



U.S. DEPARTMENT OF AGRICULTURE

ACTION PLAN FOR CLIMATE ADAPTATION AND RESILIENCE



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A Message from Secretary Vilsack

Dear Reader,

As evidenced by the historic drought in the western United States, vast wildfires, and soaring temperatures across the country, climate change is already on our doorstep, and America's producers are on the front lines. We are operating in new territory, and the changing climate creates immense uncertainty and threatens the resilience of the American agriculture and forestry sectors. Not only does climate change have a direct impact on a producer's ability to plan and manage risk, it has wider impacts on the natural systems we rely on to support production of food and fiber, keep our waters clean, and maintain cultural resources.

As the "People's Department," USDA is preparing to help communities across the United States, both rural and urban, plan for and build resilience to the impacts of climate change. Answering President Biden's call for a whole-of-government approach to climate, USDA is taking a whole-of-Department approach to address the challenges and opportunities posed by climate change. In USDA's recent Climate-Smart Agriculture and Forestry Strategy: 90-Day Progress Report, we laid out our mitigation strategy to ensure that farmers, ranchers, and landowners can seize on these opportunities and contribute to greenhouse gas emissions reductions and sequestration. Alongside those actions, we must make sure that we provide producers, landowners, and communities with the tools to manage risk and adapt to this changing reality.

This Action Plan for Climate Adaptation and Resilience outlines how USDA will provide relevant information, tools, and resources to its stakeholders and target programs and activities to increase resilience to climate impacts. USDA will prioritize equity, promote environmental justice through a focus on healthy communities,

and target adaptation actions with co-benefits for climate mitigation, conservation, and sustainability.

In addressing the climate crisis, the USDA research enterprise will develop innovative tools and practices for farmers and land managers of the future. USDA will tailor its climate outreach and assistance to be regionally specific through its vast field operations and innovative partnerships and enhance department-wide coordination through its ten regional Climate Hubs. Building climate literacy across all levels will enable USDA staff to best serve its stakeholders in the decades ahead.

Our plan will serve as the foundation for iterative climate adaptation across the Department. Taking these steps to prepare American farmers, ranchers, forest landowners, resource managers, and communities for the effects of climate change will help ensure that our agriculture and forestry sectors continue to provide healthy food and fiber for America and the world, and that we conserve our soil, air, and water for generations to come.

Sincerely,



Secretary Tom Vilsack



I. INTRODUCTION

On January 27, 2021, in Executive Order (E.O.) 14008 Tackling the Climate Crisis at Home and Abroad, President Biden laid out a vision for a United States government-wide approach and a set of coordinated domestic actions to address the risks and opportunities posed by climate change. One of these actions directs the U.S. Department of Agriculture (USDA) to submit an action plan of steps to bolster adaptation and increase resilience to the impacts of climate change across our mission and operations.

Climate change poses a significant risk to agriculture, forests, and grasslands across the United States and the communities that support and depend upon them. This risk is disproportionately high for disadvantaged communities, including Tribal nations, low-income, and minority communities. USDA is unique among federal departments in the breadth of its Mission Areas and its reach across the United States to urban, rural, and Tribal communities. Steps to reduce the vulnerability and increase the adaptive capacity of American farmers, ranchers, forest owners, and other stakeholders to climate change are needed to maintain competitiveness and sustainability in the coming decades. Through climate change adaptation planning, USDA will increase the resilience of these sectors and communities to climate change.

Agricultural producers and forest landowners have extensive experience dealing with uncertain conditions, yet climate change is producing new challenges. Adaptation actions by USDA and our stakeholders can reduce the impacts of climate change while creating opportunities or co-benefits for mitigation, sustainable production, and conservation. The co-benefits of adaptation actions may also stretch as far as the social welfare of rural and urban communities by improving economic opportunities, infrastructure, and equity. The research and development necessary to support agricultural and forestry climate adaptation have the potential to spur new tools, practices, and technologies that may underpin the future of these sectors.

USDA last undertook extensive climate adaptation planning in 2014 in response to E.O. 13653 Preparing the United States for the Impacts of Climate Change. In that plan, USDA laid out a vision for how to integrate consideration of climate change into agency operations and overall mission objectives in the context of USDA's strategic goals. USDA provided progress and strategic updates to its climate adaptation planning via USDA's annual Strategic Sustainability Performance Plan, most recently in 2017.

FY 2021 is a transition year for USDA as its leadership develops a 2022-2026 USDA Strategic Plan, to align with the Biden-Harris Administration's priorities, which include addressing climate change. At the same time, USDA is tracking key performance indicators (KPIs) for the 2018-2022 Strategic Plan. A draft of the new goals was provided to the Office of Management and Budget (OMB) in June 2021. From June to September 2021, a cross-departmental working group will establish KPIs to gauge progress towards specific performance goals that are in alignment with the new strategic plan. A full draft strategic plan will be provided to OMB in September 2021. USDA's 2021 Annual Performance Report and 2023 Annual Performance Plan, due to OMB in November

2021, will close the 2018-2022 performance cycle's KPIs and, where possible, reflect the new draft KPIs. Finally, for FY 2021, USDA's Risk Profile will be updated to incorporate risks and risk mitigation strategies that reflect the Biden-Harris Administration's priorities, like climate change, where possible.

The complete package of this USDA Action Plan for Climate Adaptation and Resilience includes:

- This Action Plan for Climate Adaptation and Resilience that builds on prior adaptation plans,
- An update to USDA Departmental Regulation 1070-001 USDA Policy Statement on Climate Change Adaptation, and
- Identification of the Director of the Office of Energy and Environmental Policy (OEEP) in the Office of the Chief Economist (OCE) as the senior agency official responsible for carrying out the climate adaptation activities described in this Plan.

This Plan, which aligns with guidance from the White House Council on Environmental Quality (CEQ), includes:

- Five vulnerabilities due to climate change that USDA has identified and must address;
- Five actions USDA will implement in its mission, programs, operations, and management in anticipation of and in response to a changing climate;
- A description of efforts to enhance the climate literacy of USDA's workforce; and
- Descriptions of how climate adaptation and preparedness is built into management and decision-points for USDA climate-ready sites, facilities, products, and services.

II. CLIMATE VULNERABILITIES

Climate change presents many challenges to USDA and its stakeholders. The five

vulnerabilities below build on prior vulnerability assessments of the Department and draw from our best understanding of the threats posed by climate change and its impacts in the Fourth National Climate Assessment. The potential climate impacts to agricultural productivity, water quantity and quality, vulnerable communities, public lands and infrastructure, and as a result of extreme events will have broad Department-wide effects. For each vulnerability, we describe the threat and propose adaptation actions to address it. Some of these actions overlap with the cross-cutting actions outlined in section III, while others specifically target the vulnerabilities described below.

1. Decreased agricultural productivity

Climate change threatens growth in agricultural productivity through direct effects such as changes in temperature and precipitation patterns, and secondary effects, such as increased pest and disease pressures, decline in pollinator health, reduced crop and forage quantity and quality, and infrastructure damage. Agricultural productivity is additionally threatened by impacts to water supply and increased frequency and intensity of extreme weather events, which are described in more detail in Vulnerabilities #2 and #4. Agricultural productivity is vulnerable to the impacts of climate change via:

- **Crop and livestock production.** With variation at local, regional, and continental scales, climate change is projected overall to impact crop production by reducing both quantity and quality of yields, altering optimal growing season periods, and increasing likelihood of crop failure and damage. Similarly, livestock production will be impacted by reducing the quantity and quality of pasture and forage, lowering the yield of feed grain, affecting livestock health, and fostering the spread and resilience of pathogens and parasites that affect livestock development.



- **Reduced soil quality.** Agricultural, forest, and grassland soils are sensitive to long term changes in temperature and precipitation, management practices, and multiple uses like recreation. The interactive effects of these stressors can increase erosion rates, reduce soil quality, and alter soil composition that supports plant growth. Additionally, increases in temperature, changes in moisture levels, and disturbances like wildfire, pests, and disease can release carbon stored in soil organic matter.
- **Pest and disease pressure.** Climate change may expand or shift the range of a pest, pathogen, or vector organism, increasing its ability to establish in areas not previously considered at risk, elevating the risks to agriculture and forestry. Climate change may also lead to changes in wildlife migratory patterns, diseases, disease life cycles, predator-livestock interactions, and mass mortality events. These increased pressures may impact the Animal and Plant Health Inspection Service's (APHIS) ability to monitor for animal and plant pests and diseases in traded and domestically produced goods.
- **Pollinator health.** Pollinator health, which is essential to successful crop production and highly correlated with floral landscapes, is threatened by climate-driven temperature

and rainfall extremes. Areas vulnerable to climate change include the commercial beekeeping industry, non-managed pollinator populations, and the subsequent threats to specialty crop industries.

- **Crop insurance.** Agricultural producers purchase crop insurance for protection against numerous production and price risks, which can include climate and weather-related losses from hurricanes, flood, drought, hail, and wildfires. Forecasts of more rapid changes in climatic conditions have raised concerns that these risks will increase relative to historical conditions. In addition to implications for landowner decisions regarding land use, crop mix, and production practices, changing agricultural risks could affect the performance of the Federal Crop Insurance Program (FCIP), managed by the Risk Management Agency (RMA). Economic Research Service (ERS) analysis suggests that even with some adaptation actions taken by producers, climate change could lower domestic production of major commodities, leading to higher prices, higher premiums and, consequently, higher FCIP subsidies. Without adaptation actions on the part of farmers, these potential cost increases are likely to be even greater.

In response to the threats and impacts to agricultural productivity described above, USDA has identified several key adaptation actions:

- **Increase implementation of on-farm adaptation strategies and practices.** The Farm Service Agency (FSA) and the Natural Resources Conservation Service (NRCS) can leverage existing programs to support farmers, ranchers, and landowners in understanding the vulnerabilities of their operations to a changing climate and implementing adaptive practices and management strategies. NRCS programs, such as the Conservation Stewardship Program (CSP) and Environmental Quality Incentives Program (EQIP), and initiatives, such as the Soil Health Initiative, can

provide financial and technical assistance and resources for implementing practices, like cover crops, reduced and no tillage, and improved irrigation systems, that contribute to more resilient landscapes. FSA loan programs, including Operating Loans, the Farm Ownership Loan Program, and the Conservation Loan Program, can also provide funds for a wide range of purposes, including short-term equipment or operating needs or long-term infrastructure enhancements to support increased resilience. USDA agencies will continue to evaluate and modify existing programs, like the Conservation Reserve Program (CRP), the Emergency Conservation Program (ECP), and the Emergency Forest Restoration Program (EFRP), for climate risks and adaptation opportunities. In administering disaster-related programs, USDA will aim to build resilience and adaptive capacity to future shocks whenever possible. Barriers to scaling up the adoption of adaptation practices include high costs of implementation, insufficient incentives, and need for additional technical assistance to aid decision-making and implementation.

- **Support active landscape-scale management and disturbance responses.** Supporting healthy landscapes starts with ensuring that whole ecosystems are managed at the landscape scale, considering multiple components, interactions, and timescales. For example, the Forest Service's (FS) Burned Area Emergency Response (BAER) teams assess post-wildfire disturbances and implement short-term treatments to stabilize soils to minimize threats to built and natural infrastructure, helping to ensure long-term ecosystem integrity. On private working lands, NRCS's area-wide and watershed planning processes bring together state agencies, soil and water conservation districts, regional planning commissions, counties, and other governmental entities to coordinate long-term resource management

at the landscape level. Current barriers include capacity to translate science into practice and ensuring sufficient workforce and public education around these topics.

- **Improve access to climate data and tools.** Improved access to climate and climate-related data can help producers better understand changing conditions and adjust their management decisions accordingly. The USDA Climate Hubs play a pivotal role in developing and curating data and tools for producers and the public. USDA's Office of the Chief Economist (OCE) will continue to partner with the National Drought Mitigation Center (NDMC) to improve their capacity to provide actionable information to the public and record observed drought impacts.
- **Enhance systems for monitoring and mitigating vector and disease spread.** APHIS and FS will improve current monitoring systems and responses to vector and disease spread, incorporate state-of-the-art modeling to inform surveillance, develop early warning systems, and identify better options for vector control and animal protection. APHIS will also evaluate its regulatory framework for biotechnology and genome editing as use of these technologies increases to support the development of climate-adapted crops and livestock.
- **Continue research into climate impacts on agricultural productivity and adaptation strategies and practices.** Further research is needed to understand the full range of potential impacts, inform implementation of adaptation strategies, and identify barriers to access. The Agricultural Research Service (ARS) and the National Institute of Food and Agriculture (NIFA) support research on adaptation strategies, including adapted cultivars and crops, enhanced water and input-use efficiency, optimal production efficiency, and improved resistance to diseases and pests. ARS's Long-Term

Agroecosystem Research (LTAR) sites will continue landscape and regional-scale approaches to investigate sustainable intensification of U.S. agriculture. The Office of the Chief Scientist (OCS) will continue to coordinate research into pollinator health, including changes in plant pollen ranges, co-benefits of resilient plant species to pollinators and carbon sequestration, co-location of pollinator habitat with renewable energy sites, and practices to address increased stress on pollinator health.

- **Provide climate-smart risk management products.** New and continuing actions that RMA will take to help producers manage climate-related production risks include:
 - Evaluation and monitoring of climate risks to the FCIP and update of program parameters, like earliest and final planting dates and sales closing dates, based on these analyses;
 - Implementation of state-funded incentives to encourage cover crop planting;
 - Use of the Whole Farm Revenue Protection product to support farmers who use crop diversification to reduce risk;
 - Continued insurance coverage for crops that accommodate new agronomic practices that minimize water use;
 - Implementation of procedures that facilitate access to insurance coverage to accommodate climate-driven shifts in production areas;
 - Application of recently revised premium rating methodology so that rates more quickly reflect changes in risk; and
 - Monitoring of premium rating methodology, loss adjustment standards, underwriting standards, and other insurance program materials to ensure they are appropriate for new production regions or practice changes within regions.
- In parallel with these efforts, the Climate

Hubs will continue to provide information and tools to support producers' capacity to manage for impacts to crop insurance, such as the AgRisk Viewer, a decision-support tool that provides historic crop insurance data to assess climate risk.

Many of the actions described above are in-progress or positioned to begin soon through coordinated Department-level efforts and creative applications of existing USDA resources and programs. Additional investments directed towards these efforts will enable USDA to more effectively address actions that rely on new data or expertise or require significant program enhancements. In the near-term, progress can be measured using existing systems that correlate well with target outcomes, like data from the North American Long-Term Soil Productivity study, led by Forest Service Research & Development (FS R&D). Agency record-keeping can also support progress measurement, including loan funds use, technical and financial assistance disbursed, and programmatic changes or additional investments made considering assessed climate risks.

2. Threat to water quantity and quality

Climate change impacts on the water cycle are resulting in earlier snowmelt, reduced water supply, more intense and frequent drought, degraded water quality, excess soil moisture, and greater flooding, all of which will alter crop and animal production and quality and management of forest and rangeland systems. In 2021, producers in areas like the Klamath River Basin and the Colorado River Basin are again experiencing severe drought conditions resulting in historically low water allocations. Key threats and impacts related to water supply include:

- **Water quantity and drought.** With climate change, producers are confronting greater intra- and interannual variability in the distribution, quantity, and timing of precipitation. Drought has become more

persistent and widespread with impacts on soil moisture and health, groundwater recharge, runoff, and ultimately agricultural productivity. Changes in snowpack also impact water supply and seasonal runoff timing. These changes in the water supply have the potential to drastically shift the geographic distribution of agriculture and exert greater pressure on finite groundwater resources.

- **Water quality.** Precipitation extremes can cause excessive runoff and soil erosion, which lead to field production issues and downstream impacts on quality of water resources, including eutrophication and hypoxia.
- **Riparian and aquatic ecosystems.** Changes in climate and the water cycle are affecting aquatic and riparian ecosystem structure and function, potentially resulting in loss of at-risk species, new species being put at risk, the introduction of additional or expansion of existing invasive species, and the establishment of new diseases and pathogens.
- **Forest resilience.** Declines in forest health because of drought, excess soil moisture and flooding will lead to increased vulnerability to disasters (see Vulnerability #4) such as wildfires, severe storms, and forest insect and pathogen outbreaks. These disasters will impact communities through decreases in ecosystem health and delivery of ecosystem services.

Priority actions that can be taken to respond to these risks to water quantity and quality include:

- **Target existing programs to support water issues.** Projected changes in water availability will require programmatic shifts that specifically integrate climate adaptation and resilience-building. FSA currently delivers several assistance programs for producers who have experienced hardships due to water-related impacts including the Noninsured Crop Disaster Assistance Program (NAP), the Emergency



Conservation Program (ECP), the Tree Assistance Program (TAP), the Livestock Forage Program (LFP), and ad hoc programs like the Quality Loss Adjustment program (QLA). USDA will evaluate the existing programs within legislative authority to ensure that coverage or grazing periods accurately represent when threats to water quantity and quality could occur. For example, FSA programs could adapt to support water quantity and quality issues by broadening support to annual cropping systems that increase water use efficiency. NRCS's Regional Conservation Partnership Program (RCPP) and EQIP can provide financial and technical assistance to the irrigated agricultural sector in support of additional water storage infrastructure and soil enhancing practices.

- **Build resilience by enhancing soil health.** Through a variety of conservation practices, soils can be enhanced to promote water infiltration and be less prone to surface runoff and downstream flooding. Building soil health is a slow process that can take a number of years and requires changes in cropping systems and management practices. Programs like EQIP, RCPP, and the Soil Health Initiative help promote practices such as cover crops, reduced tillage, and prescribed grazing that can improve soil health and

build more resilient landscapes. Adaptation Action #1, below, further highlights the impact that improvements to soil health can make on long-term sustainability.

