).
[205] Box, Jason E. et al., Global sea-level contribution from Arctic land ice: 1971-2017, 13 Environmental Research Letters 125012 (2018).
[206] Rignot, Eric et al., Four decades of Antarctic ice sheet mass balance from 1979-2017, 116 PNAS 1095 (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).
[207] Intergovernmental Panel on Climate Change, Summary for Policymakers In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-28.
[208] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. 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).
[209] Intergovernmental Panel on Climate Change, Summary for Policymakers In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at SPM-14.
[210] Intergovernmental Panel on Climate Change, Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at 9-14.

and that the rate of ocean warming is accelerating.[211] 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.[212] Global average sea surface temperature is projected to rise by 1.5°F (0.86°C) under a low emissions scenario (SSP1-2.6) and by 5.2°F (2.9°C) by the end of the century under a high emissions scenario (SSP5-8.5).[213]

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.[214] 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.[215]

I. Ocean acidification

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.[216] The ocean's absorption of anthropogenic CO_2 has already resulted in more than a 30% increase in the acidity of ocean surface waters, at a rate likely faster than anything experienced in the past 300 million years.[217] Ocean acidity could increase by 150% by the end of the century if CO_2 emissions continue unabated.[218] In the United States, the West Coast, Alaska, and the Gulf of Maine are experiencing the earliest, most severe changes due to ocean acidification.[219] 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.[220]

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[211] Cheng, Lijing et al., How fast are the oceans warming?, 363 Science 128 (2019).
[212] *Id.*
[213] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 368.
[214] *Id.* at 364, 377.
[215] Breitburg, Denise et al., Declining oxygen in the global ocean and coastal waters, 359 Science 46 (2018).
[216] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 371-372.
[217] 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.
[218] 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).
[219] 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, Francis et al., The West Coast Ocean Acidification and Hypoxia Science Panel: Major Findings, Recommendations, and Actions, California Ocean Science Trust (April 2016).
[220] 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.[221] The harms 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,[222] reduced coral calcification rates in reefs worldwide,[223] and mass die-offs of larval Pacific oysters in the Pacific Northwest.[224] 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."[225]

J. Biodiversity loss

Climate change is causing widespread harm to life across the planet, disrupting species' distribution, timing of breeding and migration, physiology, vital rates, and genetics—in addition to increasing species extinction risk.[226] Climate change is already affecting 82% of key ecological processes that underpin ecosystem function and support basic human needs.[227] Climate change-related local extinctions are widespread and have occurred in hundreds of species, including almost half of the 976 species surveyed.[228] Nearly half of terrestrial non-flying threatened mammals and nearly one-quarter of threatened birds are estimated to have been negatively impacted by climate change in at least part of their range.[229] 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.[230] Genes are changing, species' physiology and physical features such as body size are changing, species are moving to try to

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[221] 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).
[222] 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).
[223] Albright, Rebecca et al., Reversal of ocean acidification enhances net coral reef calcification, 531 Nature 362 (2016).
[224] 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).
[225] Chan, Francis et al., The West Coast Ocean Acidification and Hypoxia Science Panel: Major Findings, Recommendations, and Actions, California Ocean Science Trust (April 2016) at 4.
[226] Warren, Rachel et al., Increasing impacts of climate change upon ecosystems with increasing global mean temperature rise, 106 Climatic Change 141 (2011).
[227] Scheffers, Brett R. et al., The broad footprint of climate change from genes to biomes to people, 354 Science 719 (2016).
[228] Wiens, John J., Climate-related local extinctions are already widespread among plant and animal species, 14 PLoS Biology e2001104 (2016).
[229] 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."
[230] 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.[231]

Species extinction risk will accelerate with continued greenhouse gas pollution. One million animal and plant species are now threatened with extinction, with climate change as a primary driver.[232] At 2°C compared with 1.5°C of temperature rise, species' extinction risk will increase dramatically, leading to a doubling of the number of vertebrate and plant species losing more than half their range, and a tripling for invertebrate species.[233] Numerous studies have projected catastrophic species losses during this century if climate change continues unabated: 15 to 37% of the world's plants and animals committed to extinction by 2050 under a mid-level emissions scenario[234]; the potential extinction of 10 to 14% of species by 2100[235]; global extinction of 5% of species with 2°C of warming and 16% of species with business-as-usual warming[236]; the loss of more than half of the present climatic range for 58% of plants and 35% of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species[237]; and the loss of a third or more of animals and plant species in the next 50 years.[238] 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."[239]

The current U.S. energy system based on fossil fuel extraction and use is fundamentally damaging to wildlife. Fossil fuel production, transmission, generation, and waste disposal activities cause a wide array of harms to species and ecosystems, such as destroying and

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[231] 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 PNAS 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).
[232] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, IPBES secretariat, Bonn, Germany (2019), available at https://ipbes.net/global-assessment.
[233] Intergovernmental Panel on Climate Change, Summary for Policymakers. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (2018), https://www.ipcc.ch/sr15/
[234] Thomas, Chris. D. et al., Extinction risk from climate change, 427 Nature 145 (2004).
[235] Maclean, Ilya M. D. & Robert J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 PNAS 12337 (2011).
[236] Urban, Mark C., Accelerating extinction risk from climate change, 348 Science 571 (2015).
[237] Warren, Rachel et al., Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss, 3 Nature Climate Change 678 (2013).
[238] Román-Palacios, Cristian & J.J. Wiens, Recent responses to climate change reveal the drivers of species extinction and survival, 117 PNAS 4211 (2020) .
[239] 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.

