Center for American Progress



Revamping Federal Climate Science

Recommendations for the Next President of the United States

By John Podesta, Bidisha Bhattacharyya, and Bianca Majumder December 2020

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Introduction and summary

The United States has been the global leader in climate science for decades. Unfortunately, progress has slowed—and in some cases, even moved backward over the past four years, with the Trump administration dismantling core elements of the federal climate science apparatus. As the country and the planet head toward an increasingly unstable climate, the U.S. government needs to get back to the business of being the preeminent source of trusted applied science that supports climate change mitigation and adaptation decision-making of governments and civilian stakeholders.

The science is clear: To avoid the worst impacts of climate change, the United States and the world must take aggressive action to decarbonize all sectors of the global economy, protect the Earth's natural systems, and limit warming to 1.5 degrees Celsius above preindustrial levels. This means achieving net-zero greenhouse gas emissions globally by no later than 2050 and ensuring an equitable and just transition to a clean energy economy. Course-correcting the United States on tackling the multifaceted climate crisis is among the top challenges that the incoming Biden administration will have to address head-on. To do so, the administration must take a number of significant actions. These include setting a midcentury economywide decarbonization goal; taking steps to reduce toxic pollution in low-income communities and communities of color; making a public commitment to conserve and protect 30 percent of U.S. lands and oceans by 2030; and updating the United States' nationally determined contribution under the Paris climate agreement. For each of these major goals, the federal government must provide the scientific research and data to inform its mitigation and adaptation strategies as well as the decision-making of a wide variety of stakeholders who must respond to the climate crisis as it evolves.

This report provides a blueprint for how the Biden administration can restore, restructure, and expand federal climate science to support a bold, whole-of-government approach to tackle the climate crisis. It synthesizes recommendations that the Center for American Progress has collected from top climate science and policy experts who have worked across the federal government and academia. To address the scale of the climate coordination challenge, the report recommends actions to restore scientific integrity (SI) across the federal government; expand and improve the federal climate science workforce; make structural changes within the White House and federal agencies to support effective climate science prioritization and coordination across physical science research, mitigation, and adaptation; and prioritize international climate science collaboration. The Appendix provides a list of sources for reference and further reading.

The Biden administration must take immediate action on day one and during its first 100 days in office to restore SI across the federal government, undo the steps the Trump administration has taken to deprioritize, censor, and stall climate science, and safeguard federal science from future interference. The new administration will need to restore and revamp the federal climate science apparatus so that it can inform critical decisions—from how to develop technology and protect public lands and waters to how to address the hardestto-decarbonize sectors and best help communities to plan for future natural disasters. These actions are critical to addressing the existential climate and nature crises that threaten clean air and water, food security, biodiversity, and livelihoods around the world.

Summary of policy recommendations for the incoming administration

Actions to take on day one:

- 1. Issue an executive order to restore scientific integrity and science-based decision-making across all federal agencies.
- 2. Issue a presidential memorandum to update the social cost of carbon.
- 3. Announce the appointment of climate scientists and climate policy experts to key White House and agency positions.
- 4. Issue an executive order to establish a National Climate Council at the White House.

Actions to take in the first 100 days:

- 1. Recruit top, diverse talent into the federal climate science workforce.
- 2. Issue a presidential memorandum to centralize prioritization and coordination of climate science under the Office of Science and Technology Policy (OSTP).
- 3. Issue an executive order to elevate and refocus the U.S. Global Change Research Program (USGCRP).
- 4. Elevate and prioritize earth sciences at NASA.
- 5. Issue a presidential memorandum directing OSTP to identify major crosscutting climate research priorities for the next decade. The memorandum should:
 - a. Request a National Academies of Sciences, Engineering, and Medicine cross-agency decadal survey
 - b. Institute an interagency research and budget prioritization process for the USGCRP in lockstep with OMB that includes a stakeholder engagement process
- 6. Issue an executive order on coordination and accessibility of federal climate data that:
 - a. Initiates a process for the review and declassification of climate datasets
 - b. Initiates stakeholder engagement in USGCRP agencies to create usable climate data tools
 - c. Creates data workforce recruitment pipelines
- 7. Issue a presidential memorandum to coordinate and build out climate services.
- 8. Reinstate and update the presidential memorandum on climate change and national security.
- 9. Issue an executive order to update the Federal Flood Risk Management Standard.
- 10. Implement a road map to ensure critical infrastructure security and resilience.
- 11. Issue an executive order to ensure that addressing the climate and nature crises are central to federal land, water, and wildlife management.
- 12. Restore Endangered Species Act protections.
- 13. Reengage and invest in international research collaborations by:
 - a. Fully reengaging in the Arctic Council
 - b. Deepening and expanding bilateral climate research collaboration
 - c. Restoring full dedicated U.S. funding to the Intergovernmental Panel on Climate Change (IPCC) and the U.N. Framework Convention on Climate Change (UNFCC)
- 14. Rejoin international alliances that are coordinating on advancing climate solutions. The United States should:
 - a. Restore U.S. global clean energy R&D leadership under Mission Innovation
 - b. Return to its leadership role in the Clean Energy Ministerial
 - c. Reengage in the International Solar Alliance
 - d. Leverage science to support developing countries in implementing the Paris climate agreement

Recommendations to restore scientific integrity across the government

DAY ONE:

- Issue an executive order to restore scientific integrity and science-based decision-making across all federal agencies.
- Issue a presidential memorandum to update the social cost of carbon.

Policies to restore scientific integrity (SI) and science-based decision-making should form the backbone of any comprehensive administrative strategy to restore and ensure protection and longevity of the federal climate science apparatus. Over the past four years, federal SI policies have buckled under the weight of a concerted effort to dismantle science-backed decision-making.¹ The new administration should prioritize safeguarding the federal climate science infrastructure by building resilient SI policy and creating channels for accountability to ensure that agencies use science to support decision-making and policy design. Importantly, there must be equivalent SI policy and formal implementation procedures across all federal agencies if SI policy is to generate a culture of proper enforcement, unlike under previous administrations.

In addition to taking these forward-looking steps, the new administration must correct previous breaches in SI across agencies. It should be noted that many dedicated career scientists across agencies have worked tirelessly over the past four years to maintain SI, despite efforts to thwart them. But there is much work to be done to repair the damage. Urgent problems to address include political interference in grant-making decisions, hindered dissemination of agency science, attacks on and censorship of individual scientists and their careers, and anti-science policies and regulations in agencies. There is also a pressing need to address the previous lack of enforcement of science-based policies, the lack of accountability for breaches of SI, and the absence of channels through which federal scientists can report on infringement of their work.

This section recommends actions that the Biden administration can take on day one to restore SI across the federal government.

Issue an executive order to restore scientific integrity and sciencebased decision-making across all federal agencies

Although not specific to climate and environmental science, an executive order on SI and science-based decision-making should be a central pillar of a strengthened federal climate science apparatus. The 2009 Obama-era SI memo serves as a good starting point for a new executive order. (see Appendix) The new administration should amend and strengthen the memo so that it has a clearer oversight mechanism over SI across agencies. Below are recommendations for what the executive order should include.

Establish White House structure and oversight of SI through OSTP

The new executive order should:

- Set a multilevel structure for SI accountability and oversight across the federal government, beginning with establishing an SI structure in the White House and ending with an SI baseline for agencies, including prescribed avenues of accountability.
- Designate OSTP as the primary White House coordinator of SI policy. OSTP should be given the explicit authority and capacity to monitor, implement, and intervene on breaches of SI and agency prioritization of science. It should also oversee and coordinate a standardized baseline of SI policy across agencies, while allowing enough flexibility to accommodate variation in agency processes and cultures.
- Direct OSTP to establish clear, transparent procedures through which scientists can receive approval to go to conferences.
- Direct OSTP to set out a clear process and common baseline across agencies for how scientists can appeal or otherwise seek recourse when they are being censored.
- Direct OSTP to fund and populate the U.S. Merit Systems Protection Board to provide government scientists the ability to appeal on infringements on science and their careers.
- Include a suite of strong whistleblower protections that goes beyond these recommendations.