- **Use a landscape approach in addressing water issues.** Successful adaptation will require an integrated, landscape scale approach, including managing water resources across private and public lands, restoring terrestrial and aquatic ecosystems to enhance their resilience to climate stressors, and addressing the effects of pathogens and invasive species. Heterogeneous land cover makes developing resilience strategies for water resources on this scale complicated and requires participation, cooperation, and coordination of diverse stakeholders.
- **Explore innovative technology and approaches.** Drought-adapted varieties, dynamic and data-driven irrigation technology, and increasingly efficient delivery, storage, and recycling of water will be important adaptation tools. Improved and integrated climate, groundwater, and surface water measurements and modeling will help predict vulnerability in water availability and identify priority areas for reduced water use. Innovative translation of water management research and technology to on-field realities through extension and education will be essential to support user adoption and alleviate producer and land manager concerns.
- **Invest in water management infrastructure and adaptive irrigation systems.** Investing in additional water storage infrastructure, such as new reservoirs and managed aquifer recharge, and increasing the ability of water-related infrastructure to survive extreme events, can help irrigated agriculture adapt to a variable future and expand availability of seasonal runoff. In traditional rainfed agricultural regions, producers may adapt to more variable growing season precipitation by beginning to irrigate or practicing

supplemental irrigation. Barriers to these actions include the need to address the ecosystem impacts of dams, the relative lack of institutions to guide the development of managed aquifer recharge, and the high cost to build on-farm irrigation infrastructure.

- **Leverage existing federal coordination mechanisms.** USDA will continue to play a leading role in existing interagency drought coordination networks including the National Oceanic and Atmospheric Administration's (NOAA) National Integrated Drought Information System (NIDIS) and National Drought Resilience Partnership (NDRP). OCE and NDMC will continue to leverage their partnership to support Climate Hub projects that provide useful and usable drought products to end users. Moreover, the Climate Hubs will continue supporting NIDIS in their regional Drought Early Warning Systems (DEWS). A Drought Learning Network (DLN) was jointly developed by the Climate Hubs, NDMC, and NIDIS, and allows stakeholders to share experiences in preparing for, responding to, and recovering from drought.

Many current USDA programs are well-suited to address these water-related threats and can provide a strong foundation for completing the necessary actions. It will also take new and reinforced partnerships within federal government and with Tribes, states, non-governmental organizations (NGOs), and businesses to tackle the significant challenge of addressing the long-term sustainability of the Nation's water supply. Much of this work will take years to complete and therefore requires five- or ten-year timelines to measure progress. USDA's National Agricultural Statistics Service (NASS) data on the market value attributable to irrigated farms and irrigated land, which is collected in the Census of Agriculture, will be used to assess the efficacy of future adaptation efforts in the irrigated agricultural sector. U.S. Geological Survey's (USGS) water use reports, which are released at 5-year intervals, will serve as another useful

tool to measure changes in water use over time. Improvements in monitoring, infrastructure, and research could be realized with additional investments to further minimize the climate risks to water for soil and forest ecosystems.

3. Disproportionate impacts on vulnerable communities

Socially disadvantaged, low-income, minority, and rural populations as well as American Indians, Alaska Natives, and sovereign Tribal governments are more likely to be vulnerable to the impacts of climate change. These communities' ability to adapt to a changing climate is often limited by financial, social, and other constraints. Climate change is likely to disproportionately impact these communities via several pathways:

- **Health.** Many communities who are exposed to the impacts of climate change are already burdened by air and water pollution and other environmental health hazards. Health risks of climate change may compound existing health issues in Tribal and Alaska Native communities, including risks from the loss of traditional food and practices, community displacement, new infectious diseases, and other effects of climate change.
- **Food.** Climate change poses risks for the U.S. food system, including production risks (as described in Vulnerability #1), transport and trade vulnerabilities, the potential for increased food loss and waste, and diminished food safety. These vulnerabilities challenge USDA's mission to provide leadership on food, nutrition, and related issues.
- **Ecosystem services and livelihoods.** Climate change threatens ecosystem services that many communities depend on including clean air and water, subsistence foods, medicine, fiber, fuel, and cultural services, such as cultural heritage and identity, spiritual, aesthetic, and educational values,

and recreation and tourism opportunities. Rural communities, many of whose livelihoods are tightly tied to the agriculture and forestry sectors, and migrant workers, who provide a large share of agricultural labor in some regions, are particularly vulnerable to climate change impacts.

- **Extreme weather event impacts.** As described further in Vulnerability #4, the impacts of extreme weather events influenced by climate change are expected to have a disproportionate impact on populations lacking resources to cope with economic and environmental shocks and uncertainty. Communities in risk-prone areas can face cumulative exposure to multiple pollutants and climate event impacts. Without action, the adverse effects of extreme weather events, severe wildfire, flooding, drought, and invasive species on these populations and Tribal communities will only intensify.

USDA actions to help the most vulnerable communities adapt to climate change will include:

- **Increase equity and environmental justice awareness, skills, and abilities of USDA staff.** USDA will take additional steps to educate its staff on environmental justice, including disproportionate impacts from climate change, and how it relates to USDA agencies, programs, and activities. This will



enable the Department to assess its current and future activities, identify areas and strategies for improvement, and develop metrics to ensure progress in supporting communities most vulnerable to the impacts of climate change.

- **Engage meaningfully with impacted and vulnerable communities.** The Department will leverage existing relationships and build off past and on-going Tribal consultation and stakeholder engagement processes, including those recently initiated to seek input on the Department's climate-smart agriculture and forestry strategy. As the Department and individual agencies continue to develop adaptation and environmental justice strategies, they should engage directly with environmental justice leaders and communities impacted by climate change to understand vulnerabilities and risks, identify barriers to and resources for adaptation, and collaboratively develop solutions and responses, including through participatory adaptation planning.
- **Evaluate programs and activities for risks to communities.** In carrying out actions to address climate risks, USDA should develop robust processes to ensure disproportionately high impacts and maladaptation are avoided or mitigated. FS has developed guidance for incorporating analysis and consideration of impacted communities during Land Management Planning and National Environmental Policy Act (NEPA) processes and has established a robust Urban Forestry program to address environmental justice issues in urban areas. Evaluating risks to vulnerable communities may involve leveraging new and updated vulnerability assessments and existing and emerging tools, such as the proposed Climate and Economic Justice Screening Tool, to identify communities at risk.
- **Provide assistance and resources.** USDA will continue work to ensure its programs

and resources are distributed equitably and are accessible to those most at risk of climate change impacts and in need of adaptation support. Several USDA programs have special provisions or dedicated funding for historically underserved producers—which may include socially disadvantaged, beginning, limited resource, and veteran farmers and ranchers—who are among the most vulnerable to impacts. Activities to integrate environmental justice and equity into existing programs will require removing barriers to participation, establishing trust, transparency, and accountability, identifying opportunities for broader inclusivity, and targeting education and outreach. Additional areas for advancing equity and environmental justice are described within USDA's Climate-Smart Agriculture and Forestry Strategy: 90-Day Progress Report.

Ensuring environmental justice and equity is an ongoing activity for USDA. The actions presented here can build on recent outreach efforts that have resulted in increases in program participation by historically underserved producers. Agencies will need to prioritize environmental justice in their planning and budget processes and when implementing new programs and policies. Indicators of success will be identified in coordination with the White House Environmental Justice Interagency Council's forthcoming performance metrics.

4. Shocks due to extreme climate events

Climate change is causing more frequent and intense disruptive events including hurricanes, floods, drought (see Vulnerability #2), and fires, which can have significant impacts on agriculture and forestry. Rural and vulnerable communities will be disproportionately impacted by these events while lacking the resources to adequately prepare for and respond to them. Key areas of impact associated with extreme climate events include:



- **Hurricanes, floods, and other extreme weather events.** Extreme weather events are not new, but recent increases in frequency and severity of these events, like hurricanes, floods, tornadoes, hail, and other severe storms, have negatively affected working lands. Hurricanes and floods are expected to increasingly affect U.S. agriculture and forests leading to crop loss and production delays, degradation of soil and water resources, damage to infrastructure, alteration of forest health and productivity, and impacts to community health and safety. As hurricanes become more frequent and severe, wind, rain, and debris damage to buildings, power grids, and telecommunications will be increasingly common. Landslides, stream washouts, and downed trees can threaten water quality and community and animal safety, and frequently require targeted restoration and salvage efforts.
 - **Wildfire.** Climate change is expected to continue to alter fire regimes, increasing the frequency and extent of wildfire. As the wildland-urban interface expands, wildfire presents increased risks to human health and infrastructure. Severe wildfire can leave forests in need of reforestation and restoration and heighten the risk of secondary disturbances such as erosion, landslides, and invasive species.
 - **Vulnerability of rural communities.** As mentioned in Vulnerability #3, rural communities are particularly vulnerable to extreme weather events due to a greater direct dependence on agriculture, forestry, and outdoor recreation for income and employment, existing challenges with infrastructure and connectivity, and limited capacity to prepare and respond to these events. Severe weather events threaten ongoing rural development efforts, negatively impacting projects, destroying properties, delaying construction, and disrupting revenue for existing loans. Increasing climate variability will result in increasing uncertainty in agricultural and forest industries in rural communities, likely leading to long-lasting shifts in community structure and composition. Current declining trends in population and employment tend to also reduce resources available to local government and community associations to deal with climate change variability.
- In addition to the resilience-building actions described in Vulnerabilities #1 and #2, further actions can be taken to adapt to the risks from extreme climate events:
- **Update vulnerability assessments.** With the support of the USDA Research, Education, and Economics (REE) agencies and FS R&D, in 2015 the Climate Hubs conducted vulnerability assessments for each of their ten regions based on the Fourth National Climate Assessment. Likewise, FS engaged in science management partnerships to develop vulnerability assessments in over 100 national forests and grasslands, including other public and private lands, with applications in land management and project plans. The Hubs will update their vulnerability assessments for the forthcoming Fifth National Climate Assessment and continue to support the development of

more place-based assessments that identify climate-smart practices to build resilience.

- **Use monitoring tools to build resilience.** NASS has developed a series of geospatial agricultural monitoring portals that can be used to identify and quantify impacts from extreme climatic events. These portals can provide near real-time updates on major storm disaster events, crop condition and soil moisture, decision-support system capabilities, and annual planted crop area to inform agricultural adaptation strategies. Examples of these NASS portals and other USDA-supported decision-support tools include:
 - NASS Disaster Analysis Program, which captures impacts from major storm events,
 - The joint vegetative condition and soil moisture monitoring portal,
 - AgroClimate, a weather and climate-based decision support system for agriculture, and
 - After Fire: Toolkit for the Southwest, a resource to assess post-fire risks.
- **Build forest and grassland resilience through management, planning, and responses.** Active management to build resilience to wildfire, insects, and disease is a high priority for the FS. USDA's Climate-Smart Agriculture and Forestry Strategy: 90-Day Progress Report and Adaptation Action #1, below, discuss these efforts further. Specific actions related to extreme events include development of information on disaster preparedness and response, support for forest products and markets for salvage and small-diameter timber, and support for post-disturbance emergency stabilization and rehabilitation. Wildfire and hurricanes can provide opportunities to increase climate resilience through species selection and soils restoration in disturbed areas. Barriers to implementation include underdeveloped markets and feedstock sources that slow use

of hurricane salvage and small-diameter timber.

- **Strengthen disaster assistance and relief programs.** In addition to assistance programs mentioned in Vulnerability #2 (NAP, ECP, TAP, LFP, and QLA), FSA offers the Livestock Indemnity Program (LIP), Emergency Assistance for Livestock, Honeybees and Farm-raised Fish (ELAP), and Wildfire and Hurricane Indemnity Program and Program Plus (WHIP and WHIP+) to help producers cope with impacts of extreme events and natural disasters. FSA also provides Emergency Loans for producers who might otherwise be forced to terminate operations, and Disaster Set-Aside options, which allow direct loan borrowers to forego an installment until the end of the loan term to reduce short-term financial strain due to a disaster.
- **Enhance the adaptive capacity of rural communities.** Resilience to extreme events and other climate impacts will require increasing local capacity to make adaptive improvements to community resources and expanding options for economic opportunities. USDA's Climate-Smart Agriculture and Forestry Strategy: 90-Day Progress Report highlights ways in which USDA can support new and better for markets for agriculture and forestry products while simultaneously building the resilience of rural communities. Examples of actions include supporting participation in voluntary carbon markets, renewable energy development and energy efficiency activities, and loans and grants to expand broadband access.

Many measures to build resilience to extreme events are long term investments whereas some programs will have distinct timelines triggered by the occurrence of such events. For example, while loan assistance is on-going, Emergency Loan and Disaster Set-Aside assistance is only available after a declared disaster. The level of support proposed in the FY 2022 budget and other

mechanisms will be used to address the backlog of National Forest System (NFS) restoration projects and enhance current work on risk identification, vulnerability assessment, adaptation planning, and disaster preparedness and recovery. Program records, including FSA's loan disbursement records and NRCS's reporting on conservation and investments, can be used to track activities. Progress on NFS lands will be monitored through the FS Climate Scorecard and the number of acres restored.

5. Stress on infrastructure & public lands

The increasing frequency, severity, and extent of disturbances with climate change can have far-reaching consequences on natural and built infrastructure on public lands. Changes in flood frequency, wildfire intensity, sea level, and extreme precipitation events can cause damage to low-elevation infrastructure, threaten utilities and air quality, endanger coastal communities, and increase erosion and landslides. For the NFS, in the absence of any climate adaptation action, reforestation and restoration needs will continue to increase, ecosystem services will be lost or diminished, aging infrastructure will deteriorate, and social and economic benefits will be disrupted. Roads and bridges damaged or lost because of increased flooding can limit access to Federal lands, create safety hazards, and reduce the availability of water resources. Actions USDA can take regarding built infrastructure and forest resilience include:

- **Increase resilience of built infrastructure.** Infrastructure must be upgraded, or newly designed, to withstand increasing extreme events and disturbances. The FS is using decision support tools and climate change vulnerability assessments to identify when and where to relocate or decommission vulnerable infrastructure and improve transportation infrastructure to reduce erosion and sedimentation. Other adaptation

actions include improving streamflow forecasting and expanding streamflow and snowpack monitoring networks to help managers respond to extreme events and ensure water allocation downstream. Barriers to implementation include funding to upgrade existing infrastructure and uncertainty in future flood projections.

- **Address forest restoration needs.** FS will need to increase the pace of restoration to address 1 to 4 million acres of restoration needs on national forests as described in the FS reforestation strategy. This action will require the use of planning tools and decision-making frameworks to enable collaborative planning and implementation of large restoration treatments across management boundaries.
- **Build resilience to severe wildfires and their effects.** Building resilience to wildfire necessitates the accelerated use of prescribed fire and the strategic implementation of hazardous fuel treatments to reduce wildfire impacts. Following severe wildfires, FS will prioritize public safety, forest rehabilitation, and slope stabilization. Rural Development (RD) and FS will work together to identify opportunities to link post wildfire restoration efforts with bioenergy generation. Barriers to implementing this action include limited





capacity and competing priorities during periods of widespread wildfire activity, State and local air quality compliance for prescribed fires, and public resistance to wildfire and fuels management.

Addressing the growing reforestation and restoration backlog over the next 10 years will require a four-fold increase in planting and a 30 percent increase in certification of natural regeneration, resulting in 3.6 million acres reforested. Given the importance of forest health and resilience to the long-term sustainability of forest landowners and surrounding communities, these efforts are described in further in Adaptation Action #1 below. For infrastructure like roads, bridges, and facilities, their long service life means that adaptation will be a long-term effort. Long-term monitoring will help detect potential climate change effects and evaluate the effectiveness of adaptation options. Existing FS monitoring efforts include the Climate Scorecard (biennially through 2025), the Key Performance Indicator for Terrestrial Condition Assessment (annually for all NFS lands), the Watershed Condition Framework, Biennial Monitoring Reports, and Forest Inventory and Analysis.

Already, the Great American Outdoors Act (GAOA) is being leveraged to develop more resilient infrastructure. In March 2021, USDA announced investment via GAOA's National Parks and Public Land Legacy Restoration Fund,

which will enable implementation of more than 500 infrastructure improvements across national forests and grasslands. The Forest Service also continues to use Land and Water Conservation Fund (LWCF) programs to strategically conserve forests on private and public lands. Future investments to address the reforestation backlog and wildfire risk could be targeted towards nurseries and natural infrastructure, accelerated project planning, building expertise, and improving management strategies to build resilience to wildfire. Continued and expanded cross-boundary collaboration with other federal agencies, Tribes, states, and partners will help achieve the requisite scale of response.

III. USDA'S ADAPTATION ACTIONS

Building on the vulnerabilities identified above, USDA will take cross-cutting adaptation actions to prepare the American agriculture and forestry sectors and rural and urban communities to be resilient in a changing climate. These actions aim to bridge the gap between innovative science and technology for climate adaptation and preparedness and in-field and on-site practices to build soil and forest health. These actions will reduce producers' vulnerability to climate change through increased access to relevant climate data and expanded education and outreach efforts.

The Fourth National Climate Assessment outlines the key challenges associated with adaptation planning for USDA consideration. The first challenge is that adaptation planning must be a sustained, iterative process. Mainstreaming the climate preparedness thought process rather than making it an additive step in decision-making will lead to greater success. Secondly, it is essential that USDA considers both current and projected climate change and variability in its planning and decision-making. Supporting climate literacy within the USDA workforce, as discussed later in this Plan, can support this new mode of thinking.

A third challenge is ensuring that climate adaptation actions are not limited to the stages of awareness, assessment, and planning but are implemented, monitored, and re-evaluated, which will require sustained attention and measures of success. Finally, the impacts of climate change on USDA and its stakeholders will vary regionally and locally, requiring climate adaptation actions at relevant scales.

USDA proposes adaptation actions to:

1. Build resilience across landscapes with investments in soil and forest health;
2. Increase outreach and education to promote adoption and application of climate-smart adaptation strategies;
3. Broaden access to and availability of climate data at regional and local scales for USDA Mission Areas, producers, land managers, and other stakeholders;
4. Increase support for research and development of climate-smart practices and technologies to inform USDA and help producers and land managers adapt to a changing climate; and
5. Leverage the USDA Climate Hubs as a framework to support USDA Mission Areas in delivering adaptation science, technology, and tools.