fragmenting wildlife habitat, reducing water supplies often in water-stressed areas, causing air, noise, and light pollution, contaminating surface and ground water, and facilitating the spread of ecologically disruptive invasive species,[240] with similar harms in the offshore marine environment.[241] Fossil fuel development also creates the significant risk of oil spills and brine spills which can kill wildlife and cause devastating effects over large areas. For many species, the harms from the fossil fuel-based energy system have led to mortality, changes in behavior, population declines, disruptions to community composition, and loss of ecosystem function. Scientists have called for a rapid transformation of our energy system away from fossil fuels to avoid a mass extinction event.[242]

K. Coral reef crisis

The world's coral reefs, which support thousands 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.[243] An estimated 50% of the world's coral reefs have already been lost,[244] and an estimated one-third of all reef-building coral species are at risk of extinction.[245] 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 never bleached before, with U.S. reefs particularly hard-hit.[246] Since the first mass bleaching events began in the 1980s, severe bleaching events have increased five-fold and now occur every

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240 Butt, Nathalie et al., Biodiversity risks from fossil fuel extraction, 342 Science 425 (2013); Brittingham, Margaret C. et al., Ecological risks of shale oil and gas development to wildlife, aquatic resources and their habitats, 48 Environmental Science and Technology 11034 (2014); Pickell, Paul D. et al., Monitoring forest change in landscapes under-going rapid energy development: challenges and new perspectives, 3 Land 617 (2014); Souther, Sara et al., Biotic impacts of energy development from shale: research priorities and knowledge gaps, 12 Frontiers in Ecology and the Environment 330 (2014); Allred, Brady W. et al., Ecosystem services lost to oil and gas in North America, 348 Science 401 (2015); Harfoot, Michael B. et al., Present and future biodiversity risks from fossil fuel exploitation, 11 Conservation Letters e12448 (2018).

241 Venegas-Li, Rubén et al., Global assessment of marine biodiversity potentially threatened by offshore hydrocarbon activities, 25 Global Change Biology 2009 (2019).

242 Barnosky, Anthony D., Transforming the global energy system is required to avoid the sixth mass extinction, 2 MRS Energy and Sustainability E10 (2015).

243 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).

244 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% 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% between the 1980s and 2003.

245 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).

246 Lewis, Sophie C. & J. Mallela, A multifactor risk analysis of the record 2016 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.

six years on average, which is too frequent to allow full recovery of coral reefs.[247] Coral reefs are projected to decline by a further 70-90% with 1.5°C of warming and at 2°C, coral reef ecosystems will suffer a near total collapse with projected declines of more than 99%.[248] 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.[249]

L. Public health harms

The climate crisis threatens public health and well-being, with disproportionate harms to communities of color, low-wealth communities, children, older adults, and persons with disabilities and pre-existing medical conditions.[250] The authoritative Lancet Commission on Health and Climate Change called climate change "the biggest global health threat of the 21st century"[251] and warned that it is causing a global medical emergency that "threatens to undermine the last half century of gains in development and global health."[252] More than 200 health journals have called on governments to take emergency action to limit warming to 1.5°C, warning that the "[t]he greatest threat to global public health is the continued failure of world leaders to keep the global temperature rise below 1.5°C."[253] In the U.S., the health costs of air pollution from fossil fuel combustion and climate change are estimated to already exceed $800 billion per year and expected to become even more expensive without rapid action to curb fossil fuel pollution.[254]

Health risks from climate change include increased exposure to heat waves, floods, droughts, and other extreme weather events; increases in infectious diseases; decreases in the quality and safety

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[247] Hughes, Terry P. et al., Spatial and temporal patterns of mass bleaching of corals in the Anthropocene, 359 Science 80 (2018).
[248] Intergovernmental Panel on Climate Change, 2018, Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts
of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (2018) [Masson-Delmotte, V. et al. (eds.)], https://www.ipcc.ch/sr15/.
[249] 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% of reef locations experience severe bleaching events annually by the end of the century.
[250] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. 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).
[251] Watts, Nick et al., The 2018 report of the *Lancet* Countdown on health and climate change: shaping the health of nations for centuries to come, 392 The Lancet 2479 (2018) at 2482.
[252] Watts, Nick et al., Health and climate change: policy responses to protect public health, 386 The Lancet 1861 (2015) at 1861.
[253] Atwoli, Lukoye et al., Call for emergency action to limit global temperature increases, restore biodiversity, and protect health, 374 BMJ (2021), https://www.bmj.com/content/374/bmj.n1734.
[254] Medical Society Consortium on Climate and Health, The Costs of Inaction: The Economic Burden of Fossil Fuels and Climate Change on Health in the United States (2021), https://medsocietiesforclimatehealth.org/wp-content/uploads/2021/05/CostofInactionReport-May2021.pdf at 5.

of air, food, and water; displacement; and stresses to mental health and well-being.[255] Illnesses and deaths caused by extreme weather events are escalating as heat waves, floods and storms increase in frequency and intensity.[256] Heat is the leading cause of weather-related deaths in the U.S. as well as causing many health harms—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.[257] One third of heat-related deaths in the U.S. between 1991 and 2018 are attributable to climate change.[258]

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.[259] 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 will rise to nearly three-quarters by the end of the century, with particular impacts to the southeastern U.S., without deep cuts in greenhouse gas pollution.[260] Hotter temperatures also increase suicide risk, and rising temperatures are projected to lead to tens of thousands of additional suicides in the U.S. by mid-century.[261]