Promote SI across federal agencies

The executive order should mandate that each agency in the USGCRP have a chief SI officer (CSIO) or SI officer who will act as the point person for both internal SI directives as well as the implementation of OSTP-determined SI priorities for agencies. Some agencies, such as the U.S. Department of Agriculture (USDA), already have this position, but the remaining agencies should codify it in their

departmental regulation or equivalent internal guidance or statute in accordance with this executive order. Ideally, the executive order should recommend guidelines for the position qualifications—most importantly, that the person be a senior scientist (GS-14 or above) who has experience in managing projects or programs. Note that currently, CSIOs and chief scientists are the same or separate roles depending on the agency, so it will be important to standardize titles across agencies to ensure the two are not conflated and can coordinate internally—for example, a CSIO can be attached to the office of the agency's chief scientist.

The executive order should direct the heads of agencies to express their commitment to SI and whistleblower protections to all agency staff and to encourage agency scientists to report SI infractions to their agency SI officer. The executive order should require agency inspectors general to formalize relationships with SI officers in order to ensure adequate investigatory powers. Individual departments within agencies could be encouraged to establish department regulations specifically for SI. NASA, for example, could do so through its policy documents. The executive order should also direct agencies to restore all scrubbed climate science language from agency documents and official rule-making. Finally, the executive order should specify that career officials, not political appointees, should be in charge of grant review at agencies. This will help to safeguard against the types of infringements that occurred under the Trump administration's Department of the Interior.

Undo the Trump administration's anti-science actions

In parallel to taking proactive actions to restore SI and science-based decisionmaking across the federal government, the Biden administration must undo actions of the Trump administration. Specific actions that the new executive order can address include the following:

- Rescind President Donald Trump's executive order 13875, "Evaluating and Improving the Utility of Federal Advisory Committees,"² requiring all federal agencies to terminate at least one-third of agency advisory committees. In its place, the new executive order should direct agencies to evaluate the losses and reinstate necessary committees.
- Rescind the Environmental Protection Agency's (EPA) "Strengthening Transparency in Regulatory Science" rule³ if it is finalized before a new administration takes office. The rule prevents the EPA from using scientific studies to underpin regulatory actions if the studies' underlying raw data cannot be made available publicly—primarily affecting regulations that would be justified by often sensitive personal health information of study participants.

• Revoke the Department of the Interior's "Promoting Open Science" rule,⁴ which restricts the science and data the agency can use in its research and decision-making.

For further details on SI recommendations, see reports from the Union of Concerned Scientists and a report from a coalition of SI advocates.⁵

Along with the executive order, the new president should work with Congress to pass bills or appropriations language to more durably protect SI under future administrations. For example, the president could work with Congress to enact requirements ensuring that political appointees at agencies are not be able to interfere with the production or reporting of grant-funded climate science projects. The president could also support congressional efforts to expand the Whistleblower Protection Enhancement Act.

Issue a presidential memorandum to update the social cost of carbon

The next administration should take action on day one to update the social cost of carbon, a metric that state and federal agencies use in rule-making processes to conduct cost-benefit analyses of proposed rules or policies. This foundational element of regulatory actions is a dollar estimate of the economic damages that would result from emitting 1 additional ton of greenhouse gases into the atmosphere.⁶

President Barack Obama created the Interagency Working Group on the Social Cost of Greenhouse Gases, coordinated by the Office of Information and Regulatory Affairs (OIRA), to develop an social cost of carbon that would be used across agencies. In 2013, this working group came up with a social cost of carbon estimate of \$37 per metric ton of carbon dioxide emitted into the atmosphere.⁷ The working group then requested guidance from the National Academies of Sciences, Engineering, and Medicine on how to improve and update its estimate. In 2017, the academy issued a report laying out a process for doing so, using the best available science.⁸

That same year, President Trump issued an executive order rescinding the Obama-era social cost of carbon and set it effectively to zero.⁹ This means that the economic impacts and damages of climate change currently have effectively zero weight in government rule-making cost-benefit analyses. The next administration must revisit this immediately. On day one, the next president should issue a presidential memorandum to OIRA to reestablish the Obama-era Interagency Working Group on the Social Cost of Greenhouse Gases and direct it to update the social cost of carbon with guidance from the National Academies of Sciences, Engineering, and Medicine's 2017 report.¹⁰ The good news is that this working group does not have to start from scratch; it can build on existing work that nongovernmental groups have done in the absence of government action.¹¹

Recommendations for rebuilding the federal climate science workforce

DAY ONE:

• Announce the appointment of climate scientists and climate policy experts to key White House and agency positions.

FIRST 100 DAYS:

- Recruit top, diverse talent into the federal climate science workforce.
- Train and support the federal climate science workforce.
- Empower the next generation of climate scientists and decision-makers.

The new administration will need to rebuild the federal scientific workforce, from political appointees to career positions. It will need to ensure that diverse voices and perspectives are brought into the federal climate science apparatus. Rebuilding this workforce to meet the challenges of the coming decades is critical to ensuring that the federal climate science apparatus can function effectively.

On day one, the next president must prioritize selection and confirmation of qualified professionals for prominent climate and conservation appointments in the White House and federal agencies. Equally important is the hiring of thousands of diverse federal scientists to staff positions across agencies that were lost under the Trump administration due to agency consolidation, budget cuts, loss of morale, protest, or intimidation.

Announce the appointment of climate scientists and climate policy experts to key White House and agency positions

On day one, the president should announce appointments of scientists to high-level White House and agency roles. These scientists must have a deep understanding of climate science and/or climate policy. To ensure that equity is integrated into all decision-making, this team should include members of environmental justice communities. These actions will send an important signal that the administration is centering decision-making around science and equity. Key White House positions to fill include the director of the Office of Science and Technology Policy and NASA's chief scientist. The administration should also prioritize and fill key federal agency positions relating to energy, climate science, and the environment.

Recruit top, diverse talent into the federal climate science workforce

In its first 100 days, the new administration needs to attract top, diverse talent to fill the vacancies across agencies in the federal climate science workforce. In the first two years of the Trump administration, more than 1,600 federal scientists left the government.¹² As of January 2020, more than 700 EPA scientists had left the federal government over the preceding three years—and only half of them had been replaced.¹³ The following sections outline specific actions that the new administration can take to jump-start the process of restoring and retaining a highly qualified federal climate science workforce.

Recruit talent from diverse universities and science alliances

The White House and federal agencies must expand their recruitment pool and focus on hiring a diverse workforce that reflects the makeup of the country. The next administration should engage with science policy alliances such as the American Association for the Advancement of Science (AAAS), the Society for Advancement of Chicanos/Hispanics and Native Americans in Science, the National Society of Black Engineers, and others to recruit diverse candidates with climate science backgrounds.

Reestablish and revamp fellowship pipelines

The new administration should expand existing science policy fellowship programs, which bring talented individuals from across the country into the government on a track to become permanent federal government workers. The Presidential Talent Programs should be expanded beyond the current Presidential Management Fellows Program administered by the Office of Personnel Management. Talent programs provide time-limited tour-of-duty term appointments in the federal government, recruiting exceptional talent and expertise from outside the government to work on specific, high-impact federal projects.¹⁴ The administration should also develop new talent programs with agency climate science and data initiatives in mind to help fuel the talent pipeline from the technology and other industry sectors. It should do all of this with a focus on equity in order to attract diverse talent to the federal climate science workforce. The AAAS Science and Technology Policy Fellowship program has been among the most successful avenues for getting climate scientists into the federal government, although it functions broadly and is not exclusive to climate scientists.¹⁵ To strengthen this pipeline specifically for climate scientists and strengthen fellows' chances of permanent placement at the end of their terms, the White House could partner with the AAAS to build a Climate Science and Technology Fellowship program with an eye toward offering permanent government positions to qualified, successful fellows.

To ensure that the United States is able to attract talented, STEM-educated professionals to conduct foreign policy, the next president should reinstate the State Department's Diplomacy Fellows Program, which allows individuals who have completed certain fellowship programs at the State Department to bypass the written component of the Foreign Service exam.¹⁶

Fund climate science fellowships

Agencies should also directly fund climate-science-related fellowships, such as the EPA's Star Fellowship for climate science and international public health and the National Oceanic and Atmospheric Administration (NOAA) Sea Grant program's Knauss Fellowship that focuses on the nexus between climate and ocean, as well as coastal and Great Lakes resources policy. These programs should be prioritized for funding in the president's annual budget request to Congress.

Fix USAJobs

USAJobs, the primary portal through which prospective job seekers browse and apply to open employment opportunities in the federal government, has a notoriously poor, unnavigable, and discouraging interface. The new administration should immediately direct an overhaul and redesign of the interface and system, which is long overdue. The redesign should be done intentionally with a more diverse set of users in mind, setting a key metric of attracting a more diverse set of scientific talent from historically underrepresented communities into federal jobs.