1. Build resilience to climate change across landscapes with investments in soil and forest health

Economic vitality and quality of life throughout America depends on healthy, climate-adapted agricultural and forest systems. Proactive investments in soil and forest health will build resilience to climate change into these systems. This action includes efforts to build resilience via conservation practices, improved

water management and efficiency, climate-informed reforestation and forest management, and ecosystem restoration and management. Enhancing soil and forest health will protect ecosystem functions that support the long-term resilience of working lands and forests and enable producers to successfully and sustainably enhance productivity to meet growing global demand in a changing climate.

Climate change threatens to increase the degradation of soil and water resources, including via increases in extreme precipitation events that lead to soil erosion, degraded water quality in lakes and streams, damage to infrastructure, and diminished crop production. On forest land, a combination of acute disturbances and shifts due to gradual climate change are expected to alter forest structure, function, productivity, and health, which will decrease the ability of forests to provide important ecosystem services. The rate at which restoration services are needed across the landscape is currently outpacing the capacity of land management agencies and their partners.

A variety of conservation management practices to restore soil structure and hydrologic function of agricultural landscapes can be adopted to improve resilience, including no till and reduced till, cover crops and crop rotations, improved nutrient management, agroforestry practices such as windbreaks and buffers, and prescribed grazing. These practices help to reduce erosion and



increase organic matter in the soil, which improve water holding capacity and water infiltration, thereby increasing resilience to drought, heavy precipitation, and extreme temperatures. Current adoption of these practices varies by practice, region, and crop. For example, U.S. farmers have rapidly expanded their use of cover crops, a 50 percent increase from 2012 to 2017, yet their use spans only 5 percent of total harvested cropland. Active forest management, including thinning forests and treating fire-deficient landscapes by prescribed burning, and climate-smart reforestation can increase resilience and reduce risks of wildfire, insect, and disease related mortality.

Many of these practices provide co-benefits for climate change mitigation via enhanced soil carbon sequestration and reduced emissions and for water quality and quantity through reduced erosion and runoff. Improvements in forest health can mitigate emissions from increased wildfire, increase soil carbon sequestration, mitigate risks to communities in the wildland-urban interface, and maintain other valuable forest ecosystem services.

Recent and ongoing USDA activities to promote resilience via enhanced soil and forest health include:

- Creation of The Adaptation Workbook, which producers can use to assess threats and document management choices to minimize climate change impacts to their operations. The workbook uses menus of adaptation strategies and approaches for forests, urban ecosystems, forested watershed and water resources management, agriculture and working lands, and recently published menus focusing on Tribal perspectives, forest carbon, and recreation. The workbook has been used to generate hundreds of adaptation demonstration projects using real-world examples of forest and farm management.
- Curation and continued growth of an online compendium of nearly 500 adaptation approaches with numerous associated examples on the FS Climate Change Resource Center (CCRC).
- Awards through NIFA's Agriculture and Food Research Initiative (AFRI) to fund 14 Soil Health grants and 7 Signals in Soil grants, an interagency program with the National Science Foundation (NSF).
- Investment in NRCS's Conservation Innovation Grants (CIG) to support the development of innovative tools, approaches, practices, and technologies to further natural resource conservation on private lands. The Soil Health Demonstration Trial, part of the CIG On-Farm Conservation Innovation Trials, will focus extensively on implementation of conservation practices and systems that improve soil health.
- Commitment of NRCS resources to fund 85 locally driven, public-private partnerships via the Regional Conservation Partnership Program (RCPP) to address climate change, improve water quality, combat drought, enhance soil health, support wildlife habitat, and protect agricultural viability.
- Encouraging enrollment in the Conservation Reserve Program (CRP) with new incentives and other adjustments to payments and a focus on the program's role in climate change mitigation. CRP provides annual payments to producers in exchange for removing environmentally sensitive lands from production and implementing practices to improve soil health and provide other benefits. In addition to general and continuous CRP sign-up, FSA offers CRP Grasslands and pilot programs focused on soil health and clean water, such as Clean Lakes, Estuaries and Rivers 30-year contracts (CLEAR30). FSA administers CRP on behalf of the Commodity Credit Corporation.
- Investments in the FS and NRCS's Joint Chiefs' Landscape Restoration Partnership, which includes projects to mitigate wildfire risk, improve water quality, and restore healthy forest ecosystems on public and private lands.

- Release of a new fire mapping tool, Southeast FireMap, to enable resource managers to improve their approaches to managing wildfire risk and fire management needs through targeted prescribed burns and training.

Building on the efforts described above and in conjunction with the objectives of the Climate-Smart Agriculture and Forestry Strategy: 90-Day Progress Report, USDA will use strategic investments to carry out climate-informed forest management and restoration activities, provide wildfire mitigation response, incentivize and scale up voluntary adoption of soil and forest health enhancing practices, and support markets that value the enhanced resilience of producers and ecosystems. Climate-adaptation practices will need to fit the geographic context and align with the interests of farmers and land managers. This is especially important because implementation costs are usually incurred on shorter timescales than the soil and forest health benefits are realized. A combined effort from NRCS, FSA, FS, USDA research agencies, the Climate Hubs and other USDA agencies will be essential to implement these actions effectively and address these challenges.

NRCS will play a key role by providing technical and financial assistance to farmers to implement and incentivize conservation practices through several existing programs and initiatives, including EQIP, CSP, RCPP, CIG, and the Soil Health Initiative. The backbone of NRCS data for designing assistance is the National Cooperative Soil Survey Program, which provides information on soil and ecological site resources of farms and ranches across the United States. FSA aims to increase enrollment in CRP by 4 million acres or more over the coming year, with the long-term goal to establish valuable land cover to improve water quality, soil health and carbon sequestration, and prevent soil erosion and loss of wildlife habitat. REE agencies and other programs, like the National Agroforestry Center, will provide the science and innovations that will underpin the management choices taken by the program



agencies, as described in Adaptation Action #4.

FS will scale up its activities to accelerate the strategic implementation of hazardous fuel treatments and prescribed fire to reduce wildfire risks and to increase forest restoration and reforestation. To significantly reduce the risk of high intensity wildfire, over the next 10 years, the FS will need to treat an additional 20 million acres of NFS land and 30 million acres of other Federal, State, Tribal and private land, especially in the Western United States. These goals are consistent with the recommendations outlined in USDA's Climate Smart Agriculture and Forestry Strategy: 90-Day Progress Report and current

budget priorities. A number of FS programs and initiatives will be engaged to build resilience on forests and grasslands including the Forest Legacy Program, which supports easements and land purchases for private-land conservation, as well as the Community Forest Program (CFP), Forest Stewardship Program (FSP), Sustainable Forestry African American Land Retention Program (SFLR), and Urban and Community Forestry (UCF) Program. Planning and decision-making in these programs and management activities will be based on climate-smart principles informed by FS R&D and the Climate Hubs.

The Climate Hubs will support efforts to build soil and forest health through ongoing work to empower land managers to incorporate climate adaptation into their land management planning. Further details of the Hubs' outward and inward-facing efforts are included in Adaptation Actions #2 and #5, respectively.

Scope, Performance, and Resources

- This action will work to build resilience across diverse landscapes at local to national scales, with a particular emphasis on supporting producers and land managers most vulnerable to climate change impacts. While conservation practices are often implemented at the field, farm, and stand levels, conservation planning can also be coordinated at the area and watershed levels. Large-scale forest treatment and restoration often spans management boundaries.
- USDA will track and estimate benefits of soil health practices using national survey data and program data. These data can be used to estimate soil carbon benefits and other co-benefits of soil health practices. USDA is planning to improve conservation data collection and reporting by implementing new surveys, which will provide more information on the adoption and benefits of soil health practices.
- FS will use its Climate Scorecard, particularly the Adaptation element, to monitor progress.

- Active forest management treatments to reduce wildfire risk on Federal, State, Tribal and private lands will require cross-government coordination.
- The President's FY 2022 Discretionary Funding Request includes significant investments within FS, NRCS, and other USDA agencies to enhance soil and forest health and resilience on public and private lands, including through support for voluntary conservation on working lands and for high-priority hazardous fuels and forest resilience projects.

2. Increase outreach and education to promote adoption and application of climate-smart adaptation strategies

The Nation's farmers, foresters, and ranchers face increased vulnerability of their operations to extreme weather and long-term changes in climate. Low-income, minority, and Tribal communities as well as small-scale, beginning, young, underrepresented, and underserved farmers and foresters will bear the brunt of negative climate change impacts, made more difficult by lack of accessible and useful information sources. Maladapted agriculture and forestry sectors could lead to a less diverse and resilient food system, degraded natural resources, and missed economic opportunities.

The goal of this action is to promote adoption and application of climate-smart adaptation strategies. USDA's Climate Hubs and NIFA, in partnership with the Cooperative Extension Service, Historically Black Colleges and Universities, Tribal colleges, Hispanic Serving Institutions, additional university partners, NGOs, and others, can provide resources to farmers, ranchers, and forest landowners to increase awareness of and engagement in opportunities to address climate change. Investments in the Climate Hubs program will allow the network to scale up their efforts to

develop and deliver science-based, region-specific information and technologies. The Climate Hubs will strengthen partnerships to enhance support for science-based decision-making and facilitate knowledge sharing of climate risks, vulnerabilities, and adaptation strategies. NIFA will evaluate the inclusiveness of climate in its education and extension portfolio and leverage its resources to encourage stakeholders to partner with the Climate Hubs to develop and deliver resources to America's farmers, ranchers, and landowners. Together, the Climate Hubs and NIFA can strengthen the role of extension as a force multiplier in increasing adoption and application of climate-smart practices. With a presence in nearly all of the more than 3,000 counties of the United States, the Cooperative Extension System's network of agents and specialists will be essential to expanding the use of climate-smart strategies described in Adaptation Action #1.

Recent accomplishments by NIFA and the Climate Hubs towards this goal include:

- NIFA support for Cooperative Extension professionals who are actively engaged in the National Extension Climate Initiative (NECI), which promotes the recognition of the climate crisis, coordination and management of climate-smart agriculture and forestry outreach activities, and sharing of program materials;
- A NIFA solicitation for extension and education projects that include partnerships with the USDA Climate Hubs through AFRI's Foundational and Applied Science Request for Applications (RFA);
- Through the Climate Hubs, development of 11 curricula reaching 402 students, production of 118 in-person or virtual workshops with an estimated 7,800 participants, 214 presentations, and 439 engagements with Tribes or Tribal organizations in FY 2020.

The Climate Hubs are a focal point for outreach and education efforts around climate impacts and risk management on working lands. Moreover,



the Hubs act as conveners helping to gather information from Tribal and stakeholder groups to understand regional issues and deliver actionable, relevant information to enhance climate-informed decision making. While many of the Climate Hubs already engage with local communities, states, and Tribes, the Hubs' capacity to increase climate outreach and education could be enhanced through dedicated Tribal and state liaisons. In addition, the Climate Hubs can expand their reach into under-resourced and underserved communities through delivery of timely, relevant, and credible information, data, and tools. NIFA can leverage existing and new funding sources to support colleges and universities, especially minority-serving institutions, in developing partnerships with the Climate Hubs. NIFA will also increase consultations with community colleges and minority-serving institutions to ensure widely accessible climate education and outreach opportunities.

Implementation will be accomplished through an expansion of the USDA Climate Hubs program and establishment of NIFA funding opportunities to address this Adaptation Action. USDA intends to leverage opportunities for enhanced technology transfer and implementation of climate-smart practices by linking USDA staff with other federal climate change coordination efforts such as the Department of the Interior's Climate Adaptation Science Centers (CASCs), NOAA's Regional

Climate Centers and Regional Integrated Sciences and Assessments (RISAs), and U.S. Global Change Research Program (USGCRP) working groups.

The Climate Hubs will evaluate success based on activities including vulnerability assessments, adaptation planning and menus, jointly developing decision-support tools, building technology to support climate resilience, and stakeholder workshops/listening sessions. Key metrics for NIFA include number of RFAs published that include climate change language and projects funded that support climate outreach and education.

Scope, Performance, and Resources

- The USDA Climate Hubs are located at five ARS and five FS research stations comprising ten regions spanning the United States and its territories. The Climate Hubs support local, state, and regional efforts including cross-region and national initiatives when there are common interests or technology needs.
- The Climate Hubs are overseen at the national level by an Executive Committee (EC) comprised of senior program leaders from across the Department who provide leadership on action development, implementation, monitoring, evaluation, and oversight. The National Lead, a 2-year rotating position among ARS, FS, and NRCS, works through the EC to ensure national coordination to capitalize on synergies and efficiencies.
- New NIFA programmatic support for climate extension and education is expected in FY 2022. NIFA will need to balance climate with other priorities across its research, education, and extension portfolio. Additional National Program Leaders with social and behavioral science expertise will help develop effective climate outreach and education programs.

- The President's FY 2022 Discretionary Funding Request for the Climate Hubs will support an expansion of climate science tools and landowner awareness and engagement in climate adaptation practices.

3. Broaden access to and availability of climate data at regional and local scales for USDA Mission Areas, producers, land managers, and other stakeholders

Increasing access to and use of climate data, models, and decision support tools at the regional and local scales for producers, land managers, state and local policymakers, and USDA Mission Areas is a critical and ongoing priority for supporting timely responses to the impacts of climate change. This action necessitates organizing, streamlining, and coordinating data access points and online data delivery. Ensuring that climate adaptation strategies are accessible to all farmers, ranchers, forest landowners, and communities will require that USDA address internet access and other infrastructure or resource issues that limit access and use of climate data.

The Department aims to increase access to reliable climate data by supporting the collection and curation of scientific information on climate change and translating that information into user-friendly decision support tools, models, and recommendations to provide guidance on benefits and outcomes associated with agronomic decisions. To accomplish this goal, the Department must also provide equitable access to technical assistance and training for climate data end users.

Ways in which USDA already collects and provides data for improved resource management in a changing climate include:

- ARS's development of the Agricultural Collaborative Research Outcomes System

(AgCROS) database to provide data to the public research and development community and its Partnerships for Data Innovation (PDI) program to implement sensors and other data collection, integration, and sharing systems that will help farmers get the most from their limited resources;

- ERS's regular evaluation of its Agricultural Resources and Management Survey data products;
- NRCS, which delivers data on conservation practices and is modernizing its Plant List of Accepted Nomenclature, Taxonomy, and Symbols (PLANTS) database;
- FS's Forest Inventory and Analysis (FIA), which provides annual data on forests to assess sustainability of management practices, monitor forest health, productivity and carbon stock change, and predict the effects of climate change;
- NIFA with its AFRI Data Science for Food and Agricultural Systems program area that supports projects that harness data science to aid land managers in decision-making and a collaboration with the National Agriculture Library on an open data framework; and
- The Climate Hubs, which have improved the discoverability and usability of RMA crop insurance data for enhanced climate risk management with the AgRisk Viewer.

This action provides an opportunity to deliver credible science and user-friendly decision-making tools that can help producers and land managers apply climate change and weather-related information to their operations. Reliable data can inform planting decisions, farming practices, and business decisions. By improving current data access, this action enables USDA to provide support and incentives for agricultural data standards and to encourage partnerships with public and private data trusts. Additionally, this action presents the opportunity to create a USDA-wide open access agricultural, rangeland and



forestry database to drive development of more advanced tools for producers and land managers.

The Department will identify existing or emerging issues with data access as well as opportunities for improvement, with a particular focus on access for low-income, socially disadvantaged and historically underserved communities. Consistent financial support will be key to ensure that the necessary infrastructure exists for data access. The lack of a cohesive and consistent cloud computing environment will restrict the ability to deliver spatial data sets, and Chief Information Officer restrictions on research and development application development may delay delivery of user-friendly climate dashboards and tools. Other challenges include the availability of temporally resolved geospatial imagery, the need for additional data science expertise, and the capacity to incorporate social and behavioral sciences to evaluate human dimensions of the food system. Data and decision-support tools need to be accessible to rural communities, which may be challenging with current broadband and internet infrastructure in some communities. Collaborations with federal funding agencies to provide research support will aid in understanding complex climate issues and allow the Department to craft models and decision-making products essential for the sustainability of economic and natural resource systems.

Scope, Performance, and Resources

- Increasing access to climate data is an ongoing priority in the Department, and a reasonable timeframe for achieving the goal will be FY 2021 through FY 2025. The first key milestone of this action will be leveraging new technologies and computing resources to effectively deliver additional climate data through online tools in FY 2022 and FY 2023.
- This action will require contributions and support from ARS, ERS, FS, NASS, NIFA, NRCS, and OCS.
- Maintaining current levels of delivery and data access will likely be possible with existing resources. Direction of additional investments and technical capacity towards this action could further improve data quality, timeliness of delivery and ease of access by users.
- Increased access to and consistency of climate data should be addressed at the national, regional, and local scales.
- Supporting information tools that provide resolution across multiple scales will be critical to allow users to adjust output based on their specific need.
- Increased availability of technical assistance to support climate data and tools, increased access and use of climate and climate-related data, feedback from user communities on the usefulness of information and data, and the reduction in gaps of science and science delivery for agriculture will serve as useful performance measures.
- USDA will work to better understand Tribe and stakeholder needs for climate data, particularly in underserved communities.
- The Department will coordinate with science agencies across the federal government, including the NSF, the Department of Energy, the National Aeronautics and Space Administration, and NOAA to ensure that

federal climate-related data are accessible to those in the agriculture, rangeland, and forestry sectors.

4. Increase support for research and development of climate-smart practices and technologies to inform USDA and help producers and land managers adapt to a changing climate

USDA will continue to support and coordinate the efforts of its research agencies to develop innovations in climate-smart agriculture and forestry. Evaluating the efficacy of adaptive practices and technologies on working lands, including productivity synergies and tradeoffs and mitigation co-benefits on soil carbon storage and GHG emission reductions, is a research priority. Other key topics for climate research include improved fertilizer technologies, genetic studies to identify climate resilient plants and trees, and studies of the impacts of climate change on pollinator communities and vector-borne livestock diseases. Modeling efforts can project the affordability of climate-smart activities, infer adoption likelihood, and project pest and disease outbreaks under different climate change scenarios. USDA's long-term monitoring networks for snowpack, precipitation, and soil moisture provide data to investigate trends and develop management options.