Extreme precipitation events have become more common in the United States, contributing to increases in severe flooding in some regions.[262] 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.[263] Air pollutants—particularly ozone, particulate matter, and allergens—are expected to increase with climate change.[264] Climate-driven increases in ozone will cause more premature deaths, hospital visits, lost school days, and acute respiratory symptoms.[265] Rising temperatures are increasing human exposure to insect-borne diseases as ticks, mosquitoes and other vectors become active earlier in the season and expand northward.[266] The two species

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[255] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. 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).
[256] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 541.
[257] *Id.* at 544-545.
[258] Vicedo-Cabrera, A.M. et al., The burden of heat-related mortality attributable to recent human-induced climate change, 11 Nature Climate Change 492 (2021), https://www.nature.com/articles/s41558-021-01058-x.
[259] U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016).
[260] Mora, Camilo et al., Global risk of deadly heat, 7 Nature Climate Change 501 (2017).
[261] Burke, Marshall et al., Higher temperatures increase suicide rates in the United States and Mexico, 8 Nature Climate Change 723 (2018), https://www.nature.com/articles/s41558-018-0222-x.
[262] 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.
[263] *Id.* at 224.
[264] 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 Fed. Reg. 66496 (Dec. 15, 2009) (to be codified at 40 C.F.R. Ch. 1); U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, (2016).
[265] U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016).
[266] *Id.*

of ticks capable of spreading Lyme disease—the most common vector-borne illness in the U.S.[267]—have already expanded to new regions in part due to rising temperatures: in 2015, they were found in more than 49% of counties in the continental U.S., a nearly 45% increase since 1998.[268] Cases of Lyme disease in the U.S. are projected to increase by 20% at 2°C of temperature rise,[269] while cases of West Nile disease are projected to more than double by 2050, resulting in approximately $1 billion per year in hospitalization costs and premature deaths under a higher emissions scenario.[270]

Fossil fuel pollution not only drives climate change that causes health harms, but itself is extremely harmful to human health. Every stage of the fossil fuel life cycle—extraction, processing, transport, and combustion—generates hazardous and criteria air pollutants, including known cancer-causing chemicals like benzene and formaldehyde; ozone-forming chemicals like nitrogen oxides, volatile organic compounds, and methane; and particulate matter including black carbon and silica dust that cause lung and heart disease.[271] Research shows that people exposed to fossil fuel pollution have a higher risk for developing cancer,[272] increased asthma attacks,[273] higher hospitalization rates,[274] more upper respiratory problems and rashes,[275] birth defects,[276] premature births and high-risk pregnancies,[277] and low-birthweight babies.[278] The fine particulate pollution from fossil fuel combustion causes one in five premature deaths worldwide,

[267] Schwartz, Amy M., et al., Surveillance for Lyme Disease - United States, 2008-2015, 66 MMWR, Centers for Disease Control and Prevention (2017).
[268] 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).
[269] Dumic, Igor & Edson Severnini, 'Ticking bomb': the impact of climate change on the incidence of Lyme disease, Canadian Journal of Infectious Diseases and Medical Microbiology Article 5719081 (2018), https://www.hindawi.com/journals/cjidmm/2018/5719081/.
[270] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 552.
[271] Garcia-Gonzalez, Diane A. et al., Hazardous air pollutants associated with upstream oil and natural gas development: a critical synthesis of current peer-reviewed literature, 40 Annual Review of Public Health 283 (2019), https://www.annualreviews.org/doi/10.1146/annurevpublhealth-040218-043715; Johnston, Jill E. et al., Impact of upstream oil extraction and environmental public health: A review of the evidence, 657 Sci Total Environ 187 (2019), https://pubmed.ncbi.nlm.nih.gov/30537580/; Concerned Health Professionals of New York & Physicians for Social Responsibility, Compendium of scientific, medical, and media findings demonstrating risks and harms of fracking (unconventional gas and oil extraction) (7th ed.) (2020), http://concernedhealthny.org/compendium/.
[272] McKenzie, Lisa M. et al., Ambient nonmethane hydrocarbon levels along Colorado's Northern Front Range: Acute and chronic health risks, 52 Environmental Science and Technology 4514 (2018).
[273] Rasmussen, Sara G. et al., Association Between Unconventional Natural Gas Development in the Marcellus Shale and Asthma Exacerbations, 176 JAMA Internal Medicine 1334 (2016).
[274] Jemielita, Thomas et al., Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates, 10 PLoS One 7 (2015).
[275] Rabinowitz, Peter M. et al., Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania, 123 Environmental Health Perspectives 21 (2015).
[276] McKenzie, Lisa M., Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado, 122 Environmental Health Perspectives 412 (2014).
[277] Casey, Joan A., Unconventional Natural Gas Development and Birth Outcomes in Pennsylvania, USA, 27 Epidemiology 163 (2016).
[278] Stacy, Shaina L. et al., Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest (2015).

and one in ten deaths each year in the United States equaling 355,000 premature deaths in 2018.[279]

Numerous studies show that many lives can be saved with rapid reductions in fossil fuel pollution.[280] The Fourth National Climate Assessment concluded 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."[281] Limiting temperature rise to 1.5°C instead of 2°C would prevent an estimated 153 million premature deaths worldwide due to lowered exposure to fine particulate matter and ozone, including 130,000 fewer premature deaths in Los Angeles and 120,000 in the New York metropolitan area alone.[282] Another study estimated that every 4,434 metric tons of CO_2 added to the atmosphere in 2020—equivalent to the lifetime emissions of 3.5 average Americans—will cause one excess death globally through 2100.[283] The implications of this finding are that limiting temperature rise to 1.5°C instead of 2°C will save 169 million lives.[284]

M. Threats to water resources

Climate change is threatening water supplies in the U.S. As summarized by the Fourth National Climate Assessment, variable precipitation and rising temperature due to climate change are decreasing water quantity and quality in many parts of the U.S. by "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."[285]

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[279] Vohra, Karn et al., Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem, 195 Environmental Research 110754 (2021), https://www.sciencedirect.com/science/article/abs/pii/S0013935121000487.