Train and support the federal climate science workforce

Members of the federal climate science workforce must have opportunities for career advancement and feel empowered in their roles. During onboarding, all senior agency political appointees and career officials should be trained on the impacts of climate change and how their agencies need to prepare. Most importantly, agencies should support the professional development and growth of their workforce by providing ample funding for travel and conferences so that government scientists can share their work, collaborate, and network within their greater research community.

Empower the next generation of climate scientists and decision-makers

The next administration should encourage universities to provide crossdisciplinary education in climate science and policy. One way to do this would be to direct agencies to create a certificate program through which public policy students at universities could learn the fundamentals of climate science. The administration can also establish a Climate Science Ambassador Program to send government climate scientists to universities to educate and recruit students into government career tracks. The program should emphasize travel to historically Black colleges and universities, tribal colleges, and other minorityserving institutions. The administration can leverage existing programs such as NASA's Office of Education in order to push for funding for these initiatives in the president's annual budget request to Congress.

Recommendations to coordinate climate science in the White House and across the federal government

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DAY ONE:

• Issue an executive order to establish a National Climate Council at the White House.

FIRST 100 DAYS:

- Issue a presidential memorandum to centralize prioritization and coordination of climate science under OSTP.
- Issue an executive order to elevate and refocus the USGCRP.
- Elevate and prioritize earth sciences at NASA.

The next administration will need to update the White House structure and processes to meet the scale of coordinated action required to tackle the climate challenge and adequately address urgent research priorities related to climate science, greenhouse gas mitigation, adaptation, and resilience to climate change impacts. This will require structural changes; a clear coordination process and defined roles for White House departments; an orderly research and budget prioritization process across federal agencies; and the incorporation of social sciences and adaptation and resilience priorities into research and data investments.

This section provides recommendations to revamp White House structures to meet the scale of the climate science challenge that the nation faces today and in the coming decade. It considers how to leverage interagency processes and focus the massive capacity of the federal government toward the highest-priority areas of climate science.

Issue an executive order to establish a National Climate Council at the White House

The next president should issue an executive order on day one to establish a new White House entity as the central policy coordination body on all climate changerelated activities across the federal government. This National Climate Council would centralize and tie together coordination of federal research prioritization, policy development, and program implementation for climate science and applied science for climate mitigation and adaptation/resilience. The council would mostly focus on coordinating and developing policy, but it would have a critical role in integrating climate science into this process. It should be chaired by the president and run by the assistant to the president for climate policy, and its structure should be based on aspects of the National Economic Council and National Security Council.

Issue a presidential memorandum to centralize prioritization and coordination of climate science under OSTP

In the first 100 days, the president should issue a presidential memorandum clarifying that OSTP is the National Climate Council's research and coordination lead for all climate science activities across the federal government. OSTP will coordinate climate science priorities across basic science, applied science to inform mitigation, and applied science to inform adaptation. The OSTP director should sit on the National Climate Council. To indicate that climate is the top scientific priority of the federal government, the OSTP director should have a climate science background, along with strong leadership and management experience. Under the OSTP director, the OSTP associate director for energy should instead be called the associate director for climate and environment to reflect that this person has a clear climate mandate.

Issue an executive order to elevate and refocus the USGCRP

The U.S. Global Change Research Program is designed to be the central interagency coordinating body for federal climate science across the federal government. Congress established it in the 1990 Global Change Research Act to develop and coordinate "a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change."¹⁷

The scientists and experts who worked in the original USGCRP describe it as an effective body in coordinating and prioritizing a climate science program across government agencies. However, the program has lost a lot of its authority and effectiveness since the 1990s, resulting in a more scattered and less coordinated federal climate science apparatus. Key among this decline was the USGCRP

leadership's loss of authority to strongly influence the development of climate science elements in the president's budget and in the process, to define climate science priorities for the federal government. This task has gradually decentralized into individual agencies, leaving the USGCRP to instead react to the president's budget and climate science priorities. As described in the following section, this loss was the result of a lack of priority given to climate as a policy issue and the lack of authority given to those involved in the interagency process, the loss of important interagency tools, and several other factors.

The scale of the climate crisis demands that the federal government urgently realign and elevate the USGCRP, structuring and equipping it to fulfill its broad mandate under the law. In the first 100 days, the president should issue an executive order to elevate the USGCRP within OSTP, mandating that it report directly to the OSTP director and is the focal point of federal climate science prioritization and coordination in the White House. The USGCRP should be set up to direct climate science research and investment priorities across the federal government and run an interagency process to prioritize and implement projects under each priority area. The executive order should include the following recommendations on how to restructure and empower the USGCRP to be an effective research prioritization and coordination body.

Staffing recommendations for the USGCRP

The USGCRP National Coordination Office, which runs the operations of the body, should have permanent federal staff. Currently, it is staffed with a few federal detailees and outside contractors, so it lacks the authority to effectively steer federal work.

The next administration should also restructure the Subcommittee on Global Change Research, which serves as a board of directors for the USGCRP. This subcommittee should consist of senior-level career officials from each USGCRP member agency with expertise in climate science and the ability to make policy recommendations and resource commitments on behalf of the agency. The subcommittee should also include a principal associate director from the Office of Management and Budget (OMB) who is fully engaged in the USGCRP process and given authority by the OMB director to help coordinate USGCRP efforts and serve as a bridge with OMB. The subcommittee members should be accountable to the OSTP director and ultimately to the president, but the president should make clear that these officials are free to operate independently and make recommendations without the influence of political appointees. This independence and protection from political winds was critical to the success of and trust in the interagency process under the USGCRP of the 1990s.

Recommendations for USGCRP's structure and scope

The president should direct the USGCRP to prioritize and coordinate research to inform 1) basic climate science; 2) policy to mitigate greenhouse gas emissions; and 3) policy to adapt to and increase resilience to climate change impacts. At the USGCRP's inception, its research was largely focused on understanding the climate problem rather than identifying how to address it. Thirty years later, while such basic science continues to be critical, applied science to inform action in mitigation and adaptation is much more urgent. In addition to advancing the scientific community's fundamental understanding of how the Earth's physical systems are responding to climate change, essential scientific questions to inform mitigation and adaptation must be prioritized.

CAP recommends the creation of three subgroups under the USGCRP: one focused on climate science, one focused on applied research to inform mitigation policy, and one focused on research to inform climate resilience and adaptation, which should include studying climate impacts on both humans and the natural world. The three subgroups should not work in silos but should instead produce one coordinated research plan and set of priorities for the USGCRP that incorporates the work of the subgroups. Such a structure would allow the USGCRP to be more consistent with its original mandate in the Global Change Research Act, which is to help the world "understand, assess, predict, and respond to human-induced and natural processes of global change."¹⁸ This is not a completely new structure; the USGCRP originally focused on science, and a sister entity called the Mitigation and Adaptation Research Program worked in parallel with it on applied science for mitigation and adaptation.

Recommendations on integrating social and behavioral sciences into climate science

The USGCRP should integrate social, economic, and behavioral sciences into climate science, particularly in areas of adaptation research. In the Global Change Research Act, the USGCRP is directed to come up with a plan for "[f]ocused research initiatives to understand the nature of and interaction among physical,

chemical, biological, and social processes related to global change."¹⁹ Though it is in the statute, the incorporation of social sciences has not been a priority to date, and it needs to be.

Recommendations on expanding the National Climate Assessment

The National Climate Assessment, produced by the USGCRP, is an important tool for helping policymakers and the public to understand and respond to climate impacts. The assessment should be expanded to include a focus on climate risk and the impact of climate change on natural lands and wildlife. This would allow for local- and regional-level resolutions on flood, drought, and other increasing geophysical risks caused by climate change to inform stakeholders and the American public on the real-world costs of a changing climate. It would also provide clear and actionable information on the condition of America's natural areas, wildlife, wildlife habitat, ocean health, watersheds and wetlands, and other life-sustaining natural systems. This document would also track the country's progress toward meeting a goal of conserving at least 30 percent of its lands and oceans by 2030.