The Department's research activities form the basis for validating existing climate adaptation options and identifying and developing new ones, while ensuring the actions are regionally relevant and economically viable. USDA's research integrates climate and socioeconomic change with production and land-management outcomes, while considering the secondary effects of climate's influence on pollinators, pests, diseases, invasive species, and extreme events such as flooding and drought. New scientific information and tools, contextualized and implemented locally, can help

land and resource managers increase the resilience of those systems and the communities that depend on them. To date, however, implementation has been slow. Increasing partner engagement, science co-production, and delivery will ensure that the best available science is understood and put into practice.

USDA's efforts to understand and minimize climate risks for its stakeholders have yielded important accomplishments, a few of which are highlighted here:

- In July 2020, USDA published a report documenting 20 Climate Indicators for Agriculture to support decision making and to understand the larger climate context of U.S. agriculture.
- NIFA currently supports approximately 400 active projects related to climate change representing an investment of approximately \$200 million.
- Scientists at ARS are developing a Grand Challenge Synergy Project proposal "Creating pollinator landscapes and beekeeping practices for a changing climate," to synergize efforts across ARS and other federal and state agencies to find solutions to the climate change challenges experienced by pollinators. In May 2021, Project Leaders held a workshop to obtain perspectives from scientists and stakeholders and build collaborations required to generate and implement solutions to pollinator loss from climate change.
- FS has developed national and regional syntheses of climate effects on forests, agroforestry, non-timber forest products, forest and rangeland soils, invasive species, and the wildland urban interface and identified management opportunities and adaptation practices.
- In collaboration with ARS, NRCS, NDMC, and university partners, the Climate Hubs developed Grass-Cast to provide enhanced decision support to ranchers and grassland



managers by estimating forage productivity during the growing season.

- FS's FIA program has successfully led to practical tools for forest carbon assessment and monitoring climate change effects on forest species composition and abundance.
- NRCS's Snow Survey and Water Supply Forecasting and Soil Climate Analysis Network data are used to manage water resources and plan for water shortages in the Western United States.

Managing competing research priorities will require a coordinated effort at the Department and agency levels. As described in Adaptation Action #3, translating experimental data into information and decision tools is a complex process that is required for the adoption of climate-smart practices and technologies. Evaluating the effectiveness, tradeoffs, and synergies of climate-smart practices will require a multidisciplinary systems approach.

USDA anticipates that existing organizational, administrative, and coordination capacity will rapidly and efficiently integrate many of the new research and development priorities outlined in this Plan. As described in Adaptation Actions #2 and #5, USDA will work through the Climate Hubs, extension, and other means to understand stakeholder needs and deploy new information, data, practices, tools, and technologies to private landowners and managers for implementation. Relationships with land-grant universities, technical service providers, and other cooperators will be leveraged to achieve this goal. Finally, USDA will use internal and interagency working

groups and review of existing funding authorities to identify research opportunities and increase support where appropriate for climate-smart research activities.

Many ongoing USDA research projects with climate adaptation applications will continue into the foreseeable future, for example:

- ARS has numerous climate adaptation research projects throughout its crop, animal, natural resource, and food nutrition programs.
- FS activities to increase support for applied climate science to develop and evaluate practices and technologies, engage in the development and co-production of science, and use social science to identify adoption barriers will be initiated in FY 2022 and continue at least through FY 2026.
- NIFA will support new Artificial Intelligence Research Institutes focused on climate change in FY 2022 and continue to support climate science in the AFRI Sustainable Agricultural Systems (SAS) RFA.
- FSA's evaluation of the soil benefits of the Conservation Reserve Program will undergo a significant expansion in FY 2021 and will continue for at least five years, with the potential to go beyond 15 years.

Existing monitoring efforts and those developed by USDA's research agencies during adaptation planning will be used to track the outcomes of science implementation and adaptation actions. These efforts will consider the outcomes of focused listening sessions, adaptation case studies, dissemination and training workshops, new tools and tool improvements, research partnerships and measures like adoption rates, publications, data usage, fellowships, and funding levels.

Scope, Performance, and Resources

- OEEP coordinates USDA's climate change activities, including execution of this Plan, through the monthly USDA Global Change Task Force (GCTF) and represents USDA to the interagency USGCRP. OCS

provides Department-wide coordination of agricultural research, education, and extension needs.

- USDA's research spans field-scale practices, whole-farm or forest systems, regional monitoring networks, and national-scale analysis and assessment.
- Coordination is generally a national headquarters activity, while primary research activities largely occur in the field to capture diversity in environmental conditions, production types, and management.
- USDA will continue its participation in the USGCRP's Federal Adaptation and Resilience Group to ensure that climate-driven challenges are anticipated by new information, practices, technologies, and tools.
- Outside of the federal government, shared stewardship agreements between the FS and states will facilitate implementation of adaptive actions and support monitoring efforts.
- USDA agencies will increase consultations with Tribal communities to incorporate traditional ecological knowledge into climate-smart practices.
- Additional consultations with community colleges and minority-serving institutions will be used to make research opportunities under this effort widely accessible.
- International partnerships and dialogues allow USDA's expertise to improve global outcomes beyond U.S. borders.
- USDA research agencies are already or planning to realign personnel time and resources towards USDA's climate priorities. Additional investments would permit expansion of essential research efforts, climate-related program analysis, monitoring networks, and technology transfer.

5. Leverage the USDA Climate Hubs as a framework to support USDA Mission Areas in delivering climate adaptation science, technology, and tools

The Climate Hubs provide necessary USDA infrastructure to deliver climate adaptation science, technology, and tools to USDA agencies who, through their missions, support farmers, ranchers, and forest landowners. The Hubs were established in 2014 with the aim to develop and deliver science-based information and technologies to enable producers and natural resource managers to make climate-smart decisions and minimize risk to their operations. In January 2020, the Hubs completed a five-year review to assess their effectiveness and provided recommendations to inform a new, forthcoming, strategic plan. Over a five-year period (2014-2019), the Climate Hubs and partners hosted over 435 in-person workshops and training events and engaged over 16,000 stakeholders on critical climate issues and adaptation opportunities. The Hubs provided technical expertise through 237 webinars, podcasts, and other digital communication reaching over 17,000 people, and developed more than 25 web-based decision-support tools, including Grass-Cast and AgRisk Viewer.

To integrate climate-smart agriculture and forestry in USDA's mission, programs, operations, and management, USDA will take advantage of the Climate Hubs' unique position to work across organizational boundaries and engage their expertise and awareness of regional priorities. The Climate Hubs and USDA Mission Areas will work together within the three Hubs workstreams:

Workstream 1: Science and Data Synthesis

- The Hubs will promote coordination and joint production of resources and tools between USDA science and program agencies.

- Hubs' applied vulnerability assessments for fire, flood, drought, extreme temperatures, and hurricanes will be used to make recommendations to USDA Mission Areas to increase landscape and community resilience to extreme climate events.
- Using an adaptive management approach, the Climate Hubs plan, implement and monitor actions, analyze and synthesize results, and share their learning. USDA will use the Hubs' regional expertise and awareness of climate-smart agriculture and forestry successes to inform Mission Area management and decision-making.

Workstream 2: Technology and Tool Development and Implementation Support

- The Climate Hubs will leverage their co-production model to produce tools relevant to USDA agencies that use existing technologies and data.
- To promote co-production of tools and resources with stakeholders, the Hubs will pass back local and regional knowledge and climate adaptation needs to ensure that USDA's work is relevant and usable by farmers, ranchers, and landowners.

Workstream 3: Outreach, convening, and training

- The Hubs will provide a platform for USDA agencies to convene and work on common issues and expand their outreach.



- The Hubs will develop new partnerships and strengthen existing relationships with USDA agencies to enhance uptake of existing tools and jointly develop new products. Opportunities to partner with APHIS, FS, FSA, NRCS, RD, RMA, and other agencies will be sought.
- To build a practice of climate-thinking across USDA, the Hubs will integrate the best available science into messaging tools like research publications, gray literature, social and other media communications, and video and podcast products.
- To reach specific agency staff, the Climate Hubs will jointly develop and curate relevant educational modules, webinars, workshops, and trainings.

Scope, Performance, and Resources

- Resources to support the Hubs program are contained within the President's FY 2022 Discretionary Funding Request. These investments will allow the program to expand to meet growing demand from within and outside USDA.
- Indicators relevant to this action will include training or capacity building activities provided to USDA staff, an increase in intra-agency research or program collaborations, and development of tools, resources, and research to support Mission Area objectives. The Hubs will continue to track webinars, trainings, and other interactions with the public.
- The Climate Hubs report on their progress through quarterly reports to the Executive Committee, newsletters, and annual reports.
- The Climate Hubs have built strong relationships with external partners from local to national scales and across sectors, providing opportunities for collaboration with NGOs and other stakeholder communities to develop adaptation resources and tools to enhance USDA activities.
- The Climate Hubs will share climate adaptation science, tools, and technologies through partnerships with other federal climate service networks including the RISAs, CASCs, and NIDIS DEWS. The Hubs can assess how to adapt these interagency efforts for USDA use to increase efficiency and avoid duplication of efforts.

IV. ENHANCING CLIMATE LITERACY IN USDA'S WORKFORCE

A climate-informed and capable workforce underpins the success of the adaptation actions outlined in the sections above. Enhancing climate literacy across USDA's workforce is an essential element of integrating climate preparedness into USDA's mission, programs, operations, and management. USDA has nearly 100,000 employees at more than 4,500 locations across the United States and abroad with a diverse range of roles, responsibilities, and backgrounds. To prepare USDA's current and future workforce for the impacts of climate change, USDA will expand opportunities for education focused on how climate change affects the mission of the Department and its work. Core education and training should be accessible to staff at all levels in all locations.

Examples of ongoing activities to build climate literacy include:

- The Office of Property and Environmental Management's (OPEM) Sustainable Practices team convenes working groups on Facilities, Sustainable Buildings, Green Purchasing, Fleet Management, and Real Property to discuss policies, goals, best practices, challenges, and progress in achieving sustainability and climate goals.
- OPEM also hosts events and issues a quarterly newsletter, The EnviroPost, to increase employee awareness of sustainability and climate issues by highlighting agency

successes, best practices, awards, and training opportunities.

- The CCRC, a joint online platform of FS R&D and FS Office of Sustainability and Climate (OSC), hosts a series of three modules on climate change and natural resource management. The modules cover basic climate change science and modeling, climate change effects on forests and grasslands, and responses to climate change.
- FS OSC hosts webinar series on topics related to its mission; its current series is focused on topics related to environmental justice, including Tribes and climate adaptation, water, air, and recreation.
- FS R&D and OSC, the Climate Hubs, and NRCS regularly host webinars and training at various technical levels on topics related to climate that are accessible to USDA staff.

To build on these existing efforts, USDA can:

- Form a climate literacy working group. Coordinated by the Climate Hubs, this group would survey USDA agencies and offices for prior and ongoing climate education activities, identify climate literacy training needs for staff, including environmental justice issues, and suggest how to use existing frameworks to enhance climate literacy. Recognizing the Climate Hubs' intra-agency reach and experience in innovative and interactive methods to increase climate literacy, this working group will suggest how the Hubs can build climate capacity within USDA agencies, including how to reach regional and local offices.
- Expand information dissemination and training access. OEEP and the Climate Hubs will develop a sustainable strategy to disseminate climate science information from REE agencies, FS R&D, and USGCRP to relevant USDA staff. Building off the Climate Hubs' social science insights on encouraging knowledge co-production, USDA can ensure information sharing and

training is relevant, useful, and equitable. USDA can ensure access to and expand the CCRC modules described above to equip staff with an understanding and common vocabulary of climate change and adaptation and mitigation responses.

- Establish a USDA climate seminar series. OEEP will continue development of a yearlong, monthly seminar series that will be at a level accessible to a diverse audience of USDA staff and develops climate literacy with progressively complex topics. The series will be science-focused, for experts and non-experts, and will provide opportunities throughout to ask questions that help dispel misconceptions related to climate. Potential subjects include GHGs in agriculture, climate impacts on crop production and animal agriculture, and options for climate adaptation and mitigation.
- Consider early climate literacy development. Hiring, training, and maintaining a climate literate workforce can start with students before they become USDA staff. Working with land-grant and other university partners, NIFA will continue to play an important role funding training and education. With investments from NIFA and assistance from the Climate Hubs, youth organizations like 4-H could be supported to deliver early climate literacy and promote positive youth development. In addition, USDA could look for opportunities to develop climate-tracks within its Internship and Recent Graduates Programs.

Performance measures developed during agency and office-level adaptation planning should include workforce climate literacy targets. Current means of evaluating climate literacy include annual Sustainability Plans, OMB Scorecards for Efficient Federal Operations and Management, and, at the Forest Service, climate-related training can support progress towards Climate Scorecard elements.



V. USDA ACTIONS FOR CLIMATE-READY SITES AND FACILITIES

USDA will continue to improve the climate resilience of sites, fleet, and facilities and implement its Departmental Regulations and Directives for sustainable and climate adaptive operations of sites, fleet, and facilities. OPEM is responsible for coordinating with agencies, setting annual strategic goals, developing actions, and measuring progress by creating agency scorecards for improvement.

Construct and Operate Climate-Ready Real Property

The Department implements Department of Homeland Security structural integrity guidance to prepare for increasingly frequent and intense natural hazards, such as extreme weather and wildfires. Recent vulnerability assessments indicate many FS dams are vulnerable to large storm events for which they were not originally designed. To enhance resilience, USDA will evaluate needs to increase capacities of spillways to handle extreme storm events.

USDA is raising its standards for design, construction, operation, and maintenance of facilities and infrastructure by applying climate adaptive technologies, increasing renewable energy use and equipment efficiencies to conserve

energy, and reducing its GHG footprint. New buildings are performing 30 percent more energy efficiently than the industry standard and over 45 percent of USDA-owned buildings 10,000 gross square feet and larger meet the Guiding Principles for Sustainable Federal Buildings. USDA uses third-party certification systems such as LEED or Green Globes to validate its green buildings. For construction materials, USDA prefers wood for new buildings due to its capacity for energy savings and ability to sequester carbon. Equipment performance is monitored throughout system lifecycles.

For leased buildings, USDA increasingly seeks out third-party certified green and ENERGY STAR facilities with access to public transit. However, USDA often leases facilities in remote and rural markets with limited options for green buildings. USDA will work to build climate adaptation, resilience, and sustainability awareness in these communities to achieve further facilities-related emissions reductions and climate resilience in the future. In new leases, USDA will follow the General Service Administration's green leasing guidance. By requiring sustainable and resilient buildings in all new leases, the Department would increase availability of these sustainable and resilient buildings in remote and rural markets.

To raise facility performance levels nationwide in sustainability and resilience, USDA also plans to develop a Departmental Manual to guide staff to align sustainable and resilient facility operations with the USDA Departmental Regulations on Climate Change Adaptation and Sustainable Operations.

USDA chooses locations for utility equipment and central data centers to improve operational resilience to flooding and rising sea levels. These centers feature direct digital controls, thermal aisle design, emergency power, and redundant cooling for continuity, lower operating costs, and higher capacities.

Increase Facilities' Energy and Water Resilience

USDA will take the following actions related to facilities energy and water management that

enhance climate adaptation and resilience or have adaptation and resilience co-benefits:

- **Increase onsite renewable energy capacity and installation of microgrids.** The energy and power supply at many USDA facilities are susceptible to the increased frequency and severity of storms. Accordingly, USDA will work to increase onsite renewable energy capacity and install microgrids to improve resilience at its facilities. This may include transitioning from propane/diesel generators to mobile solar energy systems with battery backup at remote sites and installing solar panels to enable facilities to operate off-grid. Exploring the use of energy performance contracts to install solar energy equipment, geothermal energy systems, and microgrids at remote facilities to mitigate impacts from future storms will also be considered. These climate adaptation actions will reduce the cost of electricity and eliminate the dependence on unreliable and poor-quality power at remote sites.
- **Improve the condition and resilience of government-owned infrastructure.** USDA owns miles of aging overhead and underground electrical wiring, steam pipes, natural gas pipes, and domestic water and sewer lines, which are vulnerable to severe weather events. This infrastructure requires periodic maintenance to improve and maintain reliability, functionality, and resilience. To address this issue, agencies will implement actions that have co-benefits to climate adaptation and resilience. Specifically, agencies will perform leak tests on water systems that show inconsistent consumption or lack of integrity, conduct cost-effective maintenance and repair on equipment and infrastructure, and establish and maintain good communications with local utility providers.
- **Switch fuel types, use dual fuel equipment, and reduce the carbon footprint of facilities.** Dual fuel equipment is critical

for USDA's remote buildings that rely on heat from fossil fuels because interruptible natural gas supply requires secondary fuels as a backup, is subject to supply shortages, and can result in extremely high costs and damage to heating equipment. To address this issue, agencies will convert to dual fuel heating equipment, select secondary fuel types with the best GHG emission ratings, and convert heating equipment from fossil fuels to electric heat pumps that can be powered by solar panels.

Optimize Fleet Inventory and Efficiency

USDA is committed to maintaining an optimal fleet inventory and reducing its fleet's carbon footprint for climate adaptation and resilience. This effort includes developing standardized acquisition strategies that identify and eliminate inefficient vehicles and replace them, with safer, more efficient vehicles that use less petroleum per mile, alternative fuels, and electric and hybrid-electric vehicle technology. A focus on efficiency will encourage climate adaptation management actions and sustainable behaviors. Looking ahead, USDA plans to incorporate a standardized fleet replacement planning initiative to transition from primarily fossil fuel vehicles to a combination of biofuels, fully dedicated electric, and hybrid-electric vehicles to reduce costs, improve fleet efficiency, and meet environmental goals. USDA will also identify locations to install biofuel, alternative fueling, and electric vehicle charging infrastructure to better support non-petroleum vehicles.