[280] 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), https://science.sciencemag.org/content/356/6345/1362; 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 291 (2018).

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

[282] Shindell, Drew et al., Quantified, localized health benefits of accelerated carbon dioxide emissions reductions, 8 Nature Climate Change 291 (2018), https://www.nature.com/articles/s41558-018-0108-y.

[283] Bressler, R. Daniel, The mortality cost of carbon, 12 Nature Communications 4467 (2021).

[284] The difference between the carbon budget needed to limit warming to 1.5°C versus 2°C is 750 Gt, based on the IPCC Sixth Assessment (see Intergovernmental Panel on Climate Change, Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at Table SPM.2). With each 4,434 metric tons of CO_2 estimated to result in one death, the additional 750 Gt CO_2 emitted with 2°C versus 1.5°C of temperature rise equates to 169 million additional deaths.

[285] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 146.

Snowpack is important for providing water in many regions. 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.[286] As temperatures rise, western U.S. winter and spring snowpack are projected to continue to decline,[287] and more precipitation will fall as rain instead of snow in the cold season in many parts of the U.S.[288] 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.[289]

As a key example, climate change is depleting water flows in the Colorado River Basin, one of the most important water systems in the U.S. that provides water for 40 million people and supports one trillion dollars of economic activity each year. Across much of the Colorado River Basin, spring snowpack, runoff, and streamflow have declined, disrupting the region's water supply.[290] Colorado River flow has decreased by roughly 20% over the last century, and one-half of that decline is attributed to decreased precipitation and increased warming due to climate change.[291] Studies estimate that every degree Celsius of warming decreases Colorado River flow by 9%.[292]

Climate change is also playing an important role in reducing soil moisture as temperatures rise, intensifying "agricultural" droughts.[293] Under higher emissions scenarios, continuing decreases in surface soil moisture and widespread drying over most of the United States are projected.[294] Future warming is expected to lead to greater frequencies and magnitudes of agricultural droughts throughout the continental United States as evapotranspiration outpaces precipitation.[295]

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[286] 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, Vol. I (2017), https://science2017.globalchange.gov/ at 231, 236.
[287] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017) https://science2017.globalchange.gov/ at 207, 231.
[288] *Id.* at 207.
[289] *Id.* at 231, 232, 239, 240.
[290] 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; Udall, Bradley & Jonathan Overpeck, The twenty-first century Colorado River hot drought and implications for the future, 53 Water Resources Research 2404 (2017).
[291] Xiao, M. et al., On the causes of declining Colorado River streamflows, 54 Water Resources Research 6739(2018), https://doi.org/10.1029/2018WR023153; Hoerling, M. et al., Causes for the century-long decline in Colorado River flow, 32 Journal of Climate 8181 (2019), https://journals.ametsoc.org/view/journals/clim/32/23/jcli-d-19-0207.1.xml.
[292] Milly, P.C.D and K.A. Dunne, Colorado River flow dwindles as warming-driven loss of reflective snow energizes evaporation, 367 Science 1252 (2020).
[293] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 237.
[294] *Id.* at 237.
[295] *Id.* at 237.

N. Declining food security

Climate change is threatening U.S. food security[296] by decreasing crop yields and nutritional content, creating unsafe conditions for agricultural workers, increasing stress to livestock, contaminating food supplies, and decreasing access to food.[297] 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.[298] 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."[299]

Rising temperatures are projected to substantially reduce the yields of four major crops that make up two-thirds of human caloric intake and are critical for food security.[300] The U.S. is expected to suffer the greatest losses globally for maize and soybeans, with each degree Celsius of temperature rise projected to reduce maize yields by 10%, soybeans by 6.8%, and wheat by 5.5%.[301] A separate analysis estimated that *each additional ton* of CO_2 results in crop losses costing $8.50.[302] Research also indicates that crops will become less 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% less protein than the same crops grown at current carbon dioxide levels, as well as fewer key nutrients such as zinc, calcium and magnesium.[303] 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.[304] Further, since agriculture is the biggest driver of water shortages in the world, accounting for 70% of global water withdrawals,

[296] About 14% 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. *See* Public Health Institute/Center for Climate Change and Health, Food Security, Climate Change and Health (2016).
[297] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 391–437.
[298] 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 150; Brown, M.E. et al., Climate Change, Global Food Security, and the U.S. Food System (2015), http://www.usda.gov/oce/climate_change/FoodSecurity2015Assessment/FullAssessment.pdf.; U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 391–437.
[299] 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 150.
[300] Zhao, Chuang et al., Temperature increase reduces global yields of major crops in four independent estimates, 114 PNAS 9326 (2017).
[301] *Id.*
[302] Moore, Frances C. et al., New science of climate change impacts on agriculture implies higher social cost of carbon, 8 Nature Communications 1607 (2017), https://www.nature.com/articles/s41467-017-01792-x.
[303] U.S. Global Change Research Program, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment (2016) at 198.
[304] Deutsch, Curtis A. et al., Increase in crop losses to insect pests in a warming climate, 361 Science 916 (2018).

future changes in water availability will profoundly impact agricultural production on the whole.[305] Rising temperatures are also increasing unsafe working conditions for the more than one million agricultural workers in the U.S., with the number of unsafe days nearly doubling under 2°C of temperature rise and nearly tripling under 4°C.[306]

Livestock cultivation occurs over approximately 30% 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.[307] 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.[308]

Fisheries and aquaculture provide 4.3 billion people with 15 to 20% of their intake of animal protein.[309] 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.[310] 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.[311] This shift in fish distribution has negative implications for fisheries that rely on specific fish species for subsistence.