Elevate and prioritize earth sciences at NASA

Earth sciences—particularly atmospheric sciences—is part of the original mandate for NASA. Yet NASA's Earth Science Enterprise has been grossly underfunded compared with other program areas, such as human space flight. In the first 100 days, the next president should take advantage of NASA's unparalleled capabilities in climate and atmospheric sciences and data collection by restructuring and directing NASA resources to focus on climate change, the loss of nature, and the challenges these pose to the Earth.

Specifically, the administration should:

- Elevate earth sciences within NASA. Earth science currently sits under NASA's Science Mission Directorate, one of four directorates, where it is one of several priority areas. The next administration should elevate earth science by creating a new dedicated Earth Science Mission Directorate, with a focus on climate science. CAP recommends that NASA's chief scientist be an earth scientist.
- Increase NASA's earth sciences budget. The next administration should at least double the NASA earth sciences budget in the president's budget request to Congress.

- Appoint a NASA administrator who prioritizes earth sciences. In choosing a new NASA administrator, the next administration should look for someone who will make climate change and earth sciences a top priority. This person should also intimately understand the inner workings of the vast agency.
- Define NASA's climate change research priorities. NASA experts should identify top climate change research priorities through the USGCRP process laid out above. As a starting point, they can look to the National Academies of Sciences, Engineering, and Medicine's 2017–2027 Decadal Survey for Earth Science and Applications from Space as a blueprint for research priorities. (see Appendix) As the administration assembles a transition team, it should assign a set of scientists to prioritize the survey recommendations that are most relevant to and critical for climate change research, including the pace of natural area loss in the United States.
- Encourage NASA to partner with the private sector. NASA should fully utilize the capabilities of the private sector to develop satellites and sensors by incentivizing companies through data buys. This could include creating and funding an initiative that would purchase high-fidelity greenhouse gas emissions data.

Recommendations to define interagency climate science research and data priorities

FIRST 100 DAYS:

- Issue a presidential memorandum directing OSTP to identify major crosscutting climate research priorities for the next decade.
- Prioritize broad research areas.
- · Issue an executive order on coordination and accessibility of federal climate data.

The new administration should take steps to ensure that federally conducted or supported climate research reflects the recommendations of the scientific community as well as the needs of stakeholders who will utilize it for decisionmaking. As mentioned above, research priorities must inform policy for both mitigation and adaptation. There is immediate need for applied science and data to meet a new administration's high-level climate goals and decisions. For example, the administration will need to update the United States' nationally determined contribution under the Paris climate agreement, see that the Kigali Amendment to the Montreal Protocol is ratified, set a midcentury economywide decarbonization goal, and make a public commitment to conserve and protect 30 percent of U.S. lands and oceans by 2030. To deploy the strategies needed at every level to reach these targets, the federal government must provide the data and research that will inform decision-making for a wide variety of stakeholders.

Furthermore, the administration must ensure that federal climate data is both accessible and truly valuable to stakeholders such as community leaders, businesses, municipalities, planners, land managers, and farmers. Particular attention should be paid to ensuring that climate science informs critical efforts to bolster the resilience of economically disadvantaged communities and communities of color, who are often the most vulnerable to climate impacts because they have less access to resources to prepare for and recover from emergencies and disasters. They also are often located near industrial or toxic waste sites, which can make disasters far more dangerous.²⁰ This effort will require taking stock of the accessibility and usefulness of existing data and creating an interagency structure, with stakeholder engagement, that creates useful data interfaces and tools. This section outlines how the next president can bolster federal climate science by restructuring the interagency processes for determination of climate science priorities, expanding data collection, and ensuring climate data accessibility. The section also provides high-level suggestions for next-generation climate science priority areas.

Issue a presidential memorandum directing OSTP to identify major crosscutting climate research priorities for the next decade

In the first 100 days, the president should issue a presidential memorandum directing OSTP to set major crosscutting climate science priorities for the next decade. Climate science priorities have historically focused on studying and understanding the problem of climate change. While this continues to be a priority, it is time to move from simply studying the problem to taking action: Research priorities must focus on the most urgent questions around emissions mitigation and adaptation; these questions must be answered to inform policy decisions.

The following section provides recommendations for how the government, through the USGCRP, should identify broad research priority areas for the next decade. These priorities can then inform the annual USGCRP planning process outlined in the previous section. The following sections discuss what a new presidential memorandum should include.

Request a National Academies of Sciences, Engineering, and Medicine cross-agency decadal survey

The president should direct OSTP to request a National Academies of Sciences, Engineering, and Medicine cross-agency decadal survey specifically focused on climate science priorities for physical sciences, applied science for mitigation, and applied science for adaptation. Alternatively, OSTP can issue a request for proposals for a decadal survey from nonprofit firms, research centers, and universities and select the best one. The last National Academies of Sciences, Engineering, and Medicine decadal survey focused on earth science centered on earth observation. The academies should broaden this to include adaptation and resilience and mitigation research needs. OSTP should ask the academy to come up with a set of data requirements that federal, state, and local governments need to robustly build plans for climate adaptation and decision-making. The National Academies of Sciences, Engineering, and Medicine should also frame high-priority questions around species and biodiversity loss under different warming scenarios. Institute an interagency research and budget prioritization process for the USGCRP in lockstep with OMB that includes a stakeholder engagement process The president should direct OSTP to reinstate and build off the highly effective interagency process that was implemented in the early days of the USGCRP. The Global Change Research Act statute explicitly states that the USGCRP should have a coordinated, interagency budget process to prioritize and fund specific climate science.²¹

In the early 1990s, there was an effective annual interagency process within the Subcommittee on Global Change Research for defining the research priorities across agencies included in the USGCRP. The outcome was a coordinated set of activities, agreed to by all the agencies in the USGCRP, to recommend for inclusion in the president's budget request to Congress. This was followed by coordinated outreach to Congress to fund the USGCRP priorities across agencies. In recent administrations, this coordinated interagency process has fallen by the wayside, leading to a lack of climate science coordination across agencies. CAP recommends reinstating this process. Below is a recommended budget prioritization process that builds on what worked well in the early days of the USGCRP.

Recommended budget prioritization process and timeline

January-February: Stakeholders provide input to inform research priorities.

Early each year, the USGCRP's research priorities for the following fiscal year should be determined by the Subcommittee on Global Change Research, in lockstep with OMB. In January 2021, for example, the subcommittee will be thinking about what should be in the president's budget request to Congress in January 2022. These research priorities should incorporate climate science, applied science to inform mitigation, and applied science to inform adaptation.

The Global Change Research Act mandates that the subcommittee "consult with actual and potential users of the results of the Program to ensure that such results are useful in developing national and international policy responses to global change."²² Federal climate science must better address the most pressing questions that communities need in order to adapt to the impacts of climate change. It must provide policy-makers and local leaders with information and data—in an accessible format—that allows them to make decisions. Below are recommendations on how OSTP and the USGCRP can collect broad stakeholder input to inform research priorities.

• External expert input through the President's Council of Advisors on Science and

Technology (PCAST): OSTP should engage PCAST to identify applied climate science priorities for mitigation and adaptation. These priorities should be fed into the USGCRP Subcommittee on Global Change Research. Priority questions should focus on the impacts of climate change on human health, livelihoods, and security; biodiversity and species loss; and the interaction between natural and human impacts.

- State, local, and tribal input: The president should direct the Council on Environmental Quality (CEQ) to reestablish the State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience to advise on what the federal government should do to respond to communities who are coping with and preparing for the impacts of climate change.²³ The task force should be run by the CEQ and OSTP.
- Input from the environmental and climate justice community: The administration should create and implement a process to collect input from

environmental justice advocates and community leaders on science priorities to inform climate planning in low-income communities, tribal communities, and communities of color.

• Interagency input: The president should reestablish the Obama-era Interagency Council on Climate Preparedness and Resilience, which consisted of more than 25 relevant federal agencies.²⁴ This council was previously co-chaired by four entities, which people close to the process, interviewed for this report, say was too many. CAP recommends that the council be co-chaired by the National Security Council and OSTP, in close consultation with the CEQ. OSTP should direct the USGCRP to consult with these entities to identify research priorities to inform resilience and adaptation.

Based on the above inputs from the National Academies of Sciences, Engineering, and Medicine and various stakeholder channels, the president should task OSTP with drafting a document on how to make climate research useful for adaptation and resilience. By the end of February, the subcommittee's research priorities should be sent to OMB and OSTP.