VI. USDA ACTIONS TO ENSURE A CLIMATE-READY SUPPLY OF PRODUCTS AND SERVICES

Through its Office of Contracting and Procurement (OCP), USDA supports E.O. 14008 Sec. 206 and E.O. 14005 Ensuring the Future Is Made in All of America by All of America's Workers, issued January 25, 2021. USDA is



committed to adhering to the requirements of the Made in America Laws in making clean energy, energy efficiency, and clean energy procurement decisions. Consistent with applicable law, USDA is applying and enforcing the Davis-Bacon Act and prevailing wage and benefit requirements. USDA will stay vigilant should the Secretary of Labor take steps to update prevailing wage requirements or should the Federal Acquisition Regulatory Council develop regulatory amendments to promote increased contractor attention to climate adaptation and resilience with co-benefits of reduced carbon emissions and federal sustainability. Focusing on these adaptation areas can help prevent disruption of supplies and services for mission critical activities. Furthermore, USDA procurement leadership seeks to use contracting as a lever to promote protection of communities and ecosystems where USDA has a presence. Our efforts will focus on the effects of climate change while also building long-term resilience to evolving environmental conditions.

The Department has implemented policies and practices to purchase energy efficient, sustainable, and USDA-designated biobased products in compliance with requirements in the Federal Acquisition Regulation to support climate adaptation efforts. Energy efficiency contributes to climate adaptation by reducing peak energy demand as more energy is required for air conditioning and to address uncertainty in energy generation and use resulting from extreme weather events. USDA is committed to increasing the use of sustainability criteria in its purchasing. For example, USDA continues to use blanket purchase agreements that provide efficient electronic equipment that is registered with the Electronic Product Environmental Assessment Tool (EPEAT). Purchasing EPEAT-

registered equipment reduces GHG emissions, hazardous waste, and water pollutants over the life of the equipment. Procurement requirements to promote resilience apply to contracts for design, construction, operations, and maintenance. USDA selects materials made with post-consumer and pre-consumer recycled materials including carpet, gypsum board, ceiling tiles, millwork, furniture, and furnishings. In addition, the BioPreferred Program continues to support climate adaptation, working with CEQ, OMB's Office of Federal Procurement Policy, and other federal agencies, to develop guidance for establishing annual biobased-only procurement targets.

The five critical areas where procurement processes are at risk due to acute or chronic climate change impacts are:

1. **Facility upgrades.** USDA facilities need modernization to improve energy efficiency and provide resilient infrastructure. Energy efficiency, water conservation, and sustainability are all considerations for new construction and modernization. To the extent possible, USDA will expand the Solar ARS program, which is based on a contract template that was developed to be customized for performance contracts and appropriate funds projects.
2. **Forest Service infrastructure.** Forest Service infrastructure is highly susceptible to climate change and large storm events, for which it was not originally designed. For dam infrastructure, actions to address this include an inventory assessment of dam spillway capacity and a spillway rehabilitation plan.
3. **Puerto Rico infrastructure.** Puerto Rico and its infrastructure are vulnerable to the impacts of climate change particularly increased frequency and severity of storms. At ARS Mayaguez and Isabela facilities, a project to install a microgrid has been developed but remains unfunded. It can be implemented with a performance contract with sufficient capital infusion. The microgrid would eliminate the dependence of the research program on the local electrical grid.

4. Growth of net-zero facilities. ARS has one net-zero electricity facility and another under construction that align with current budget priorities. In 2019 an Energy Conservation Measure at the Jornada Experimental Range in Las Cruces, New Mexico, was awarded an Energy and Water Management Award by the Department of Energy's Federal Energy Management Program. A net-zero project carried out this year, at the Fort Collins Research Farm in Colorado, is complete and awaiting final connection. As energy is saved, environmental sustainability will improve due to decreasing GHG emissions and conservation of limited resources.

5. Forest restoration. Four Forest Restoration Initiative (4FRI) is accelerating a large-scale restoration program across 2 million acres in northern Arizona to improve forest and watershed health so forests are more resilient to climate change. 4FRI has embarked on an ambitious project to award a 20-year contract to provide forest restoration treatments on over 500,000 acres. Increased certainty of supply will help stimulate investment in restoration to reduce the impacts of climate change while supporting forest industries that strengthen local economies and conserving natural resources and aesthetic values.

this Plan and how they might contribute to the vulnerability-specific and cross-cutting adaptation actions. This process will provide the opportunity to identify knowledge gaps or programmatic needs that can be addressed through coordination with OEEP, the Climate Hubs, and intra-agency collaborations.

To measure progress towards achieving climate adaptation goals, during adaptation plan formulation, USDA agencies and offices will develop metrics relevant to their missions and adaptation strategies. The Forest Service Climate Scorecard is one model internal to USDA that can be emulated for each agency's unique needs. These agency-relevant frameworks will be used for measuring, sharing, and learning from adaptation successes and enable USDA to demonstrate how adaptation actions are making the Department and its stakeholders more resilient. Through iterative climate risk management, USDA will address emerging and future climate risks, adjust efforts and resources, and prepare American agriculture, forestry, and rural and urban communities to be resilient in a changing climate.



VII. NEXT STEPS

Concurrent with the release of this plan, USDA will develop guidance for agencies and offices to prepare new climate adaptation plans in line with updated Departmental Regulation 1070-001 with the aim of completing these plans by spring 2022. Agencies and offices will identify how climate change is likely to affect their ability to achieve mission, operations, and program objectives. Through adaptation planning, they will develop, prioritize, implement, and evaluate actions to integrate climate risks into strategic planning and decision-making. Agencies and offices will identify alignment with the vulnerabilities identified in

APPENDIX

U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

DEPARTMENTAL REGULATION	NUMBER: DR 1070-001
SUBJECT: U.S. Department of Agriculture Policy Statement on Climate Change Adaptation	DATE: May 26, 2021
OPI: Office of the Secretary	EXPIRATION DATE: May 26, 2026

1. PURPOSE

This Departmental Regulation (DR) provides guidance on the establishment and periodic revision of the United States Department of Agriculture's (USDA) *Climate Change Adaptation Plan*. It is consistent with guidance from the Council on Environmental Quality (CEQ) for the implementation of Executive Order [\(E.O.\) 14008](#), *Executive Order on Tackling the Climate Crisis at Home and Abroad*, issued on January 27, 2021.

Climate change poses a significant risk to the agriculture and forestry sectors and the communities that support and depend upon them. Through climate adaptation planning and implementation, USDA will identify how climate change is likely to affect its ability to achieve its mission, operations, and policy and program objectives. Climate change adaptation is a critical complement to mitigation; both are required to address the causes and consequences of climate change. Through climate adaptation planning, USDA will develop, prioritize, implement, and evaluate actions to minimize climate risks, and exploit new opportunities that climate change may bring. Climate adaptation planning and implementation should align with USDA efforts to ensure equity and environmental justice. By integrating climate change adaptation strategies into USDA's programs and operations, USDA better ensures that taxpayer resources are invested wisely, and that USDA services and operations remain effective under current and future climate conditions. Through climate adaptation planning, USDA is taking a leadership role in ensuring the vision of a resilient, healthy, and prosperous Nation in the face of a changing climate.

2. ACTIONS ORDERED

This policy establishes the USDA directive to integrate climate change adaptation planning, implementing actions, and performance metrics into USDA programs, policies, and operations in accordance with executive orders and additional guidance from CEQ.

- a. The Chief Economist, with the full support and participation of USDA Mission Areas, agencies, and staff offices, will:

- (1) Develop a *USDA Climate Change Adaptation Plan* in accordance with E.O. 14008 and CEQ guidance;
 - (2) Issue guidance in accordance with CEQ guidance to Mission Areas, agencies, and staff offices to complete or update their climate adaptation plans, as well as required interim deliverables; and
 - (3) Update the *USDA Climate Change Adaptation Plan* as appropriate and provide progress reports on the status of implementation efforts annually in accordance with CEQ guidance.
- b. USDA Mission Area, agency, and staff office heads, in developing organization-specific contributions, will:
- (1) Analyze how climate change may affect the ability of their organization to achieve its mission and policy, program, and operational objectives and authorities to:
 - (a) Identify potential impacts of climate change on their organization's areas of responsibility;
 - (b) Prioritize, implement, and integrate response actions into their Mission Area's, agency's, or staff office's operation, contingent on the availability of resources;
 - (c) Continuously assess and improve the capacity to adapt to current and future changes in the climate; and
 - (d) Prepare contributions to the Department's *Climate Change Adaptation Plan*.
 - (2) Identify, as appropriate, key performance measures to evaluate progress in climate change adaptation in the annual Departmental and Mission Area, agency, and staff office budget material, to include measures in the Summary of Budget and Performance section of the explanatory notes, submitted as part of the Congressional justification.
 - (a) Identify, to the extent possible, the costs associated with the accomplishment of Mission Area, agency, or staff office performance measures and provide accessible information to producers; and
 - (b) Identify returns to Mission Area, agency, or staff office end-users for climate adaptation actions in terms of a list of expected accomplishments.
 - (3) Identify, as part of the annual budget process, to the Office of Budget and Program Analysis (OBPA), areas where budget adjustments would be necessary to carry out actions identified under this DR;

- (4) Identify, as appropriate, for USDA's Office of the General Counsel, areas where legal analysis is needed to carry out actions identified under this DR; and
- (5) Identify the point of contact for and coordinate actions with the USDA's Global Change Task Force, as appropriate.
- c. USDA Mission Areas, agencies, and staff offices will integrate information that reflects the current understanding of global climate change and its projected impacts when undertaking long-term planning exercises, setting priorities for scientific research and investigations, developing performance metrics, and making decisions affecting Mission Area, agency, or staff office resources, programs, and operations.

3. EFFECTIVE DATE AND TERMINATION

- a. The provisions of this DR are effective immediately and will remain in effect until superseded or revoked.
- b. This policy supersedes and replaces DR 1070-001, *U.S. Department of Agriculture (USDA) Policy Statement on Climate Change Adaptation*, dated June 15, 2015.



/s/ THOMAS J. VILSACK
SECRETARY OF AGRICULTURE



CLIMATE CHANGE **ADAPTATION PLAN**

July 2022

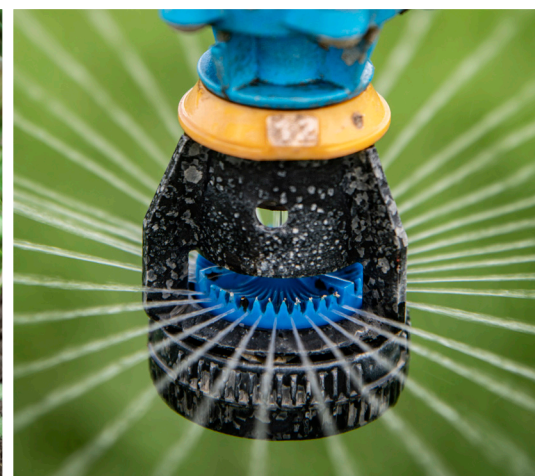
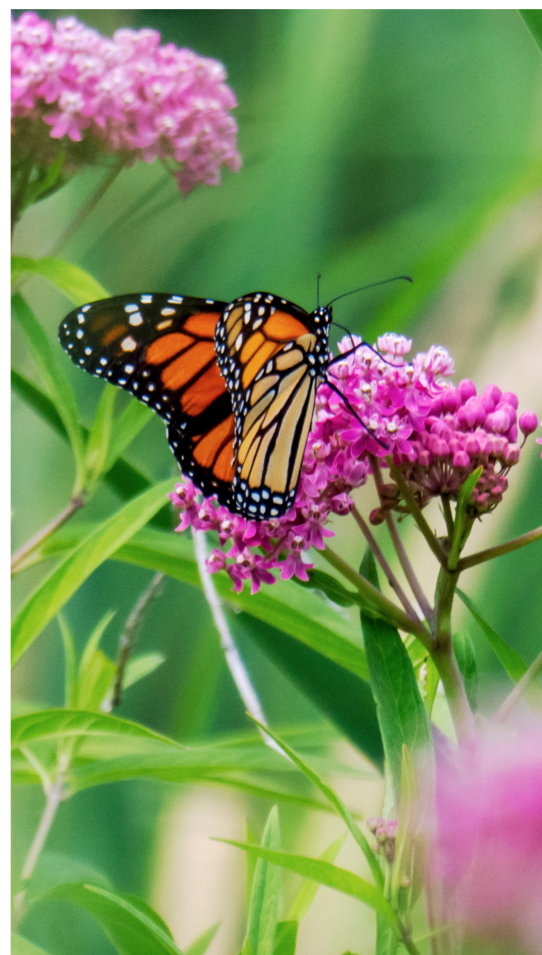




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MESSAGE FROM NRCS CHIEF



Terry Cosby
NRCS Chief

“Together, we can lead the way with conservation solutions that improve the resilience, health, productivity, and profitability of the Nation’s agricultural operations, while also addressing the impacts and root causes of climate change.”

Dear Reader,

At NRCS, we have a long history of working with farmers, ranchers and landowners to identify and address the natural resource challenges they face. From controlling soil erosion to improving water and air quality, our agency was founded on helping people help the land through locally led conservation that leverages the passion and commitment of agricultural producers. We use the best available science and a comprehensive conservation planning process to provide producers with technical and financial assistance to meet their objectives. For nearly 90 years, we have continued to fulfill this conservation legacy, all while adapting to changing concerns and taking on new responsibilities to address current and future challenges.

Climate change is altering our Nation’s agricultural landscape as we know it, presenting new challenges and opportunities. In working one-on-one with America’s producers, we know that they are on the frontlines of climate change, experiencing impacts such as increased and more intense droughts and floods, as well as shifting weather patterns and growing seasons. These impacts threaten production as well as conservation efforts. More than ever, planning and decision-making need to account for the impacts of climate change, and we have a responsibility to provide relevant information, tools, resources, and assistance to support producers in these endeavors.

This Adaptation Plan lays out a framework for how we will continue to build on our expertise and ensure our tools and programs meet the demands of this changing agricultural landscape. It serves as a starting point for our National, State and local staff, together with partners and communities, to further develop necessary actions based on local impacts, experiences, and knowledge. But this is just the beginning. We know that we must continuously improve our programs and services to ensure we’re giving farmers, ranchers and landowners the best tools possible to conserve our natural resources. Together, we can lead the way with conservation solutions that improve the resilience, health, productivity, and profitability of the Nation’s agricultural operations, while also addressing the impacts and root causes of climate change.

Recognizing the urgency of the climate crisis, one of our top agency priorities this year is increasing assistance for climate-smart agriculture and forestry, including and alongside our commitment to ensure equity throughout program and service delivery as well as serve urban agricultural communities. These priorities will be integrated into all the work we do at NRCS to ensure the long-term sustainability and productivity of our Nation’s natural resources.

As we adapt to the demands of a changing climate, our mission to deliver conservation solutions will remain steadfast. In the months and years ahead, NRCS will continue to serve as a leader, using the best science, research, and conservation tools to assist producers and address climate change, while we do our part to support healthy landscapes and communities for generations to come.



INTRODUCTION

The Natural Resources Conservation Service (NRCS) is the primary Federal conservation agency working cooperatively on private lands to preserve and enhance our Nation's natural resources.

More than 70% of the land surface in the United States is privately owned. NRCS's mission is to deliver conservation solutions so agriculture producers can protect natural resources and feed a growing world. The agency's vision is a world of clean and abundant water, healthy soils, resilient landscapes, and thriving agriculture communities through voluntary conservation.

NRCS helps farmers, ranchers, and forest landowners, and the communities in which they live, improve the long-term viability of their operations while protecting our natural resources.

The anticipated impacts of climate change will create both challenges and opportunities for NRCS and the clients and communities it serves. NRCS is committed to helping clients identify and implement the actions needed to adapt and become more resilient in the face of climate change. NRCS has a history of changing our operations to address emerging needs based on the best available science. The challenges and opportunities presented by climate change are no different. NRCS continues to work with diverse partners to implement locally led strategies to address soil degradation, landscape instability, extreme weather and climate events, increasing climate variability, natural disasters, and other issues. Through

the expansion of current activities and the development and implementation of innovative science, programs, activities, and practices, NRCS will continue to assist clients in identifying and applying contextually appropriate solutions to adapt to climate change and develop more resilient ecosystems. NRCS also will continue to build on existing and expanded activities that will enable clients to contribute to mitigation strategies that reduce present and future atmospheric greenhouse gas (GHG) concentrations. Providing clients with the information, recommendations, and assistance they need to address climate change represents a significant expansion of NRCS activities. As a consequence, this work will require substantial NRCS investments over the next decade.