Algal bloom species have been expanding their ranges, and many are dangerous to humans because the toxins they produce can 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.[312] 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

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305 United Nations Convention to Combat Desertification, The Global Land Outlook (2017), https://www.unccd.int/actions/global-land-outlook-glo.
306 Tigchelaar, Michelle et al., Work adaptations insufficient to address growing heat risk for U.S. agricultural workers, 15 Environmental Research Letters 094035 (2020), doi:10.1088/1748-9326/ab86f4.
307 U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 406-408.
308 Brown, M.E. et al. Climate Change, Global Food Security, and the U.S. Food System (2015), http://www.usda.gov/oce/climate_change/FoodSecurity2015Assessment/FullAssessment.pdf at 57.
309 *Id.* at 58.
310 Tirado, M. C. et al., Climate change and food safety: A review, 43 Food Research International 1745 (2010).
311 Porter, J.R. et al., Food security and food production systems. In: 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 493.
312 Tirado, M. C. et al., Climate change and food safety: A review, 43 Food Research International 1745 (2010).

of PSP have expanded along both U.S. coasts, and also throughout Southeast Asia, Europe, and South America.[313] 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.[314]

O. Economic impacts

The climate crisis is exacting a heavy economic toll, already costing U.S. economy more than $1 trillion dollars in damages, with economic losses worsening with each additional ton of carbon pollution.[315] Each 1°C temperature rise is estimated to decrease U.S. gross domestic product (GDP) by 1.2%, with the poorest regions of the U.S. suffering most.[316] A 2021 study of the health costs in the U.S. of air pollution from fossil fuel combustion and resulting climate change estimated the costs already exceed $800 billion per year and are expected to become even more expensive without rapid action to curb fossil fuel pollution.[317] At the global scale, warming of 2°C versus 1.5°C is projected to decrease global GDP by an additional 1.5 to 2% and cost $7.7 to 11.1 trillion in damages by mid-century.[318]

The Fourth National Climate Assessment similarly concludes 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.[319]
>
> 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

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[313] Gilbert, P. et al., The global, complex phenomena of harmful algal blooms, 18 Oceanography 136 (2005).
[314] Tirado, M. C. et al., Climate change and food safety: A review, 43 Food Research International 1745 (2010).
[315] Hsiang, Solomon et al., Estimating economic damage from climate change in the United States, 356 Science 1362 (2017), https://science.sciencemag.org/content/356/6345/1362; Burke, Marshall, Written Testimony of Marshall Burke, Assistant Professor of Earth System Science, Stanford University, Hearing on "Examining the Macroeconomic Impacts of a Changing Climate," United States House Subcommittee on National Security, International Development, and Monetary Policy (2019), available at https://www.congress.gov/116/meeting/house/109911/witnesses/HHRG-116-BA10-Wstate-BurkeM-20190911.pdf.
[316] Hsiang, Solomon et al., Estimating economic damage from climate change in the United States, 356 Science 1362 (2017), https://science.sciencemag.org/content/356/6345/1362
[317] Medical Society Consortium on Climate and Health, The Costs of Inaction: The Economic Burden of Fossil Fuels and Climate Change on Health in the United States (2021), https://medsocietiesforclimatehealth.org/wp-content/uploads/2021/05/CostofInactionReport-May2021.pdf at 5.
[318] Burke, Marshall et al., Large potential reduction in economic damages under UN mitigation targets, 557 Nature 549 (2018), https://www.nature.com/articles/s41586-018-0071-9.
[319] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol. II (2018), https://nca2018.globalchange.gov/ at 25.

impacts will be irreversible for thousands of years, while others will be permanent.[320]

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.[321] The National Oceanic and Atmospheric 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.[322] 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.[323]

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% 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.[324] 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.[325] 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.[326] Annual damages to labor would be approximately $155 billion under RCP 8.5, but reduced by 48% under RCP 4.5.[327] While coastal property damage would carry an annual cost of $118 billion under RCP 8.5 in 2090, 22% of this cost would be avoided under RCP 4.5.[328]

P. Tipping points and compound climate extremes

The more fossil fuel pollution that is added to the atmosphere, the higher the risk of crossing planetary tipping points—abrupt and irreversible changes in Earth systems to states wholly outside human experience, resulting in severe physical, ecological and socioeconomic harms.[329] The Fourth National Climate Assessment concluded with very high confidence that 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

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320 *Id.* at 1357.
321 *Id.* at 81.
322 *Id.* at 66.
323 *Id.* at 66.
324 *Id.* at 1358, 1360.
325 *Id.* at 1349.
326 *Id.* at 552.
327 *Id.* at 1349.
328 *Id.* at 1349.
329 Intergovernmental Panel on Climate Change, Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021), https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ at 4-76; Fourth National Climate Assessment, Vol. I (2017) at 32, 411-423; Lenton, Timothy M. et al, Tipping elements in the Earth's climate system, 105 PNAS 1786 (2008).

as warming increases.[330] The IPCC *Climate Change 2021* report similarly concluded that "the higher the warming level and the longer the duration of overshoot [beyond 1.5°C], the greater the risk of unexpected changes."