March: OSTP and OMB send an annual memo to agencies. OSTP and OMB should include these climate science priorities in the annual memo they transmit to all the agencies that lays out the president's science and technology priorities. While this memo did go out to agencies under the Obama administration, it was sent far too late to inform agency climate science priorities. Going forward, the memo should make clear that climate change is the top scientific priority for the next president.

April–July: The Subcommittee on Global Change Research prioritizes projects to include in the USGCRP. Based on the USGCRP's priorities identified earlier in the year, the subcommittee identifies which agency projects should be included in the USGCRP. For this process to be effective, it is extremely important to appoint senior career officials with the authority to make policy for and resource allocations to the subcommittee.

August: OSTP and OMB review USGCRP priorities. The Subcommittee on Global Change Research produces a set of cross-agency climate science research project priorities that is reviewed by OSTP and OMB. It is possible that not all of the USGCRP programs make it through this review process. Once the review is completed, the funding requests for the approved USGCRP agency projects and programs are fenced in the OMB budget process, meaning that these funds cannot be allocated by the relevant agency to fund other activities, which may not be popular with agency heads. It is therefore important that this effort has full backing from the president.

November: Agencies include USGCRP priorities in the president's budget. USGCRP priorities are supported in the agency budgets that are sent to OMB, and they are ultimately rolled into the president's budget request that is sent to Congress early the following year.

Prioritize broad research areas

The next administration will need to take major steps in climate, energy, and conservation policy to meet the midcentury decarbonization goal. Priorities will include updating the U.S. nationally determined contribution under the Paris climate agreement; setting a regulatory and legislative policy agenda to reduce greenhouse gas emissions economywide; see that the Kigali Amendment is ratified; enact policies to ensure pollution-free communities across the United States; and move to conserve and protect 30 percent of U.S. lands and oceans by 2030. The administration must also ensure that state and local governments have the tools they need to implement planning and policymaking at the local level for mitigation, adaptation and resilience, and protection of natural systems. Major climate and conservation needs such as these must guide the federal government's approach to research.

Research priorities for the federal climate science apparatus should be determined by stakeholder and agency engagement through the White House and USGCRP coordination process laid out in the previous section. Several categories for focus in research and data collection are listed below, based on conversations with experts. These do not represent a comprehensive list, but rather a starting point for thought and context-setting for the state of climate science.

The United States has historically been the foremost leader in climate modeling and the collection of climate data, thanks to heavy government support and investment. The federal government should continue to support the basic sciences, which feed into the Earth system models that are required to understand the evolution of the fully integrated global climate system, continuing to target data resolution improvements. At the same time, as mentioned earlier, understanding how climate change will interact with human systems and how it will affect natural systems and species loss is critical to policy decisions. This science will require the next administration to expand ground data collection, both through the direct work of federal agencies and the funding of research partnerships with universities, nonprofits, and the private sector.

Climate and earth science research

The federal government should continue to conduct and support basic climate and earth science research. This includes investing in a greater understanding of the atmosphere, particularly aspects that create the most uncertainty in climate models, such as clouds and aerosols; oceans; terrestrial science; biodiversity; and arctic research. This should be informed by decadal surveys and the recommendations of the scientific community. As discussed earlier in this report, agencies such as NASA should refocus their priorities on earth science and the study of the home planet.

Remote sensing: Investment should focus on remote sensing, supporting improvements in ground, sea, and satellite systems. Under the leadership of NASA, NOAA, the USDA, and the U.S. Geological Survey (USGS), the portfolio of U.S.-launched Earth observation satellites and the immense database they offer to the public at no cost have conveyed countless benefits across fields such as agriculture, water use, energy, environmental protection, land use planning, species recovery, and more. Research priorities in this area could include sustaining the Argo fleet of ocean-monitoring buoys and expanding their reach into the Arctic, as well as global methane and emissions satellite monitoring to inform mitigation strategies.

Climate modeling: The next administration should also focus on climate modeling, including increasing spatiotemporal resolution of models, leveraging artificial intelligence and machine learning, and further developing quantum and exascale computing. Climate models, from fully coupled Earth system models to regional climate models, are integral to understanding the climate system and how it will evolve in the future. In addition to the current models, there is an acute need for models that focus on near-term guidance; seasonal to decadal prediction is necessary to make models useful to communities and economic sectors. Decision-makers at different levels of government need detailed Earth system modeling across various spatial and temporal scales.

Applied science to inform mitigation and adaptation

Going beyond basic climate and earth science, the federal government must expand its applied research to inform mitigation and adaptation decision-making. Integrated assessment models, which integrate societal data into climate models, and earth science data collections should inform the process and decision-making behind these goals.

Science to inform mitigation policy: The next administration must make a concerted effort to develop and study the impacts of science and technology solutions for greenhouse gas mitigation. This includes categories such as technology development for emissions reductions across the power, transportation, industrial, building, agriculture, and waste sectors; natural and technology solutions for carbon dioxide removal; better measurement of land sector emissions and sequestration; and continued study of technologies such as solar radiation management to gain a full understanding of its impact and potential negative consequences.

Science to inform adaptation and resilience policy and the protection of natural systems: This includes categories such as studies of cumulative pollution impacts on communities and assessments of future resilient infrastructure needs in the face of more and increasingly severe extreme weather impacts.²⁵ On the natural systems side, meeting the national conservation goal to protect 30 percent of U.S. lands and water by 2030 will require assessments of current conservation practices and studies identifying regions, habitats, and ecosystems that warrant additional protection.

Research on the nexus of climate and society: Understanding the impact of climate change on human systems within societally relevant time scales is crucial for informing U.S. domestic and international decision-making across disciplines and policy areas. Modeling climate-induced displacement and migration of people, food insecurity, public health concerns such as heat strokes, and extreme-weatherinduced conflicts will be increasingly important as the effects of climate change accelerate. Integrated assessment models and earth science data collection should inform the process and decision-making for national security, international relations, and military engagement. Behavioral research is also important as the United States undergoes an economywide energy transformation, and individual and societal behaviors become larger barriers. Consider, for example, consumers' anxiety about the range of electric vehicles, which has the potential to slow vehicle adoption rates. Finally, climate models should inform the intersections of climate impacts with other policy areas such as public health, housing and urban planning, and how climate change factors will disproportionately affect low-income communities, tribal communities, and communities of color.²⁶

The next president should work to encourage doubling funding for the National Science Foundation (NSF) to ensure that robust science underpins the ongoing federal investment in climate models. While the evidence for human-induced climate change is clear, there are significant unknowns in how the climate system works, from the poles to the deep oceans, that require strong ongoing research programs. Increased funding for the NSF should be explicitly focused on convergent research that addresses key societal problems, and the engagement and co-production of the knowledge should ensure that the knowledge is not just useful but also used.

The federal government can also influence nonfederal research in climate science to expand into these areas. In order to encourage universities to expand their climate-society research lines, the NSF should include requirements in a portion of its climate science grants that principal investigators take an interdisciplinary approach to climate science research questions, actively including social sciences and humanities in research. For these grants, the NSF should also require that one or more principal investigators have demonstrated skill in managing interdepartmental or intercollegial projects.

Data collection needs

Ultimately, data and research needs should be determined by stakeholder and agency engagement through the White House. Select priorities in data collection are listed below and do not represent a comprehensive list.

Independent global greenhouse gas measurements: The Paris climate agreement's compliance metrics are currently based on self-reported emissions, which vary in accuracy and could open up the possibility for clever accounting schemes to avoid ambitious climate action. Independent, scientific, and standardized measurement of greenhouse gas emissions from party nations could legitimize the compliance scheme and better hold nations accountable. A focus on developing the capability to use satellite and in situ, or in-ground, measurements of atmospheric greenhouse gas concentrations and inverse modeling to understand emissions from the energy sector anywhere in the world is a very basic, yet unmet, necessity in a voluntary Paris compliance scheme and could be a major boon to international decarbonization efforts. As mentioned later in this report, the State Department could use these data to aid countries developing their technical abilities to implement their promises under the Paris climate agreement.

Land sector emissions: An obvious missing piece in the United States' ability to accurately and precisely account for net carbon emissions is measurements of emissions in the land sector. Developing capabilities to measure land sector emissions, including negative emissions, is vital to informing the policy- and decision-making that will put the country on a path to meeting its various climate goals.