A steering team, comprised of experts from across the agency, was assembled to review the agency's 2014 Climate Change Adaptation Plan and provide an updated assessment and recommendations for the agency. This effort builds upon earlier policy and strategic efforts to identify climate vulnerabilities and define necessary action that began more than a decade ago. This 2022 Climate Change Adaptation Plan ("Adaptation Plan") includes an evaluation of current vulnerabilities to NRCS's mission, operation, and infrastructure that may be affected by climate change impacts, as well as actions to address these vulnerabilities. The 2022 steering team assembled seven sub-teams focusing on each identified vulnerability. These teams included NRCS staff from deputy areas, divisions, centers, states offices, and Climate Hubs. The plan highlights seven areas identified as key agency vulnerabilities. It also includes a list of prioritized actions that can be taken to address the agency vulnerabilities. The details of the resulting plan are organized by the following action areas:

7 ACTION AREAS



Increase climate literacy and staffing capacity to deliver assistance that is reflective of climate change



Enhance science, research, and data for understanding, measuring, and tracking climate-related impacts and outcomes



Integrate climate information into current business procedures, assessments, and opportunities



Ensure current and future applied conservation investments are reflective of climate change needs



Assess and address disproportionate climate change impacts on vulnerable communities



Strengthen partnerships and collaboration to address climate change



Address risks to agency infrastructure

This Adaptation Plan serves as a framework for the key actions that NRCS will take to research, develop, implement, and finance climate change adaptation activities at the agency. These proposed actions will guide national, state, and local decision-making to further identify priorities, implement actions, and work with farmers, ranchers, and forest landowners as they voluntarily apply conservation on their operations. Furthermore, these actions will complement other ongoing and proposed work targeted specifically towards climate change mitigation activities that provide opportunities to

voluntarily reduce GHG emissions and increase carbon sequestration, supporting USDA's wider climate-smart agriculture and forestry strategy as outlined initially in the [USDA Climate-Smart Agriculture and Forestry Strategy: 90 Day Progress Report](#). The framework also complements other Department-wide efforts to increase resilience across the sector, including options proposed within the [USDA Agri-Food Supply Chain Assessment: Program and Policy Options for Strengthening Resilience](#). Many of the actions in this plan encompass changes to overarching NRCS operations and procedures to better respond

to and incorporate climate change information, which support climate change mitigation as well as adaptation and resilience. Given the significant overlap that targeted climate investments provide for both mitigation and adaptation, implementation of this Adaptation Plan will support both critical efforts. As one of NRCS's identified priorities for FY22, targeting assistance for climate-smart agriculture and forestry to support producers in mitigating climate change and building resilience across their operations is an important focus area for the agency, alongside ensuring equity throughout NRCS programs services, supporting urban farmers and communities, and other FY22 priorities. All this work will contribute to the vision and goals laid out in [USDA's Strategic Plan Fiscal Years 2022-2026](#), in particular Strategic Goal 1 to Combat Climate Change to Support America's Working Lands, Natural Resources, and Communities.

Over the coming decades, NRCS technical and financial assistance will help transform vulnerable working lands to more healthy and resilient landscapes. NRCS is committed to being inclusive and equitable while delivering assistance to address current and emerging issues and natural resource concerns ranging from long-standing priorities such as soil erosion, water quality, air quality, and soil health to emerging issues such as pollinator habitat and invasive species control. NRCS strives to equitably serves farmers, ranchers, forest landowners and communities of all sizes, including Tribes and historically underserved populations, to help them manage their lands in ways that are more adaptable and resilient to future environmental changes.





CLIMATE CHANGE EFFECTS AND VULNERABILITIES

Key climate change impacts on agriculture and natural resources

The effects of climate change on agriculture and natural resources are already apparent in the United States and throughout the world. These impacts to food, fuel, and fiber production, wildlife habitat, pollinators, native species composition, acceleration of invasive species establishment and proliferation, and wider ecosystem services are projected to increase. The Fourth National Climate Assessment (NCA4) identified many examples of likely climate change impacts on agriculture and natural resources. These include:

- ▶ Food and forage productivity decline in many regions experiencing temperature and moisture stress and more frequent and longer drought periods.
- ▶ Temperature and rainfall driven shifts in cropping and grazing systems to less-ideal areas for production where more inputs (e.g., irrigation, fertilizer, lime) are needed to maintain productivity.
- ▶ Increased risk of pest and disease pressure due to plant stress and the spread of invasive species into new areas.
- ▶ Increased risk of degradation of soil and water resources due to excessive runoff and associated erosion from more frequent and larger extreme events (e.g., floods, hurricanes).
- ▶ Increased challenges to maintaining livestock health and productivity under increased heat and potential water stress; and

- ▶ Increased occurrence and spread of wildfire driven by shifting precipitation frequency and patterns as well as species changes.

These largely physical and biological issues are compounded by economic and social issues faced by many of our clients and potential clients. Far too many individuals, families, and communities, especially members of historically underserved and vulnerable communities, have limited capacity to respond to climate change impacts due to poverty and resource limitations. In addition, community and individual infrastructure including communications, transportation, water, and sanitary facilities are vulnerable to climate-change related disruptions, especially extreme weather events.

These broad national trends—both the physical and biological issues, as well as the economic and social issues—were consolidated into four key vulnerabilities in the [USDA Action Plan for Climate Adaptation and Resilience \(2021\)](#):

- ▶ Decreased agriculture productivity
- ▶ Threats to water quality and quantity
- ▶ Disproportionate impacts on vulnerable communities
- ▶ Shocks due to extreme climate events

As the USDA agency charged with assisting farmers, ranchers, and forest landowners in addressing natural resource concerns on their properties to ensure the development and maintenance of resilient, productive, and sustainable managements systems, NRCS is already addressing these key risks. The agency remains committed to broadening and deepening the wide range of its work and services, including its technical and financial assistance programs and opportunities, to address and account for climate change through the actions described in this plan.

Vulnerabilities to NRCS Mission and Operations

The impacts described above will affect farmers, ranchers, and forest landowners in different ways, depending on their local contexts, the impacts and stressors experienced and anticipated, and their existing capacities to respond. NRCS's approach to addressing climate change must be flexible to cover this wide range of impacts and accommodate a variety of adaptation options and strategies. Rather than focus on vulnerabilities tied to specific climate change impacts

and hazards, NRCS assessed how delivering its mission could be impacted by a variety of climate change impacts and how it could be improved by institutionalizing climate change data and information into everyday business processes across its deputy areas. NRCS identified seven key climate change vulnerabilities needing to be addressed to prepare the agency to effectively and appropriately continue delivering on its mission. Addressing these fundamental vulnerabilities will enable NRCS to in turn better support clients and communities in adapting and building their resilience to the specific climate change impacts they may face.

7 VULNER- ABILITIES



Climate change preparedness depends on a climate literate and capable workforce



The pace and intensity of climate change impacts may exceed existing conservation science, knowledge, and data systems



Shifting climate trends and increasing variability require nimble and comprehensive business processes that support adaptive conservation



Climate change impacts threaten the viability and longevity of current and future applied conservation investments



Climate change disproportionately impacts vulnerable communities



The scale and complexity of climate change demands broad and diverse partnerships



Increasing frequency, severity, and extent of disturbances pose risks to current agency infrastructure



Vulnerability 1: Climate change preparedness depends on a climate literate and capable workforce

With over 9,000 staff at approximately 3,000 field offices and centers across the country and territories, NRCS risks the effectiveness of its operations if its employees are not climate literate. NRCS identifies the need to continually provide training and education to keep up with the latest climate science and to accommodate new hires. Staff education is essential to providing technical assistance and conservation planning that plans for a spectrum of future conditions and not just historical averages. Furthermore, because climate change impacts vary at regional to local scales, there is a strong need to build climate literacy at all levels of the agency, from field offices to national headquarters. Because NRCS provides one-on-one help to clients to evaluate and communicate risks on individual operations, it is imperative that every planner, and not just a limited number of agency experts, be knowledgeable about climate change impacts.

In addition to understanding the climate science and regional impacts, staff need to be trained in the use of planning tools that help them incorporate potential climate change impacts in their discussions and recommendations to clients. Staff need to build skills to help them communicate climate change risks to clients and to promote actions that will increase the resilience of their operations. Staff also need to be well versed on the range of opportunities, assistance, and resources NRCS has to offer to help clients address these impacts and implement climate solutions on their operations. Without increased climate literacy, conservation planning accounting for climate impacts is likely to be sporadic and less effective, and key tools and resources will remain underutilized. To meet these needs, NRCS must expand its methods of educating staff about global climate change and localized impacts through providing a variety of learning options that account for differences in access to materials, time availability, and learning styles. Training also must be equally accessible to all employees. This is necessary to account for the fact that people learn differently, have various needs and available time, and require different levels of knowledge for different positions.



Vulnerability 2: The pace and intensity of climate change impacts may exceed existing conservation science, knowledge, and data systems

As a science-based agency, another major vulnerability that NRCS faces is the increased need for improved and up-to-date science, research, and data for understanding, measuring, and tracking climate-related impacts and outcomes. Risks within this broader vulnerability include the inadequate management of climate information such that it is not available to inform conservation planning and other core agency business processes; changes in natural and managed environments that have not been seen before (sometimes called “novel ecosystems”) that require the development of new conservation guidance and tools beyond current processes; and knowledge gaps which continue to make it difficult to connect and coordinate voluntary field- and farm-scale actions to regional priorities and plans.

Although NRCS’s current operations and procedures aim to incorporate the most recent science related to the natural resources impacted by—and impacting—agricultural operations, NRCS currently lacks a systematic way to organize, analyze, synthesize, and curate climate information and relevant research at scales appropriate to our agency’s field and landscape level conservation planning model. Despite the amount of climate information available, individuals are often unable to determine the imminent climate change threats for a particular operation, especially when climate change information is provided at the regional scale, as it often is. Thus, there is a need to improve field-level data collection related to climate change impacts to better understand local impacts, support planning, and continue to refine model estimates. In addition, the emergence of novel ecosystems will present new challenges for how NRCS considers and plans for present and future conditions. Climate change, along with other ecosystem change driving forces, is creating novel agroecosystems that will require new conservation systems to stabilize and maintain them and the ecosystem services they provide. NRCS needs to actively address these issues to ensure that staff can provide the best possible information to our clients.

NRCS remains committed to the locally led conservation model that has served the agricultural community well for nearly 100 years. This will be a critical component to our ability to help farmers, ranchers, and forest landowners face globally known, but locally emerging issues, such as impacts to crops and grasslands from expanded ranges and impacts of invasive species or “ghost forests” resulting from sea level rise. The multiple-scale impacts of climate change, from site-specific to global, present a challenge for NRCS. As climate change accelerates, cumulative effects on ecosystem level processes are resulting in demonstrable large-scale opposing trends, especially in areas such as arid rangelands. In some cases, successful efforts to address the impacts of climate change will require coordination across multiple clients and multiple local jurisdictions. This presents challenges for local, state, and national staff and program managers.

NRCS takes a multi-scalar approach in several aspects of its work, communication structure, and organizing principles including through area-wide planning, targeted initiatives, and a distributed agency structure that consistently relays information between states, regions, centers, and national headquarters. Nonetheless, many current NRCS processes often do not always connect or articulate national or regional conservation priorities and needs to local activities, nor do they clearly describe how local activities and outcomes can be scaled-up to capture and project regional impacts. Improving these existing processes to better link field scale actions to landscape and regional outcomes will require up-to-date soil and landscape properties data, assessment, monitoring, and modelling at multiple geographic and temporal scales. The demand for these data and information products from a range of internal and external clients will also likely increase across a variety of potential reporting and monitoring scenarios.



Vulnerability 3: Shifting climate trends and increasing variability require nimble and comprehensive business processes that support adaptive conservation

NRCS staff follow a set of core business procedures including assessments to ensure consistent implementation of the agency’s conservation planning mission. Most of the current business procedures and assessments do not fully integrate climate change and weather variability impacts. This poses a risk to the agency’s abilities to design and deliver assistance to

clients. While Vulnerability 2 describes the need for continually updating and improving the underlying science and data that NRCS produces or works with, this vulnerability looks at the need to ensure that up-to-date science is in turn incorporated appropriately into necessary business procedures that in turn support the agency’s program and assistance delivery. Procedures associated with the conservation planning process, including the identification and evaluation of natural resource concerns, comprise a fundamental piece of NRCS’s conservation model. NRCS has identified a need to institutionalize and integrate climate data into NRCS core planning procedures, assessments that inform priority setting, short and long-range planning, and financial assistance eligibility and ranking.

NRCS also needs to improve its ability to quickly integrate the science of climate change into operational definitions and procedures including supporting documents such as handbooks, manuals, and technical guidance materials. Therefore, business processes need to be updated to efficiently and nimbly integrate emerging climate change science into the conservation planning process. Furthermore, NRCS assessments need to better assist landowners in making their operations adaptable and resilient to climate change. Capturing field level data on climate change impacts is needed so that NRCS planners can more effectively and efficiently evaluate the existing conditions and identify natural resource concerns, recommend and support the implementation of conservation practices, and monitor conservation practice effectiveness at the local level. In addition to improving the quality of the information and technical recommendations provided by staff, NRCS will continue to increase information on outcomes of implementing climate-smart agriculture and forestry (CSAF) practices. This will facilitate informed decisions on the cost and benefits of implementing these practices. Data and research created or used by NRCS must meet the highest standard for scientific integrity.



Vulnerability 4: Climate change impacts threaten the viability and longevity of current and future applied conservation investments

In addition to risks associated with not fully incorporating climate information into current business tools and procedures, NRCS recognizes the need to also make

its current investments adaptive to climate change as well. This includes planned and implemented practices on private lands that must be flexible enough to meet local climate conditions and client needs, as well as long-term conservation easements that require flexibility to accommodate habitat loss, species shifts, and changing resource conditions due to climate change. Disaster programs such as the Emergency Watershed Protection (EWP) Program may need adjustments to better support innovative climate change resilient engineering solutions and pre-disaster preparedness in the face of increasingly frequent natural disaster events. Structures constructed through the Watershed Protection and Flood Prevention Act (Public Law 566, PL-566) are experiencing challenges that may not have existed at the time of enrollment or construction. NRCS products, including conservation practice standards, technical directives, resource concern information sheets, and planning criteria, also will need to reflect current and anticipated conditions caused by climate change and provide the most up-to-date science-based conservation information.

NRCS must also identify measurements of baseline conditions and success to understand how and where investments are proving useful in making clients more resilient to climate change. Unlike climate change mitigation, for which methods exist to quantifiably estimate the greenhouse gas emission reductions or carbon sequestration benefits associated with certain practice installations, climate change adaptation and resilience do not lend easily to the same type of benefits analysis. Measuring adaptation is challenging as outcomes may not be evident in the short-term, effects are influenced by a variety of interacting physical and social factors, and there is often a lack of consensus around goals, which are subject to change given changing conditions and are defined differently by various stakeholders. Evaluating the impact and success of investments that support adaptation will therefore require a unique approach involving the analysis of existing science and outcome procedures, through the lens of the resilience goals of a particular region. Defining and measuring these successes could provide an opportunity to more clearly attribute, quantitatively or qualitatively, adaptation outcomes to our conservation programs and practices.

NRCS investments that address climate change must be dynamic and adaptive as local conditions change, whether the change happens gradually or catastrophically. Sea level rise, water availability, salinization of irrigated lands, changing habitat of threatened and endangered species, declines in pollinator availability, richness and diversity, and

invasive species control are all examples of climate change-related stressors that are now becoming challenges on lands and investments that NRCS provides assistance on or holds responsibilities over. Without action to acknowledge potential climate change impacts and add flexibilities to address them, current and future investments of the agency will not be suitable to endure the wide range of impacts expected to increase under climate change.



Vulnerability 5: Climate change disproportionately impacts vulnerable communities

Vulnerable communities—including historically underserved, low-income, minority and rural populations as well as American Indians, Alaska Natives, and sovereign Tribal governments—are often subject to multiple, simultaneous stressors such as pollution, increased exposure to extreme weather events, poor air quality, environmental injustice, habitat fragmentation, and poverty. Because climate change can have a multiplier effect on these stressors it is necessary to assess impacts on these communities from a holistic perspective, with the aim to strengthen the weakest links first. Additional resources are needed to adequately address the composite threats faced by vulnerable communities and to assess tradeoffs among costs, benefits, and risks.

For NRCS, these disproportionate impacts result in several areas where the agency needs to improve its operations and services to meet the needs of vulnerable communities. This includes the need to understand, strengthen, measure, and evaluate ecosystem services specific to vulnerable communities that protect livelihoods and to support food production and associated conservation activities. NRCS must be able to assess and tailor responses to extreme weather events specific to vulnerable communities, increase competencies of NRCS staff and clients on equity and environmental justice issues, and develop ways to meaningfully engage with vulnerable communities. Lastly, NRCS should increase technical and financial assistance for vulnerable communities.

Several NRCS programs have special provisions or dedicated funding for historically underserved producers, who may be more vulnerable to impacts of climate change, alongside impacts of systemic discrimination and racial, economic, health and social disparities. Further integrating equity into existing program implementation, including how funding is provided,

will remove barriers to participation, establish trust, transparency, and accountability, identify opportunities for broader inclusivity, and better target education and outreach efforts. The risk of not accounting for the unique challenges faced by vulnerable communities may result in NRCS not being able to adequately diagnose natural resource concerns and implement conservation systems, and, in turn, to effectively serve its clients in improving their operations and contributing to thriving agriculture communities.



Vulnerability 6: The scale and complexity of climate change demands broad and diverse partnerships

NRCS has a long and productive history of collaboration with a wide-ranging group of partner organizations to help accomplish core mission objectives. These partnerships begin with the foundational relationship between NRCS and the Soil and Water Conservation Districts, and have expanded to include federal, state, and local agencies, educational institutions, producer and commodity groups, and non-profit and for-profit entities who share a commitment to improving the management of natural resources on private lands through voluntary locally led actions. This diversity of partners working on projects and initiatives at multiple scales creates a core vulnerability related to climate change adaptation planning and implementation at national to local levels. Efforts

to address climate change adaptation needs will only be successful if relationships with current partners are maintained and strengthened to build from areas of mutual agreement, if the information provided to clients by NRCS and our partners is consistent, and if NRCS continues to work with new partners as appropriate to reach new audiences including historically underserved and underrepresented individuals and vulnerable communities.



Vulnerability 7: Increasing frequency, severity, and extent of disturbances pose risks to current agency infrastructure

A key vulnerability for NRCS is the risks that increasing frequency and intensity of extreme weather events and other climate change impacts pose to current and future NRCS infrastructure. This infrastructure includes physical structures and facilities, communication systems, information technology (IT) systems and components, weather information gathering systems, watershed structures such as dams, and vehicles within the NRCS fleet. This also includes mission critical facilities, such as the Plant Materials Centers (PMC) and other sites with unique equipment and vehicle inventories. Much of the physical infrastructure will require a coordinated effort across other Farm Production and Conservation (FPAC) agencies, as well as coordination with partner organizations who share resources.