Warm-water coral reefs and Arctic ecosystems are already experiencing devastating regime shifts, and evidence indicates that climate system is nearing tipping points including the collapse of the West Antarctic ice sheet,[331] enormous CO_2 and methane release from thawing Arctic permafrost,[332] and slowing of the Atlantic meridional overturning circulation which would worsen sea level rise along the U.S. east coast and cause global weather and climate disruptions.[333]A 2019 expert review concluded in stark terms that "the evidence from tipping points alone suggests that we are in a state of planetary emergency: both the risk and urgency of the situation are acute."[334]

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.[335] 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."[336] Another tipping point is the release of carbon as CO_2 and methane from thawing Arctic permafrost, which has the potential to "drive continued

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[330] 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).

[331] 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); U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 420; Pattyn, Frank et al., The Greenland and Antarctic ice sheets under 1.5°C of global warming, 8 Nature Climate Change 1053 (2018); Garbe, Julius et al., The hysteresis of the Antarctic ice sheet, 585 Nature 538 (2020).

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

[333] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 418; Boers, Niklas, Observation-based early-warning signals of the collapse of the Atlantic Meridional Overturning Circulation, 11 Nature Climate Change 680 (2021).

[334] Lenton, Timothy M. et al., Climate tipping points—too risky to bet against, 575 Nature 592 (2019).

[335] 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).

[336] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 420.

warming even if human-caused emissions stopped altogether."[337] Evidence suggests that increased rainfall and meltwater from Arctic glaciers are causing the weakening of 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).[338] Another analysis warns that 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.[339]

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."[340]

Q. 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. 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. 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. Even if all greenhouse emissions were to completely cease today, significant ongoing regional changes in temperature and precipitation would still occur, global average temperatures would not drop significantly for at least 1,000 years, and sea-level rise would continue for millennia. 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."[341]

VII. The Managed Decline in Federal Oil and Gas Extraction Should be Accomplished in Conjunction with Other Policies to Redress the Inadequacy of Current U.S. Climate Policy

The United States has contributed more to climate change than any other country and is a dominant global driver in expanding the fossil fuel production driving the climate crisis. The

337 U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ 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).
338 U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 418; Fourth National Climate Assessment, Vol. I (2017) at 418; Boers, Niklas, Observation-based early-warning signals of the collapse of the Atlantic Meridional Overturning Circulation, 11 Nature Climate Change 680 (2021).
339 Steffen, Will et al., Trajectories of the Earth System in the Anthropocene, 115 PNAS 8252 (2018).
340 U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/ at 416.
341 National Research Council, Warming World: Impacts by Degree (2011) at 3.

U.S. is the world's biggest cumulative emitter of greenhouse gas pollution, responsible for 25% of cumulative global CO_2 emissions since 1870,[342] and is currently the world's second highest emitter on an annual basis and highest emitter on a per capita basis.[343] The U.S. is also the world's largest oil and gas producer and second-largest coal producer.[344] However, current U.S. climate policy is wholly inadequate to meet the international Paris Agreement climate limits and avoid the worst damages of climate change.

Estimates of an equitable U.S. "fair share" of emissions reductions needed to meet a 1.5°C climate limit make clear that the U.S. must rapidly decarbonize across all sectors. The United States has a responsibility to make much larger emissions reductions than the global average due to its dominant role in driving fossil fuel emissions and resulting climate change harms, combined with greater financial resources and technical capabilities to implement emissions cuts and transition to clean energy. Using an equity approach based on responsibility and capability, the U.S. fair share of emissions reductions for meeting a 1.5°C Paris limit equates to cutting U.S. domestic emissions by at least 70% below 2005 levels by 2030 and reaching near zero emissions by 2040, paired with financial and technological support for large-scale emissions reductions internationally.[345]

However, the United Nations *Emissions Gap Report* warned that the United States is vastly off-track to limit warming to 1.5°C or even 2°C and must greatly accelerate greenhouse gas emissions reductions.[346] The report concluded that limiting warming to 1.5°C requires countries to strengthen their climate pledges fivefold to cut emissions by at least 7.6% per year through 2030, for a total emissions reduction of 55% between 2020 and 2030.[347] Importantly, the report concluded that the U.S. "in particular" must ramp up climate action to meet global climate limits and its pledge under the Paris Agreement.[348] The report warned that further delays in emissions cuts threaten the global economy, food security, and biodiversity:

> Further delaying the reductions needed to meet the goals would imply future emission reductions and removal of CO_2 from the atmosphere at such a magnitude that it would result in a serious deviation from current available pathways. This,

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342 Global Carbon Project, Global Carbon Budget (Dec. 5, 2018), https://www.globalcarbonproject.org/carbonbudget/18/files/GCP_CarbonBudget_2018.pdf at 19 (*See* Historical cumulative fossil CO_2 emissions by country).
343 Le Quéré, Corinne et al., Global carbon budget 2018, 10 Earth Syst. Sci. Data 2141 (2018), at 2163, Figure 5.
344 SEI, IISD, ODI, E3G, and UNEP, The Production Gap Report 2021 (2021), http://productiongap.org/2021report at Table 4.1.
345 Muttitt, Greg & Sivan Kartha, Equity, climate justice and fossil fuel extraction: principles for a managed phase out, 20 Climate Policy 1024 (2020); U.S. Climate Action Network, The U.S. Climate Fair Share (2020), https://usfairshare.org/backgrounder/.
346 United Nations Environment Programme, Emissions Gap Report 2019, UNEP, Nairobi (2019), https://www.unenvironment.org/resources/emissions-gap-report-2019 at 37.
347 United Nations Environment Programme, Emissions Gap Report 2019, UNEP, Nairobi (2019), https://www.unenvironment.org/resources/emissions-gap-report-2019 at XV, XX, 26.
348 United Nations Environment Programme, Emissions Gap Report 2019, UNEP, Nairobi (2019), https://www.unenvironment.org/resources/emissions-gap-report-2019 at 12 ("the main contributions would need to come in particular from the United States of America.") and 11 (Table 2.2 shows the U.S. on course to exceed its pledge under the Paris Agreement by 16.5% by 2030 under current policy).