At the USDA, the U.S. Forest Service's Forest Inventory and Analysis National Program takes a rigorous approach to measuring forest conditions, but it only provides carbon data for forests that are part of the Forest Inventory and Analysis, a ground-based forest assessment that does not currently include nonforested lands such as grasslands or agricultural lands. This presents a large problem for U.S. carbon accounting efforts. At the beginning of the Obama administration, the USGS was compelled by legislation to fill this gap using ground truth modeling; the executive branch should direct the Forest Service to utilize this methodology immediately in accordance with this legislation.

At the Department of the Interior, in 2016, the secretary of the interior asked the USGS to produce an annual public report on estimated greenhouse gas emissions from fossil fuels on federal public lands. To date, however, the agency has published only one report that provided a first-of-its-kind analysis of emissions, as well as estimates of carbon sequestration on public lands.²⁷ The agency should again be tasked with producing this valuable information on an annual basis in order to help policymakers support federal public lands in phasing out fossil fuel emissions and maximizing carbon sequestration potential.

The EPA's greenhouse gas inventory is the United States' main repository for emissions reporting and data collection, developed by the federal government to meet U.S. commitments under the U.N. Framework Convention on Climate Change. Currently, the process dramatically undercounts biological carbon, both sinks and sources. It also undercounts methane.²⁸ If the EPA integrates the above recommendations for a more robust accounting of land sector emissions—sinks and sources—it will improve the annual dataset. The EPA should also continue to update and refine its methodology for accounting for methane leaks at industrial facilities according to what it determines to be the best available science.

Additionally, the EPA may consider providing at least state-level inventories of greenhouse gas emissions. Most states do not have reliable or current greenhouse gas inventories, which will be essential as more states develop reduction targets and plans.

Issue an executive order on coordination and accessibility of federal climate data

The new administration should ensure that all federal climate data are open source and free for research and public use. In the first 100 days, the president should issue an executive order for an Interagency Climate Initiative for climate data coordination and accessibility. The executive order should direct OSTP and OMB to make the government's data enterprise centralized, accessible, and useful for decision-makers such as farmers, mayors, citizens, advocates, and businesses. This effort should be directed jointly by OSTP and OMB to ensure that it is close to the president and truly interagency, since datasets at different agencies may need to be integrated into a single useable tool or suite of tools. The executive order should also direct OSTP's chief technology officer to work with the U.S. Digital Service (USDS) to ensure that taxpayer-funded federal research gets into the hands of those who need it. Through the USGCRP, OSTP can coordinate with agencies on data accessibility, interoperability, and workforce recruitment and retention for technical implementation.

This should be a broad initiative, similar to former President Obama's Climate Data Initiative, which launched in 2014.²⁹ The administration should create a fresh alternative to climate.data.gov in order to make the data available to the public.

Initiate a process for the review and declassification of climate datasets

OSTP should conduct a 90-day review of datasets relevant to climate change. These datasets—including older datasets that are relevant to climate science and in storage but no longer used by the U.S. Department of Defense and intelligence agencies—should then be optimized and declassified. Declassified climate data relevant to U.S. strategic interests abroad should be shared with the State Department in cases where it would inform diplomatic or aid-related strategy. Each agency should also investigate its stranded assets—datasets that are digitally inaccessible and whose user interfaces need to be updated.

Initiate stakeholder engagement in USGCRP agencies to create usable climate data tools

The executive order should direct federal agencies to involve users, including state and local governments and community organizations, in designing a system for data access and usability. Often, federal agencies do not know how to make their data useful for stakeholders and nonscientists; merely publishing their individual datasets, raw or without much thought about the user interface, is not enough to ensure that they are informative. USGCRP agencies should be directed to appoint a designated position or create a small office—an Office of Information for Climate Resilience, for example—that is tasked with interagency climate data and information collaborations. These people or offices should have the authority to conduct stakeholder engagement, and such engagement should be conducted continuously in order to ensure that tools are regularly updated with the latest science and informed by the evolving needs of stakeholders as the economywide transition evolves and the climate continues to change.

These agencies should conduct regular internal assessments of their climate and resilience datasets, studies, and assessments and then come together with the other USGCRP agencies to combine data and create useable tools for stakeholders on different issues. For example, by combining individual agency data and perspectives, an interagency process could create heat maps, flood risk maps, and maps displaying the readiness of the electricity grid for extreme weather. Such maps would be immediately useful for communities, industry, and subnational governments as they would integrate all of the best available science from across the government.

OSTP and OMB should also implement an ongoing stakeholder engagement process that informs production or updating of climate information tools. Through PCAST and in coordination with the CEQ, OSTP should continuously take stakeholder requests, prioritize them, and coordinate with the appropriate agency to implement them.

Create data workforce recruitment pipelines

This whole-data effort will require a strong pool of technical and management talent from across the public and private sectors. As a reference point, the new administration can update Obama executive order 13642, "Making Open and Machine Readable the New Default for Government Information."³⁰ The executive order should recommend that agencies leverage the Presidential Innovation Fellows (PIF) program, the General Services Administration's (GSA) 18F group, and the USDS to bring in external tech talent and drive and make permanent intra-agency data accessibility projects. Agencies should look to the USDS to design and launch this initiative within and across agencies. The USDS has a process to deploy small, responsive groups of technologists, designers, engineers, product managers, and bureaucracy specialists to work with civil servants in government agencies on data-related projects. The USDS also works to embed teams within federal agencies and their in-house digital technology divisions.

To bolster this effort, agencies should leverage the PIF program, which places highly qualified technologists, designers, and strategists from the private sector within the federal government for yearlong residencies to work on specific agency projects. The next OSTP should ensure that the PIF program includes a focus on recruiting top technologists qualified to work on the cross-agency project of gathering federal datasets and making them accessible to scientists. USGCRP agencies should reach out to the GSA's 18F group, which partners with federal agencies to improve user experience of government services, in order to bring in the PIFs and provide technical support for this project.

Collaborate with the private sector

The administration should encourage agencies to partner with the private sector on large-scale projects. For example, NOAA and the PIF program have teamed up to implement the Big Data Project, a public-private partnership in which Amazon, Google, and other private cloud computing providers placed bids to host massive amounts of geophysical data, to in turn receive revenues when usage of the data increased.³¹

Expand climate data collection through citizen science

To better inform climate models and general federal and nonfederal climate research, the U.S. government must expand its collection of ground truth data, which are sorely lacking in places such as the Arctic and domestic nonforested lands. Both remotely sensed and in situ data will be important to inform the best available science behind decision-making. The president, through the updated executive order, should encourage the relevant agencies to consider more and bigger citizen science programs, as was promoted under the Obama administration.³² Volunteer members can collect the scores of ground data needed for high-resolution, regional, and local understanding of climate impacts. Such participation in the scientific process will encourage STEM education for youth and project engagement for adults interested in climate science.

Recommendations for prioritizing adaptation and resilience

FIRST 100 DAYS:

- Issue a presidential memorandum to coordinate and build out climate services.
- Reinstate and update the presidential memorandum on climate change and national security.
- Issue an executive order to update the Federal Flood Risk Management Standard.
- Implement a road map to ensure critical infrastructure security and resilience.
- Issue an executive order to ensure that addressing the climate and nature crises are central to federal land, water, and wildlife management.
- Restore Endangered Species Act protections.

Like the federal government's climate science apparatus, its climate resilience apparatus is dispersed and uncoordinated, and there is no clear process to ensure that research priorities are informed by the adaptation and resilience needs of communities. In its first 100 days in office, the Biden administration should issue an executive order on climate resilience. This is a much broader topic than climate science, and the executive order in part should direct the USGCRP to address key questions in order to inform priority actions around adaptation and resilience. While not a comprehensive list, below are examples of priority actions for adaptation and resilience that will need to be informed by climate science.

Issue a presidential memorandum to coordinate and build out climate services

The next administration must act to better coordinate climate services across the federal government—including technical assistance, data, and funding in order to help communities, especially low-income communities and communities of color, plan for and adapt to climate impacts and to ensure that climate science priorities are informed by community needs. Climate services entities translate climate science and data for communities, making it accessible and useful for policymakers and local leaders in their decision-making.

The president should issue a presidential memorandum directing the Interagency Council on Climate Preparedness and Resilience to coordinate the federal climate service entities—including the USDA Climate Hubs, the USDA Natural Resources Conservation Service's technical assistance, NOAA's Regional Integrated Sciences and Assessments (RISA) program, the USGS Climate Adaptation Science Centers, and the Department of the Interior's Landscape Conservation Cooperative Network—to work together and present a plan with joint priorities to better serve consumers and communities. One approach is to pilot an interagency coordination of resilience activities, including those that promote healthy, productive ecosystems and wildlife species recovery, in one particular region of the United States. Another pilot project should focus on serving vulnerable communities. The council can review the results of these programs and then replicate the process nationwide. NASA could also train young people on data science and send them into local areas to train decision-makers on how to use the data.