CLIMATE CHANGE ADAPTATION ACTIONS

For NRCS to address these vulnerabilities and better support clients and partners in adapting to the specific climate change impacts they are and will continue to face, the agency proposes a number of priority actions. These priority actions are organized around seven action areas that seek to address the seven identified vulnerabilities.



Action Area 1: Increase climate literacy and staffing capacity to deliver assistance that is reflective of climate change.

Vulnerability: Climate change preparedness depends on a climate literate and capable workforce

Key Actions

- ▶ Establish a comprehensive Communications Strategy that evaluates audiences, prioritizes actions, and assesses performance.
- ▶ Communicate with external clients to increase awareness of NRCS programs and services that support voluntary conservation efforts furthering climate-smart agriculture and forestry, and specifically those that build climate resilience, through targeted outreach.
- ▶ Develop a training curriculum to ensure NRCS staff continue to enhance their expertise and incorporate connections to climate within their area of responsibility; and to increase all NRCS staff ability to articulate the nexus of all conservation activities and practices with climate change.
- ▶ Develop a staffing plan to support climate change needs, including identifying future capacity and workload; recruitment, training and retention of diverse new staff; and internal and external staffing support options.

Building a workforce that is competent in understanding, communicating, and delivering assistance to address climate change will be key to the success of this entire plan. NRCS will take several actions to leverage the strengths of its staff to improve the organization's climate literacy and capacity. First, together with the FPAC Mission Area, NRCS will establish a comprehensive Communications Strategy that evaluates audiences, prioritizes actions, and assesses performance. The outcomes of this strategy include that (a) NRCS employees at all levels (especially field staff) are aware of terminology, basic climate change information, and the most likely impacts to agriculture and natural resources for their region/state/field office, (b) NRCS employees are aware of and understand how to utilize the USDA data sources for their local outreach, (c) NRCS employees understand what they can do to assist clients to mitigate risks and become more resilient, and (d) NRCS employees are able to articulate climate change information with their local partners and clients.

Building on and guided by the Communications Strategy, NRCS will communicate with external clients to increase awareness of NRCS programs and services that support voluntary conservation efforts furthering climate-smart agriculture and forestry, and specifically those that build climate resilience, across the nation's working lands. This will include targeted outreach, both to clients and partner groups at the local level to better support equitable delivery of NRCS programs and services supporting climate solutions, with an emphasis

on reaching historically underserved producers.

NRCS is currently made up of a myriad of technical professionals with a depth of knowledge of natural resources conservation. A training curriculum will be developed to ensure that these experts continue to enhance their expertise and incorporate connections to climate change within their areas of responsibility. NRCS employees will be aware of essential principles of climate science, how to assess the applicability of climate science, updated on recent trends and the most likely impacts for their region/state/field office, and will understand how to effectively communicate about climate change and use knowledge to inform the planning process. This will include identifying which clients face the most risk and what NRCS can do to assist them. Through improved and increased training opportunities, courses, and accessible resources, NRCS will implement this curriculum to increase its staff's ability to articulate the nexus of all conservation activities and practices with a changing climate.

Lastly, NRCS will develop a staffing plan to support its climate change work to ensure it has adequate and appropriate capacity for delivering high quality assistance to clients. This may include identifying future capacity and workload with consideration of climate change trends; recruitment, training and retention of diverse new staff, including technical discipline specialists and social scientists; and identifying internal and external staffing support options.

NRCS is already making initial strides in this action area. In 2021, NRCS, in partnership with the USDA Climate Hubs, began hosting a series of Climate Conversations across the country. These 1–2-hour training sessions are tailored to each state covering local climate changes and how climate-smart agriculture and forestry can help clients and partners adapt. Over the past year, trainings were given to 16 states and staff at the East National Technology Support Center and the Easements Program Division. NRCS has begun and continues to build out additional resources to be used for training and communication.



Action Area 2: Enhance science, research, and data for understanding, organizing, measuring, and tracking climate-related impacts and outcomes

Vulnerability: The pace and intensity of climate change impacts may exceed existing conservation science, knowledge, and data systems

Key Actions

- ▶ Improve climate information management, including capturing, organizing, and integrating climate information and relevant research at appropriate scales
- ▶ Better understand and address novel ecosystems and emerging issues, including by integrating new technology, evaluating and targeting plant materials, and developing regional priorities for new conservation systems, with a concerted effort on at-risk ecosystems
- ▶ Establish multi-disciplinary climate change technical expertise team and strategies to evaluate and determine climate change requirements and guidance for conservation planning, implementation, assessment, research/demonstration, and investments
- ▶ Maintain, strengthen, and enhance climate-related SWAPA+HE-associated databases, information platforms, and datasets (including soil and vegetative information), as well as ongoing data collection, measurement, and modeling efforts

Within this action area, NRCS will take several steps to enhance its science and data processes and assets, organized around four broad priority actions. The first is to improve climate change data and information management, including capturing, organizing, and integrating climate information and relevant research at appropriate scales. This may involve reviewing and improving data collection related to measurement of climate change impacts and outcomes, along with continued research to develop new ways of describing and integrating climate attributes. This will also include enhanced management of basic soil and vegetation information used by NRCS modeling efforts, as well as the basis for collaboration with other agencies and organizations.

NRCS will act to better understand and address novel

ecosystems. As part of this action, NRCS will work with partners to identify threats and develop priorities at the regional level for the development and application of new multi-year conservation systems to address emerging novel ecosystems. NRCS's Plant Materials Center program, which has developed its own [Climate-Smart Agriculture Action Plan](#), will play a leading role in this action, including through its ongoing work to target conservation plant selection efforts to increase adaptability, document changes in the adaptation of conservation plants, provide guidance to conservation planners on appropriate plant materials as ecosystems change, and evaluate establishment technologies and management strategies for plant materials subject to climate change.

The third broad action seeks to establish climate change technical expertise and strategies to evaluate and determine climate change requirements and guidance for conservation planning, implementation, assessment, research/demonstration, and investments. This will include assembling a national level multi-disciplinary climate change technical team that evaluates climate-related requirements for the agency's planning and delivery processes. The action will also include developing climate-smart research and demonstration strategies that identify knowledge gaps and on-farm research needs to help guide investments, including through the Regional Conservation Partnership Program (RCPP) and Conservation Innovation Grants (CIG) program.

NRCS will maintain, strengthen, and enhance its climate-related databases, as well as ongoing data collection, monitoring, measurement, and modeling efforts. NRCS manages a wide range of information platforms, datasets and databases, as well as data collection and modelling efforts. NRCS will continue to maintain and expand existing databases and information platforms, such as the National Soils Information System (NASIS), Ecosystem Dynamics Interpretive Tool (EDIT) and Plant List of Acceptable Nomenclature, Taxonomy and Synonyms (PLANTS), as well as ongoing data collection and inventory programs including the National Cooperative Soil Survey (NCSS), National Resources Inventory (NRI), Snow Survey and Water Supply Forecasts (SSWSF), the Soil Climate Analysis Network (SCAN), and the Tribal Soil Climate Analysis Network (TSCAN). These data collection activities and associated databases systems provide the fundamental, geo-referenced, soil, vegetation, and weather data and information needed to understand climate change impacts and develop responses. In addition, NRCS will expand existing efforts to support the collaborative improvement of current models and tools like the Conservation Effects

Assessment Program (CEAP) and the CarbOn Management Evaluation Tool (COMET) and the development of new models based on rapidly emerging climate change science. As part of this action, NRCS will take steps to maintain the integrity of these programs and improve upon them where possible, including through periodically reviewing data needs to ensure necessary climate data are timely and up to date, and further developing methods for measuring and evaluating climate change adaptation benefits. NRCS will also build upon the ongoing Department-wide partnership to enhance and scale up soil carbon monitoring efforts, including through Conservation Evaluation and Monitoring Activities (CEMA), which will enable the agency to provide more and better data on the impacts of management practices on soil health properties, including those that may contribute to resilience.



Action Area 3: Integrate climate information into current business procedures, assessments, and opportunities

Vulnerability: Shifting climate trends and increasing variability require nimble and comprehensive business processes

Key Actions

- ▶ Identify and prioritize climate change-related resource concerns and provide climate-smart opportunities based on producer needs/desires/goals
- ▶ Address existing gaps in NRCS assessments for evaluating climate change impacts, including through integration of climate trends information into conservation planning process and IT applications such as business tools.
- ▶ Provide support to make climate-smart practices economically feasible for the producer in order to make their operation adaptable and resilient to climate change.

Leveraging the science and expertise available internally and through partners, NRCS will take steps to integrate climate information fully into current business procedures and assessments. NRCS proposes to evaluate current natural resource concerns and how they may be impacted by stressors identified in the current National Climate Assessment. Through this evaluation and input from NRCS clients, partners, and the public, NRCS will identify gaps and capture new or emerging natural resource concerns.

The results of the analysis and input will enable NRCS to prioritize opportunities and increase assistance for CSAF while meeting the needs of their clients, including through targeted program opportunities and initiatives.

Key to NRCS's mission is the three-phase, nine-step conservation planning process. The latest science and technology behind that process is critical to NRCS providing the best services and assistance to farmers, ranchers, and forest landowners and the lands they manage. Integrating precipitation, drought, wildfire, and wildlife resiliency evaluations that reflect current weather and climatic trends into business tools using geospatial data is a key piece in NRCS's adaptation to changing conditions. This necessitates consistent understanding and application of weather and climatic trends NRCS-wide so that strategies can be implemented that would include the review of existing natural resource concerns, how they are inventoried and evaluated, and how weather and climatic trends will impact natural resource concerns on various land uses in urban and rural landscapes.

NRCS is acutely aware that their client's bottom line is critical to implementing climate-smart practices. NRCS will develop a process to assess and quantify economic impacts of conservation practices that support climate change adaptation, mitigation, or both. The assessment of these impacts will include specific conservation measures that are scalable at the practice, field, and farm level. Additionally, NRCS will identify economic constraints to climate-smart conservation measures that affect all communities, with special emphasis on vulnerable communities.

NRCS has already begun work in this area, including initial work to correlate climate change stressors identified in the 4th National Climate Assessment with the agency's identified natural resource concerns for conservation planning. NRCS has also initiated several targeted program opportunities such as the EQIP WaterSMART Initiative (WSI) in collaboration with the Bureau of Reclamation (BOR) to help farmers and ranchers conserve water and build drought resilience in their communities, and the EQIP Conservation Incentive Contracts pilot targeted at drought-impacted states to help alleviate the immediate impacts of drought and other natural resource challenges on working lands.



Action Area 4: Ensure current and future applied conservation investments are reflective of climate change needs.

Vulnerability: Climate change impacts threaten the viability and longevity of current and future applied conservation investments.

Key Actions

- ▶ Increase the presence of climate change information in professional certifications and provide examples of applying climate change information to conservation planning on agricultural lands under a variety of scenarios.
- ▶ Integrate the science and understandings of climate change impacts to agriculture into the discussions and framework of NRCS's State Technical Committees.
- ▶ Clarify policies that serve to evaluate the benefits of a long-term investment to be sure that climate change impacts and opportunities are addressed in addition to traditional ecological benefits.
- ▶ Maximize the impact of NRCS funding investments by identifying areas of need that overlap for the priorities of environmental justice, climate adaptation needs, and vulnerable populations.
- ▶ Maximize local flexibility for using Conservation Practices to address natural resource issues by sharing examples, integrating new technologies, and prioritizing national review of practices that will have the most impact helping producers adapt to climate changes.
- ▶ Develop criteria and data that can be used to describe and evaluate the success of NRCS investments in supporting adaptation to the general public.

To address the vulnerabilities associated with the exposure of NRCS's current and future investments to climate change, several actions have been proposed. First is to increase the presence of climate change information in professional certifications and provide examples of applying climate change information to conservation planning on agricultural lands under a variety of scenarios. This may include examples where it is appropriate to use future conditions as the planning objective for programs such as restoring habitat in coastal wetlands or designing

infrastructure to meet future hazards. NRCS also will seek to integrate the science and understandings of climate change impacts to agriculture into the discussions and framework of NRCS's State Technical Committees and local work groups in a way that considers regional variation and agricultural production systems.

NRCS will review and make necessary adjustments to policy as possible. This would aim to clarify policies that serve to evaluate the benefits of long-term investments to ensure that climate change impacts and opportunities are addressed in addition to traditional ecological benefits. This could include policy and guidance for stewardship of perpetual easements that includes an evaluation of local climate change impacts and projections.

To maximize the impact of its funding investments, NRCS will identify opportunities to incorporate climate change data targeting adaptation and disaster response needs (e.g., drought) into annual allocation planning to better target funding nationwide. This will require identifying areas of need that overlap for the priorities of environmental justice, climate adaptation needs, and vulnerable populations to direct resources toward areas of greatest needs for natural resources, producers, and communities.

Conservation practice standards, along with the conservation planning process, are the foundation of NRCS's technical assistance program and are used by local, state, and Federal government agencies as well as by non-governmental organizations engaged in working lands conservation. To respond to climate change, NRCS will take actions to maximize local flexibility for using these practices to address natural resource issues. This will entail developing an "actual cost" database that can be used to provide more accurate and accessible cost estimates, developing additional practice implementation flexibility examples of how to use practice standard flexibilities to address adaptation needs and local variabilities, integrating new technologies, and prioritizing national review of practices that will have the greatest impact helping clients adapt to climate changes. This may include continued work to improve measurement of field level data and refining practice standards, practice implementation, and program outreach accordingly.

Lastly, NRCS will develop criteria and data that can be used to evaluate and communicate the success of NRCS investments in adapting to climate change. Ecological benefits from NRCS activities are complex and interact at a variety of scales, from farm to landscape. Defining where and how they are successful in the context of climate adaptation will require establishing baseline resource

conditions and linking data and information in new ways, including across temporal and spatial scales. This work would complement NRCS's ongoing efforts to evaluate the mitigation outcomes of its practices and investments.

NRCS has already begun making progress in this area through several initial steps. These include allocations conversations for climate mitigation that can be leveraged for climate adaptation and resilience, as well as ongoing work with the Easement Division to strengthen the narrative describing environmental benefits of the NRCS easement portfolio. NRCS also has ongoing work to incorporate geospatial climate change information, such as drought data, into planning and decision-making tools and dashboards. Additionally, with initial funding provided through the Bipartisan Infrastructure Law, NRCS is working with local communities to invest in new dam and flood prevention projects and in repairs on existing watershed infrastructure through the Watershed and Flood Prevention Operations (WFPO) Program, Watershed Rehabilitation Program (REHAB) and Emergency Watershed Protection (EWP) Program, with initial priority to communities heavily impacted by drought and other natural disasters as well as historically underserved and limited resource communities.



Action Area 5: Assess and address disproportionate climate change impacts on vulnerable communities through intentional engagement, planning, and assistance

Vulnerability: Assess and address disproportionate climate change impacts on vulnerable communities through intentional engagement, planning, and assistance

Key Actions

- ▶ Understand, strengthen, measure, and evaluate ecosystem services specific to vulnerable communities to protect livelihoods
- ▶ Support food production and associated conservation activities in vulnerable communities
- ▶ Assess and tailor responses to extreme weather events specific to vulnerable communities
- ▶ Increase awareness, skills, and abilities of NRCS staff and clients on equity and environmental justice issues

- ▶ Ensure outreach and meaningful engagement with vulnerable communities and that recommendations they provide are used to update and revise policy where possible.
- ▶ Increase technical and financial assistance for vulnerable communities

Climate change planning provides the opportunity to take immediate and long-term action to strengthen and build resilience in ecosystem services, food production, conservation, and emergency responses in the most vulnerable communities, who are often disproportionately impacted by climate change. These actions include understanding ecosystem services specific to vulnerable communities and assessing and developing responses that are tailored to the unique climate change impacts they are experiencing. Actions will also include supporting food production and associated conservation activities in these communities, including strengthened urban agriculture efforts. Increasing NRCS's internal awareness, skills, and abilities on equity and environmental justice issues and ensuring outreach and meaningful engagement with vulnerable communities will be essential to the success of NRCS's efforts in this area. This will include learning from traditional ecological knowledge and other experiences and conservation approaches unique to Tribes and other communities and integrating that learning into NRCS's work. NRCS will also increase technical and financial assistance for vulnerable communities, integrating the feedback gained through engagement. Several actions in this area intentionally overlap with actions proposed in other areas because the needs of this vulnerability touch nearly every aspect of NRCS's operations. As such, NRCS will work across the organization to ensure these actions are coordinated and implemented in collaborative and complementary ways.

Within these broader actions, some proposed steps include creating direct and indirect connections between conservation practices and increased health benefits to promote urban and small-scale production for vulnerable communities. NRCS can support adaptation and mitigation actions for conservation practices and enhancements to maintain cultural food gathering traditions, which could be lost as a result of climate change. NRCS can also build upon needs already identified by vulnerable communities such as soil testing and soil remediation for urban and small-scale production and conservation. NRCS can collaborate with the US Forest Service's Burned Area Emergency Response (BAER) teams to create multistate or multiarea teams to rapidly deploy to any community,

including vulnerable communities. NRCS can also establish subcommittees as part of the State Technical Committees to focus on urban and vulnerable communities.

Work in this action area is already underway. In FY21, NRCS invested \$50 million in 118 partnerships to expand access to conservation assistance for climate-smart agriculture and forestry. Through the Office of Urban Agriculture and Innovative Production, NRCS updated the evaluation criteria on its funding opportunities to include climate, equity, and environmental justice considerations. NRCS purchased multiple portable X-ray fluorescence devices to conduct technical soil services in urban areas for food production and conservation considerations and detailed soil survey data is currently available for urban areas, including the cities of Baltimore, Chicago, Cincinnati, Detroit, Los Angeles, New York, San Diego, San Jose, St. Louis, Washington, D.C., and surrounding suburban areas.