together with necessary adaptation actions, risks seriously damaging the global economy and undermining food security and biodiversity.[349]

Yet as summarized by the Fourth National Climate Assessment, U.S. efforts to mitigate greenhouse gas emissions do not approach the scale needed to avoid "substantial damages to the U.S. economy, environment, and human health and well-being over the coming decades":

> Climate-related risks will continue to grow without additional action. Decisions made today determine risk exposure for current and future generations and will either broaden or limit options to reduce the negative consequences of climate change. While Americans are responding in ways that can bolster resilience and improve livelihoods, neither global efforts to mitigate the causes of climate change nor regional efforts to adapt to the impacts currently approach the scales needed to avoid substantial damages to the U.S. economy, environment, and human health and well-being over the coming decades.[350]

Importantly, to meet a 1.5°C limit, most U.S. and global fossil fuels must remain undeveloped including an immediate halt to new fossil fuel production and infrastructure and a phase-out of existing production and infrastructure within the next several decades.[351] However, rather than reducing fossil fuel extraction and use, U.S. policies have aggressively promoted ever greater fossil fuel production and infrastructure including by enabling dangerous hydraulic fracturing, lifting the crude oil export ban, providing billions in government subsidies to the fossil fuel industry,[352] and violating Indigenous Peoples' treaty rights.[353]

The managed decline in federal oil and gas extraction should be taken in conjunction with other critical policy actions to redress this inadequacy. Complementary policy measures include, but are not limited to, permanently ending new federal fossil fuel leasing[354] and cancelling existing leases that were improperly issued, obtained through fraud or misrepresentation, and for

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[349] United Nations Environment Programme, Emissions Gap Report 2019, UNEP, Nairobi (2019), https://www.unenvironment.org/resources/emissions-gap-report-2019 at XX.

[350] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Vol.II (2018), https://nca2018.globalchange.gov/ at 34.

[351] Rogelj, Joeri et al., Energy system transformations for limiting end-of-century warming to below 1.5°C, 5 Nature Climate Change 519 (2015): Rogelj et al. (2015) estimated that a reasonable likelihood of limiting warming to 1.5° or 2°C requires global CO_2 emissions to be phased out by mid-century and likely as early as 2040-2045; 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 (Oct. 6, 2018), http://www.ipcc.ch/report/sr15/; 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.

[352] SEI, IISD, ODI, E3G, and UNEP, The Production Gap Report 2021 (2021), http://productiongap.org/2021report at 39.

[353] Indigenous Environmental Network & Oil Change International, Indigenous Resistance Against Carbon (2021), https://www.ienearth.org/wp-content/uploads/2021/09/Indigenous-Resistance-Against-Carbon-2021.pdf.

[354] 500 Groups Urge Biden to Order Fossil Fuel Leasing Ban, Center for Biological Diversity (Dec. 15, 2020), https://biologicaldiversity.org/w/news/press-releases/500-groups-urge-biden-order-fossil-fuel-leasing-ban-2020-12-15/.

unacceptable environmental damage.[355] Additional measures include ending the approval of new fossil fuel infrastructure projects[356], declaring a climate emergency and re-instating the crude oil export ban[357], and limiting gas exports to the full extent allowed by the Natural Gas Act. Further necessary actions are contained in a model executive order submitted to President Biden by over 350 organizations.[358]

VIII. DOI Must Acknowledge And Reject The Myth Of "Perfect Substitution"

In its review of this petition, the Department of the Interior must disavow a discredited economic assumption known as "perfect substitution," which obscures the greenhouse gas emissions from federal fossil fuel production. Rejecting the "perfect substitution" myth is necessary to accurately analyze the impacts of the managed decline of federal oil and gas production proposed herein.

Four separate federal court decisions, from the Ninth, Tenth, and D.C. Circuit Court of Appeals, and the District of Montana, all firmly rejected federal agency NEPA reviews that either denied the proposed fossil fuel project would have any adverse market and climate effect or claimed that the market effect was too uncertain. Most recently, the Ninth Circuit invalidated a Bureau of Ocean Energy Management ("BOEM") NEPA review that failed to adequately compare the greenhouse gas emissions of the action and no action alternatives of the Liberty oil and gas drilling project.[359] BOEM concluded that the no action alternative — rejecting the Liberty project — would, counterintuitively, increase greenhouse gas emissions by shifting production to foreign sources with comparatively weaker environmental protections.[360]

But BOEM's model assumed foreign consumption of oil would remain static were the Liberty project approved; crucially, this assumption ignored "basic economic principles" that are key to understanding climate impacts. As the Court explained, increasing the supply of fossil fuels such as oil (*i.e.*, approving the Liberty project) reduces prices; as price drops, foreign consumers will buy and consume more oil.[361] Thus, the Court concluded, emissions from predictable market responses, whether domestic or foreign "are surely a 'reasonably foreseeable' indirect effect" that must be analyzed and disclosed under NEPA.[362]