Reinstate and update the presidential memorandum on climate change and national security

The president should update and reinstate the Obama-era presidential memorandum that declared climate change a national security threat and directed federal agencies to consider climate change in the development of national security policies and plans.³³ The Trump administration reversed this focus on climate change in national security policy in 2017.³⁴

Issue an executive order to update the Federal Flood Risk Management Standard

The president should issue an executive order directing OSTP to work with the Federal Emergency Management Agency (FEMA) to finish the process started under the Obama administration executive order³⁵ to update the Federal Flood Risk Management Standard. In 2015, the National Security Council under President Obama conducted an interagency policy process to propose a new standard, and the order set forth a process for collecting stakeholder input from governors, mayors, and other stakeholders.³⁶ President Trump revoked this standard in 2017.³⁷ The new executive order should finish the process to update

the national standard to ensure that federally funded projects are taking climate change-induced flood risk into account and protecting flood plains to increase community resilience. This standard should use the best available science and modeling related to flooding risk.

Implement a road map to ensure critical infrastructure security and resilience

In 2016, the Obama administration produced the "Implementation Roadmap for the National Critical Infrastructure Security and Resilience Research and Development Plan,"³⁸ which laid out concrete activities for research and development (R&D) investment to improve the security and resilience of the country's critical infrastructure against natural disasters and terrorist attacks. The new administration should implement the plan.

Issue an executive order to ensure that addressing the climate and nature crises are central to federal land, water, and wildlife management

In 2017, the Trump administration withdrew a U.S. National Park Service framework that considered climate change in the management of natural and cultural resources.³⁹ The next president should issue an executive order to ensure that relevant land management agencies—including the National Park Service, the U.S. Fish and Wildlife Service, the Bureau of Land Management, and the Forest Service—are managing the nation's resources in a way that reflects the best available science, stems climate change, and slows the rapid loss of nature and biodiversity.

Restore Endangered Species Act protections

The Trump administration weakened this bedrock conservation law, narrowing the government's ability to consider the projected impact of climate change on species' habitat in the foreseeable future.⁴⁰ The next administration should restore protections for the nation's imperiled and at-risk species.

Recommendations to promote international coordination on climate science

FIRST 100 DAYS:

- Reengage and invest in international research collaborations.
- Rejoin international alliances that are coordinating on advancing climate solutions.

Although this report is focused on the domestic actions that the next administration can take on climate science, reengagement in the international climate science space is an important component of a broader strategy that would allow the next administration to begin to rebuild global acceptance of a U.S. return to climate change leadership. The next administration has a number of opportunities to demonstrate climate science leadership and contribute to scientific advances, both in climate science research and technology deployment collaboration platforms.

Reengage and invest in international research collaborations

Bilateral and multilateral research collaborations will be crucial in understanding the globally diffuse effects of climate change, as well as the issue areas particular to different regions and nations around the world that could benefit from expanded research capacity. The key federal technical agencies—NOAA, NASA, the USGS, and the NSF—all have international climate science activities, and the next president should request funding increases for those agencies' international research cooperation activities. Specifically, increased funding for those agencies' earth science programs to advance the recommendations of the National Academies of Sciences, Engineering, and Medicine's "Thriving on Our Changing Planet" report⁴¹ would support further scientific advances under existing and potentially new multilateral and bilateral efforts. Such efforts could include global methane satellite monitoring with the European Commission and West Antarctic Ice Sheet monitoring with other Arctic nations. Below are additional, discrete recommendations for how the new administration can jump-start international climate science research collaborations.

Fully reengage in the Arctic Council

The Arctic is warming, on average, more than twice the rate of the rest of the planet.⁴² Warming is already having profound effects on the Arctic region and has the potential to have an outsize impact on the climate of the rest of the Earth and its inhabited regions. In past years, the Arctic Council has produced groundbreaking analyses of climate change in the Arctic that, among other things, helped spur the development of the Paris climate agreement. In fact, much of the council's work over the past decade has related to climate change in some fashion. The Trump administration has sought to put the brakes on this work, highlighted by its refusal to accept climate change language in, and block consensus on, an Arctic Council ministerial statement in 2019.⁴³

The next administration will have the chance to repair the damage to U.S. credibility within the Arctic Council—and the damage to the council itself. The council remains a vital institution through which to study, monitor, and model climate change and to advocate for stronger climate action on a global scale. The next administration should make certain that the United States resumes its leadership position in the Arctic Council in general and particularly in the working groups that study changing conditions in the Arctic. These groups include the Arctic Monitoring and Assessment Program, which has a specific responsibility for climate science research.

More broadly, the next administration can fill key Arctic-related positions that have remained vacant, including in the White House and State Department, and revive the Arctic Executive Steering Committee established under President Obama to catalyze action among the 20 or more federal agencies that work on Arctic issues. Under renewed U.S. leadership, there should also be the scope to strengthen the international governance regime for the Arctic in concert with other Arctic nations.

Deepen and expand bilateral climate research collaboration

The United States has worked with a number of key bilateral partners on climate science research, particularly in Europe and Japan. In particular, NASA collaborates with the European Commission, the European Space Agency, and Japan already, and its international reputation should be leveraged to expand established partnerships with space agencies in Europe, Canada, and Asia, and to create new partnerships with emerging space agencies in the Middle East and South America.

Fully support the NSF and NASA to lead large international scientific expeditions

The next administration should call on NASA and the NSF to lead large international scientific expeditions to ensure that the United States resumes its position as the leading producer of climate science. International collaboration in ocean sampling and study of the ice sheets are two critical areas where U.S. leadership can provide important new advances.

Restore full dedicated U.S. funding to the IPCC and the UNFCCC

U.S. support for the Intergovernmental Panel on Climate Change—the U.N. body tasked with synthesizing the international scientific consensus on climate change—has a high return on investment: U.S. scientific agencies rely on IPCC findings to develop the National Climate Assessment, and they would need to draw on IPCC findings for future domestic climate risk assessments. The United States has supplied nearly one-third of the IPCC's income since its inception in 1988 and supplied 44 percent of its funds in 2016.⁴⁴ U.S. contributions to the IPCC and the UNFCCC under the Obama administration reached \$10 million annually in 2016, but the Trump administration quickly pivoted to cutting funding, including zeroing out the U.S. contribution in 2017.⁴⁵ That year, the U.N. body did not have enough funds and was forced to solicit additional funding from other member states as it neared a financial crisis point. Congress has since acted as a backstop to the administration's budget cut requests, increasing funding to \$3 million in fiscal year 2018 and again in fiscal year 2019.⁴⁶ Importantly, due to leadership from Congress again, the United States elevated funding to the two bodies to \$10 million for fiscal year 2020.⁴⁷ Nevertheless, at a time when the role and contributions of the IPCC and the UNFCCC are more important than ever, a new administration must demonstrate sustained policy and financial commitment to the important work of the IPCC and the UNFCCC both groups by pledging consistent funding at the pre-Trump levels of \$10 million or more.⁴⁸

Rejoin international alliances that are coordinating on advancing climate solutions

The next administration should join or rejoin existing international alliances for clean technology development and deployment and guide domestic research, development, and demonstration to meet these goals and initiatives. These platforms serve joint initiatives that allow the United States to coordinate research, development, and demonstration alongside other countries, sharing best practices and holding parties accountable. The goals that come out of these joint initiatives can inform the science that the United States needs to advance climate solutions. These coordination efforts will be extremely important platforms for jointly developing clean energy solutions and driving down the costs of meeting global midcentury decarbonization goals.

Restore U.S. global clean energy R&D leadership under Mission Innovation The Obama administration spearheaded the creation of Mission Innovation—a 2015 joint effort by more than 20 nations to double clean energy R&D spending over five years.⁴⁹ At the end of its second term, the Obama administration had set the United States on a course to achieve that goal, further accelerating U.S. scientific and commercial leadership in clean energy technology. However, the Trump administration slashed clean energy R&D spending upon taking office, ceding the U.S. edge to others. In the meantime, other countries have been driving forward their national strategies and directing the Mission Innovation agenda. In fact, leading Mission Innovation governments are looking to launch Mission Innovation 2.0 in the near future, with a focus on identifying a few select, highprofile, high-impact areas that merit a concerted global focus.⁵⁰ It is in the United States' climate policy and commercial interest to return to the table and influence the direction of these critical global missions.

The next president should immediately reenter Mission Innovation and pledge to triple climate and clean energy R&D funding over five to seven years across the 13 federal agencies that make up the USGCRP. In particular, it must prioritize development of new technology for harder-to-decarbonize sectors such as manufacturing and agriculture as well as negative-emissions technologies. Research is also needed to help communities become more resilient and adapt to continued climate changes even as emission levels fall, with particular emphasis on science that informs equitable policies and programs. The next administration could announce this research at the U.N. Climate Change Conference in Glasgow, Scotland, in November 2021.

Return to its leadership role in Clean Energy Ministerial

The United States launched the Clean Energy Ministerial in 2009, inviting energy ministers from major industrialized countries and key emerging economies to join a collaborative global forum that partners with the clean energy industry and stakeholders to advance clean energy technology development and deployment and to share lessons learned and best practices.⁵¹ Clean Energy Ministerial now comprises 25 countries and the European Commission, which account for about

90 percent of global clean energy investments and 75 percent of global greenhouse gas emissions.⁵² Clean Energy Ministerial has done leading work in supporting the deployment of renewables and smart grid and energy efficiency technologies and strengthening capacity in power sector transformation and energy management, among a range of other areas.

The United States led or participated in nearly all of Clean Energy Ministerial's initiatives, but the U.S. Department of Energy has pulled back significantly under the Trump administration, focusing on the nuclear energy and carbon capture, utilization, and storage initiatives that former Secretary of Energy Rick Perry championed.⁵³ The dramatic turn from U.S. leadership to U.S. absence has stunted Clean Energy Ministerial's influence and the momentum to spur broader deployment of clean energy technologies, particularly in emerging economies. A new administration should return to leadership at Clean Energy Ministerial and go beyond Obama-era efforts to increase the Energy Department's program resources for Clean Energy Ministerial activities. It should even consider increasing White House involvement in Clean Energy Ministerial, which would spur other governments to increase their attention and resources to the program. The next administration could signal a return through an announcement at the climate world summit that President-elect Joe Biden has proposed to convene early in his administration.⁵⁴

Reengage in the International Solar Alliance

The next administration should immediately reengage with the International Solar Alliance, an international initiative launched by India and France in 2015 for developed and developing countries to partner to increase deployment of solar energy technologies and to improve access to energy in developing member countries. Under the Obama administration, the Energy Department and the National Renewable Energy Laboratory partnered with Australia to create the Solar Technology Application Resource-Center (STAR-C) program, in which solar experts provide training on solar finance, innovative policy options, photovoltaic technology advancements, and market insights for the benefit of alliance member countries.⁵⁵ A new administration should bolster support for programs such as STAR-C and discuss with International Solar Alliance leadership other areas where the United States could contribute.

Leverage science to support developing countries in implementing the Paris climate agreement

President Trump dismantled the Obama administration's Enhancing Capacity for

Low Emission Development Strategies (EC-LEDS) program, under which U.S. policy and technical experts advised developing country counterparts in order to help them strengthen their development planning and goals, with a focus on pursuing a sustainable, low-emissions pathway. A key element of the EC-LEDS playbook was bringing together technical experts to collaborate on data analysis and modeling to support partner countries as they developed their national greenhouse gas inventories, data critical to informing and tracking their Paris climate agreement nationally determined contribution goals. The next presidential administration should restore this well-received program and seek to triple its funding from 2016 levels—which supported work in 22 targeted countries—in its budget request.⁵⁶

Conclusion

Putting science back at the center of federal decision-making will be of the utmost importance in effectively tackling the climate crisis and protecting American communities both today and in the future. The world cannot wait any longer for ambitious climate action—and action cannot be effective without a strong, continuously improving understanding of the changing climate and energy systems on a global, national, regional, and local scale. By rebuilding the climate science workforce within the White House and federal agencies; creating a wellfunctioning interagency process to coordinate science and science policy; and making commitments to scientific integrity, the Biden administration will build the backbone of a healthy federal science apparatus.

The administration also has a historic opportunity to create an inclusive system and processes to bring stakeholders—including federal and nonfederal scientists, impacted communities, tribes, workers, and businesses—to the table in establishing the most critical scientific priorities and processes to back successful climate action. Implementation of the recommendations in this report will put the federal government on track to build a robust scientific foundation for its climate ambitions and send a strong message: The United States is, in its commitment to the safety and well-being of the American people, once again committed to science.

About the authors

John Podesta is the founder and a member of the Board of Directors for the Center for American Progress. Podesta served as counselor to President Barack Obama, where he was responsible for coordinating the administration's climate policy and initiatives. In 2008, he served as co-chair of President Obama's transition team. He was a member of the U.N. Secretary General's High-Level Panel of Eminent Persons on the Post-2015 Development Agenda. Podesta previously served as White House chief of staff to President William J. Clinton. He chaired Hillary Clinton's campaign for president in 2016.

Bidisha Bhattacharyya is the deputy director for Climate and Energy Policy at the Center for American Progress. Bhattacharyya previously worked on Capitol Hill as the senior energy and agriculture policy adviser to former Sen. Al Franken (D-MN) and as energy and agriculture legislative assistant for Rep. Betty McCollum (D-MN). She also ran the international impact-investing practice at Village Capital and headed the product team for off-grid solar company Simpa Networks. Bhattacharyya received her master's degree in public policy from Harvard University and a B.A. in economics from St. Olaf College.

Bianca Majumder is a research associate for Energy and Environment Policy at the Center for American Progress. Prior to joining the Center, Majumder received her master's degree in climate remote sensing from the University of Miami's Rosenstiel School for Marine and Atmospheric Science. She received her B.S. in biology and geoscience from the University of Miami.

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Joel Clement, Senior Fellow, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University; former Director, Office of Policy Analysis, Office of the Secretary, U.S. Department of the Interior

Kristina Costa, Principal, Fenway Strategies

John Deutch, Emeritus Institute Professor, Massachusetts Institute of Technology

Tamara Dickinson, President, Science Matters Consulting LLC; former Principal Assistant Director, Energy and Environment Division, Office of Science and Technology Policy

Scott Doney, Joe. D. and Helen Kington Professor in Environmental Change, Department of Environmental Sciences, University of Virginia

Cristin Dorgelo, President Emeritus, Association of Science and Technology Centers; former Chief of Staff, Office of Science and Technology Policy

Philip B. Duffy, Ph.D. President and Executive Director, Woodwell Climate Research Center (formerly Woods Hole Research Center); former Senior Policy Analyst, Office of Science and Technology Policy

Jack D. Fellows, Director Emeritus, Climate Change Science Institute; former Branch Chief, Office of Management and Budget

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Alice Hill, David M. Rubenstein Senior Fellow for Energy and the Environment, Council on Foreign Relations; former Special Assistant to President Barack Obama; former Senior Director for Resilience Policy, National Security Council John Holdren, Professor of Environmental Science and Policy, Harvard University; former Science Adviser to the President; former Director, Office of Science and Technology Policy

Rush Holt, CEO Emeritus, American Association for the Advancement of Science; former Member of Congress

Jason Kessler, Director of Partnerships, Earthrise Alliance

Ken Kimmell, President, Union of Concerned Scientists; former Commissioner, Massachusetts Department of Environmental Protection

Rachel Licker, Senior Climate Scientist, Union of Concerned Scientists

Ali Nouri, President, Federation of American Scientists

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David Reidmiller, Director, Climate Center, Gulf of Maine Research Institute; former Director, Fourth National Climate Assessment, U.S. Global Change Research Program

Kevin Rennert, Fellow and Director, Social Cost of Carbon Initiative

Rod Schoonover, CEO and Founder, Ecological Futures Group; Adjunct Professor, Georgetown University; former Director of Environment and Natural Resources, National Intelligence Council

Bina Venkataraman, Editorial Page Editor, The Boston Globe

Jonathan W. White, Rear Adm., U.S. Navy (Ret.), President and CEO, Consortium for Ocean Leadership; former Oceanographer and Navigator, U.S. Navy; former Director, U.S. Navy Task Force on Climate Change

Emily Wimberger, Climate Economist, Rhodium Group; former Chief Economist, California Air Resources Board

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