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[355] After Spill, Legal Petition Urges Biden Administration to End Oil Drilling Off California, Center for Biological Diversity (Oct. 20, 2021), https://biologicaldiversity.org/w/news/press-releases/after-spill-legal-petition-urges-biden-administration-to-end-oil-drilling-off-california-2021-10-20/.
[356] Legal Petition Demands Biden Administration Stop Unlawful Fossil Fuel Projects, Center for Biological Diversity (Oct. 6, 2021), https://biologicaldiversity.org/w/news/press-releases/legal-petition-demands-biden-administration-stop-unlawful-fossil-fuel-projects-2021-10-06/.
[357] Legal Petition Pushes President Obama to End Crude Oil Exports, Declare Climate Emergency, Center for Biological Diversity (Apr. 20, 2016), https://www.biologicaldiversity.org/news/press_releases/2016/climate-emergency-04-20-2016.html.
[358] Biden Urged to Sign Climate Emergency Executive Order, Center for Biological Diversity (Dec. 16, 2020), https://biologicaldiversity.org/w/news/press-releases/biden-urged-sign-climate-emergency-executive-order-2020-12-16/.
[359] *Center for Biological Diversity v. Bernhardt*, 982 F.3d 723, 736 (9th Cir. 2020).
[360] *Id*.
[361] *Id*.
[362] *Id*.

Similarly, the Tenth Circuit Court of Appeals invalidated a BLM NEPA review where the agency asserted that there would be no difference in the market or climate effects of a decision to authorize the expansion of two coal mines that operate on public lands in Wyoming. "Even if we could conclude that the agency had enough data before it to choose between the preferred and no action alternatives, this perfect substitution assumption is arbitrary and capricious because the assumption itself is irrational (i.e., contrary to basic supply and demand principles)."[363]

The D.C. Circuit similarly rejected a Federal Energy Regulatory Commission ("FERC") NEPA review for the Sabal Trail natural gas pipeline where FERC dodged meaningful analysis of substitution effects by asserting that the project's GHG emissions "might be partially offset" by the market replacing the project's gas with either coal or other gas supply.[364] The Court dismissed FERC's failure to study this issue, stating, "[a]n agency decisionmaker reviewing this EIS would thus have no way of knowing whether total emissions, on net, will be reduced or increased by this project, or what the degree of reduction or increase will be. In this respect, then, the EIS fails to fulfill its primary purpose."[365]

The federal district court in Montana, like the Tenth Circuit, rejected a Department of the Interior environmental assessment where the agency claimed its decision would not likely have any impact on nationwide GHG emissions because other coal mines would be available to meet a supposedly immutable demand for coal if the agency were to select the no action alternative.[366] In *Montana Environmental Information Center v. OSM*, the federal Office of Surface Mining Reclamation and Enforcement ("OSM") asserted in its environmental assessment that, "[t]he No Action Alternative would not likely result in a decrease in CO_2 emissions attributable to coal-burning power plants in the long term. There are multiple other sources of coal that could supply the demand for coal."[367] The *MEIC* court squarely rejected OSM's assertion:

> This conclusion is illogical, and places [OSM's] thumb on the scale by inflating the benefits of the action while minimizing its impacts. It is the kind of "inaccurate economic information" that "may defeat the purpose of [NEPA analysis] by impairing the agency's consideration of the adverse environmental effects and by skewing the public's evaluation of the proposed agency action."[368]

This long line of cases provides the Department of the Interior with ample justification to acknowledge and reject past assumptions of perfect substitution that downplayed the significance of agency actions with respect to reducing greenhouse gas pollution and associated climate change impacts. Indeed, in correcting these prior analytic errors, the Department must abandon its past reliance on perfect substitution and explain why that approach was wrong.[369] Such action

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[363] *WildEarth Guardians v. BLM*, 870 F.3d 1222, 1236 (2017).
[364] *Sierra Club v. Fed. Energy Regulatory Comm'n*, 867 F.3d 1357, 1375 (D.C. Cir. 2017).
[365] *Id.*
[366] *Montana Environmental Information Center v. OSM*, 274 F.Supp.3d 1074, 1098 (D. Mont. 2017).
[367] *Id.*
[368] *Id.* (quoting *NRDC v. Forest Service*, 421 F.3d 797, 811 (9th Cir. 2005)).
[369] *W. Deptford Energy, LLC v. FERC*, 766 F.3d 10, 17 (D.C. Cir. 2014) (agencies "cannot depart from [prior] rulings without provid[ing] a reasoned analysis indicating that prior policies and standards are being deliberately

is crucial to accurately measure and analyze the phase-down of oil and gas production proposed herein.

CONCLUSION

Thus, you must take swift and decisive action to implement a managed decline of oil and gas production on public lands and waters. Allowing continued, unchecked extraction of fossil fuels would all but make it impossible to avoid disastrous climate change and to keep global temperature increases well below 1.5°C of warming. We have reached the point that unabated fossil fuel production now presents a clear and present danger to the climate, natural habitats and wildlife across the United States, and is unjustly burdening impacted communities everywhere. With the aforementioned in mind, we respectfully ask that you grant our petition and use your inherent authority to control the rates of oil and gas production in order to save our environment from the disastrous scourge of fossil fuels.

Respectfully submitted,

Center for Biological Diversity
[List of Groups]

changed, not casually ignored"); *Wis. Valley Improvement v. FERC*, 236 F.3d 738, 748 (D.C. Cir. 2001) ("an agency acts arbitrarily and capriciously when it abruptly departs from a position it previously held without satisfactorily explaining its reason for doing so").

APPENDIX