In FY22, NRCS has taken several actions to advance equity and support historically underserved communities and areas. These actions include policy changes and waiver options to allow more overall flexibility in program implementation and to streamline application and contracting processes, including through Alternative Funding Arrangements for EQIP and CSP. NRCS has also taken steps to prioritize selection and funding of historically underserved applicants within its programs, including through the Wetland Reserve Enhancement Partnership program in which \$17 million was obligated for four projects with specific ties to historically underserved communities in the first year. Lastly, NRCS has made additional improvements to better serve Limited English Proficient customers and address barriers and access to program information, including through the translation of critical contract and other key program documents.



Action Area 6: Strengthen partnerships and collaboration to address climate change

Vulnerability: The scale and complexity of climate change demands broad and diverse partnerships

Key Actions

- ▶ Increase familiarity with the state/local climate change "landscape" in order to design and implement more effective and efficient programs and facilitate improved, targeted, communication.

- ▶ Expand existing partnerships and build new and essential partnerships to integrate all aspects of socio-economic and natural resource considerations into the agencies approach to addressing climate change.

NRCS will take several steps to ensure its partnerships, and the way it engages with them, are sufficient to meet the demands created by climate change. NRCS will work to become familiar with the local climate change “landscapes” of states and other partners to design and implement more effective and efficient programs that are responsive to climate change. This will also allow NRCS to facilitate improved, targeted communication with these partners. To do this, NRCS will work through its regional and state offices to build and strengthen partnerships with state, Tribal, and community partners to ensure strategies are locally led.

NRCS will prioritize the expansion of existing partnerships and building new and essential partnerships to integrate socio-economic and natural resource considerations into the agency’s approach to addressing climate change. This may include leveraging existing capacity and partners to engage with underserved and new partners and working to overcome potential language or cultural barriers with new partners. New or enhanced outreach and partnership efforts will seek to include climate messaging around the unique impacts of climate change on historically underserved producers, Tribes, and vulnerable communities. NRCS will also seek to incorporate climate change considerations into its work on all emerging efforts around other USDA priorities including equity and urban agriculture.

In addition to these priority actions, NRCS also will work to maintain connections with and continue providing information and assistance to existing partners even if approaches, understanding, and priorities around climate change are not in complete alignment. NRCS will further coordinate with partners to reduce duplicative activities in order to allow for more actions and broaden the collective impact. As a leader on several interagency groups and coalitions, including the National Drought Resilience Partnership and the Coastal Resilience Interagency Working Group, NRCS will continue to work with other agencies and partners to ensure its climate change work is coordinated and strategically aligned with efforts across the federal government.



Action Area 7: Address risks to agency infrastructure

Vulnerability: Increasing frequency, severity, and extent of disturbances pose risks to current agency infrastructure

Key Actions

- ▶ Explore alternative communication systems to have multiple forms available.
- ▶ Ensure national and regional datasets used in identification and assessment of climate change impacts are protected from loss.
- ▶ Work with Homeland Security Division and FPAC-BC to ensure one FPAC resilience portfolio to provide a unified mission area framework for tracking, evaluating, and managing risks to facilities and accessibility, including via COOP plans.
- ▶ Increase resilience of data collection and monitoring sites through additional sites and various measurement sensors, enhanced equipment, and functional redundancy in physical IT infrastructure
- ▶ Continually update DamWatch dam monitoring tool as new climate data becomes available and enable watershed project sponsors to monitor their small watershed dams
- ▶ Support fleet resilience through improved tracking of utilization standards, service center enhancements, use of mobile workstations, and improved fuel efficiency and procurement.

Critical to NRCS’s continued effectiveness in responding to client conservation needs is the infrastructure necessary for a geographically diverse workforce. Whereas existing infrastructure may be taken for granted on a day-to-day basis, emergency circumstances tend to highlight how vulnerable they are, especially when needed to respond to those emergencies. Much of this infrastructure has shared needs by NRCS’s FPAC sister agencies (Farm Service Agency and Risk Management Agency), as well as partners, such as Soil and Water Conservation Districts.

Many of these recommendations will require a coordinated effort with Farm Service Agency, Risk Management Agency, FPAC Business Center, and Office of the Chief Information Officer, and may rely on guidance from the Office of Contracting and Procurement and Office of Property and Environmental Management, where applicable. Although NRCS recommends several actions

in this area, they recognize that they may not be the lead implementing agency for several of these actions. NRCS will assist and participate in activities that would be more appropriately handled by the FPAC Business Center.

NRCS identified various aspects of infrastructure that need to adapt to reduce ongoing and future vulnerabilities caused by climate change. Paramount to this is the need to maintain communication. NRCS proposes to review and identify alternative communication methods, as well as systems where redundancy can support the maintenance of communication in the event of disruptions. For instance, if cellular communication is compromised, NRCS must ensure that staff can continue communications with higher authorities via other means.

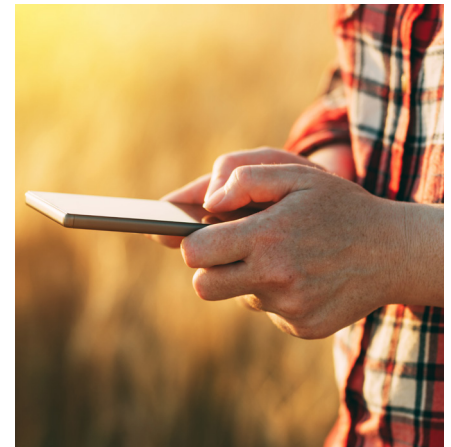
NRCS maintains many sources of data housed within IT systems, including geospatial data, tabular data used in calculations, and historical data used for soils databases, among others. Additionally, NRCS has agreements with entities outside of our current IT systems that may be the main repository for similar data. NRCS's action here is twofold. Data, regardless of format, needs to be updated regularly to keep pace with climate change. For NRCS IT business tools to remain up to date, these data must also be updated by data stewards outside of NRCS. The second part of this is protection of the data such that if there are events that are local, regional, or national in scope, there is no loss of data. This will require internal updates and continued protections, as well as coordination with partners and other outside entities to make sure the same level of data protection is consistently applied.

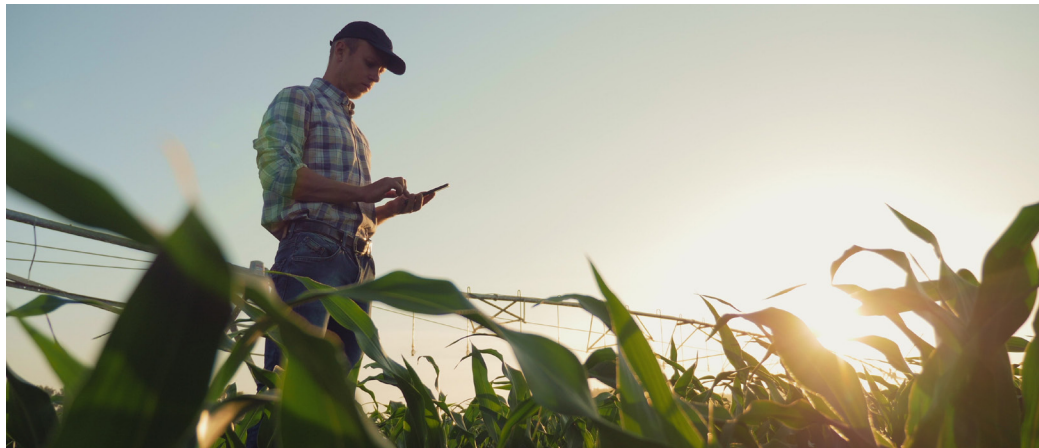
NRCS proposes that physical structures, including offices and facilities such as PMC, be evaluated through a dashboard to identify vulnerabilities and what can be

done to adapt. This will also include keeping an up-to-date Continuity of Operations Plan (COOP). Currently, the COOP is required to be reviewed annually. NRCS recommends that sections of the COOP be identified that may need a more frequent cadence of review and update, such as points of contact. Like physical structures, vehicles are a large portion of NRCS's property portfolio that can be improved upon. This may include purchase of alternative energy vehicles, and careful consideration of other forms of transportation such as all-terrain vehicles, boats, snowmachines, mobile workstations, and emergency backup generators.

NRCS provides leadership and management to the Snow Survey and Water Supply Forecasting Program (SSWSF) and the Soil Climate Analysis Network (SCAN) programs which provide data that is instrumental in predicting available water critical to drinking water supplies, irrigations of crops, and aquatic habitat resources, particularly to vulnerable communities. The current programs rely on a set of nationally dispersed monitoring stations. NRCS will work to maximize the utilization and capacity of these programs to address limitations in the number, distribution and functionality of sites as increasingly common extreme events (storms, floods, wildfires) damage monitoring stations.

Lastly, NRCS monitors over 11,000 small dams across the United States using software called DamWatch. DamWatch is critical in ensuring communities remain safe during extreme events. NRCS is recommending the underlying data, used within the DamWatch system, is updated regularly as new weather and climate data becomes available.





CROSS-CUTTING ADAPTATION ISSUES AND CONSIDERATIONS

Environmental Justice

Pursuing equity and environmental justice is paramount at NRCS. As such, NRCS is currently developing an agency-wide Equity Plan making equity and environmental justice awareness mainstream across the agency and hiring staff that reflects the diversity of the communities the agency serves, including vulnerable communities. The Equity Plan will include building upon certified training programs to include the intersections between climate, equity, and environmental justice. It will also entail creating partner and stakeholder awareness of a clear and consistent vision of racial equity and inclusion in programs.

In line with this agency priority, equity and environmental justice were considered and embedded throughout this entire plan. Disproportionate impacts on vulnerable communities were elevated as its own vulnerability and action area, with several corresponding actions to explicitly address the identified challenges and risks to vulnerability communities. Each of the other action areas also include activities that specifically target vulnerable communities, including historically underserved groups and urban settings. Actions within this plan will also support and be in alignment with NRCS's contributions to the Justice40 Initiative, a whole-of-government effort to deliver at least 40 percent of the overall benefits from Federal investments in climate and clean energy to disadvantaged communities.

Workforce Climate Literacy

Workforce climate literacy is a key priority for NRCS and is highlighted as its own agency vulnerability with several identified actions. Adequate climate literacy and

capacity among staff underpins much of the work of this plan and is essential to many of the identified actions. NRCS continues to build out actions to ensure its staff have the training, education, and resources to effectively meet the climate-related needs while working together with the Department to provide additional opportunities related to shared climate literacy needs across agencies.

USDA Climate Hubs

Since their inception in 2014, the USDA Climate Hubs (Hubs) have developed and delivered science-based, region-specific information and tools that support climate-smart agriculture and forestry, including adaptation and mitigation efforts. The ten Regional Hubs are a unique interagency program leveraging the best science and resources across USDA and providing usable resources to American farmers, ranchers, forest landowners, land managers, and rural communities in preparing for and responding to climate-related risks and vulnerabilities. In addition, Hubs serve as a central source of connection, communication, information, tools, applied climate and weather-related information and technical assistance helping farmers, ranchers, forest managers, land operators and rural communities.

NRCS is named as one of the three co-lead agencies for the Hubs in the original charter. Although NRCS is not the lead administrative agency for any of the Hubs, the agency has maintained close connections with the Hubs and continues to be involved in all aspects of Hub governance and to support the collaborative development and dissemination of climate-related information and resources.

NRCS support and collaboration with the Climate Hubs

NRCS supports Climate Hubs through many means. NRCS provides support through representation on the Climate Hubs Executive Committee. There is also an NRCS national representative to the Climate Hubs who works collaboratively with the Climate Hubs National Lead and representatives from ARS and USFS to provide national-level coordination of Hub activities. Select NRCS senior technical staff are designated as co-leads for each Regional Hub and members of the Regional Hub governing board. Some NRCS staff are assigned to a specific Hub or multiple Hubs on one-year details to conduct specific projects of mutual interest to the Agency and the Climate Hubs. A total of eighteen staff members have participated in this program since its inception in 2016.

NRCS has contributed direct financial support for Hub operations since the creation of the Hubs. NRCS has provided funding to the Hubs for projects that provide information, resources and tools that support NRCS priority needs. In FY21, NRCS provided a total of \$550,000 for five projects.

NRCS has partnered with the Hubs on several recent projects that support NRCS's efforts around climate change adaptation, including:

- ▶ Adaptation Resources for Agriculture and the Climate Adaptation Workbook
- ▶ Training materials for employees related to climate change (these are currently being updated to reflect the best available information and current Agency and Departmental Priorities)
- ▶ Climate Conversations: short (1-1.5 hour) meetings that provide high-level climate information (USDA approved sources) focused on Resiliency/Adaptation.
- ▶ Identification, Mitigation, and Adaptation to Salinization on Working Lands in the U. S. Southeast (Manual for producers developed by the SE Hub, NRCS detailees were co-authors)
- ▶ Irrigation Pays in Protecting Crop Revenues (NE Climate Hub case study)
- ▶ Southern Plains Podcast providing timely information to landowners and other interested groups and individuals (<https://www.climatehubs.usda.gov/hubs/topic/southern-plains-podcast>)

NRCS will continue to seek ways to leverage and contribute to the Hubs to advance its climate change work, including several actions outlined in this plan such as providing additional resources for climate literacy, providing updates to certifications and curriculum, identifying and communicating appropriate science, and supporting expansions of partnerships.



TABLE 1: NRCS ADAPTATION ACTIONS TO ADDRESS CLIMATE CHANGE

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 1: Climate change preparedness depends on a climate literate and capable workforce	Establish a comprehensive Communications Strategy that evaluates audiences, prioritizes actions, and assesses performance.	Proposed and ongoing	Agency Climate Lead, All Deputy Areas, FPAC-BC Communications	2022 and continuous	All agency wide, with partnerships, cross walked with other USDA agencies,	Plan Developed, Action Items to be tracked	Strategy has been developed and will be continuously reviewed and improved
	Communicate with external clients to increase awareness of NRCS programs and services that support voluntary conservation efforts furthering climate-smart agriculture and forestry, and specifically those that build climate resilience, including through targeted outreach	Proposed and ongoing	Agency Climate Lead, All Deputy Areas and RC's, FPAC-BC Communications	2022 and continuous	All agency wide, with partnerships, cross walked with other USDA agencies	Communications toolkit will be developed and utilized by Sr. Leaders, STC and all NRCS Employees. Farmers.Gov will include climate adaptation and resilience information	Toolkit in progress
	Develop training curriculum to ensure NRCS staff continue to enhance their expertise and incorporate connections to climate within their area of responsibility; and to increase all NRCS staff ability to articulate the nexus of all conservation activities and practices with climate change.	Proposed and ongoing	Agency Climate Lead, All Deputy Areas, RC's	2022 with expansion in 2023-2025	USDA-NRCS Deputy areas, SSRA, S&T and RC's office; All agency wide, with partnerships, cross walked with other USDA agencies	Training plan will be developed, and training reviewed and updated. NRCS will collaborate with Climate Hubs on existing Climate information	Climate Hubs have already developed Climate Conversations. NRCS has delivered to multiple states

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 1: Climate change preparedness depends on a climate literate and capable workforce	Develop a staffing plan to support climate change needs, including identifying future capacity and workload; recruitment, training and retention of diverse new staff; and internal and external staffing support options.	Proposed	Agency Climate Lead, All Deputy Areas, FPAC-BC Communications	2023 with action in 2023-2025	USDA-NRCS Deputy areas, SSRA, S&T and RC's office; All agency wide, with partnerships, cross walked with other USDA agencies	Staffing plan to be Developed September 1, 2023	Existing staffing plan team may be leveraged for this action
Vulnerability 2: The pace and intensity of climate change impacts may exceed existing conservation science, knowledge, and data systems	Improve climate information management, including capturing, organizing, and integrating climate information and relevant research at appropriate scales	Ongoing and proposed	SSRA, S&T (NDLs in particular), CPPD (Programs and Planning in particular)	Begin in FY22/23 and then ongoing	Climate Hubs, REE (especially ARS); DOI (USGS, BLM, FWS), NOAA, DOE, EPA	Various, including emerging issues identified; literature reviews conducted, datasets and practices reviewed, geographic coverage evaluated	Initial work has begun through Climate Stressors and Climate Resilience Quick Reference projects, as well as existing Edge of field monitoring activities and revised Conservation Evaluation and Monitoring Activities
	Better understand and address novel ecosystems, including by integrating new technology, evaluating and targeting plant materials, and developing regional priorities for new conservation systems, with a concerted effort on at-risk ecosystems	Ongoing and proposed	SSRA, S&T (including PMC in particular), CPPD	Some actions have already begun but will be accelerate and updated in FY22/23; Others begin FY22/FY23, and then ongoing	Climate Hubs, REE (especially ARS), USFS; DOI (USGS, BLM, FWS), NOAA	Reginal threats and priorities identified, new conservation plants released, and state needs completed via PMC needs assessment process	PMCs have long history of selecting conservation plants for unique environments, including those that may support adaptation
	Establish multi-disciplinary climate change technical expertise team and strategies to evaluate and determine climate requirements and guidance for conservation planning, implementation, assessment, research/ demonstration, and investments	Proposed	SSRA, S&T, CPPD (including Projects branch in particular)	FY22-23	REE	Establishment of technical team and strategic plans; partnerships and projects supported with CSAF focus and outcomes and dollars invested	Cross-agency consultation for CIG climate priorities has begun.

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 2: The pace and intensity of climate change impacts may exceed existing conservation science, knowledge, and data systems	Maintain, strengthen, and enhance climate-related SWAPA+HE-associated databases, information platforms, and datasets (including soil and vegetative information), as well as ongoing data collection, measurement, and modeling efforts	Ongoing and proposed	SSRA, S&T, CPPD	Begin in FY22-24 then ongoing	OEEP and REE (especially ERS) for some actions	Periodic review of programs and databases; adaptation benefit method developed, and benefits captured	Ongoing effort
Vulnerability 3: Shifting climate trends and increasing variability require nimble and comprehensive business processes that support adaptive conservation	Identify and prioritize climate change-related resource concerns and provide climate-smart opportunities based on producer needs/desires/goals	Ongoing and Proposed (with additional resources)	CPTAD, SSRA, S&T	2022-2024, then ongoing with certain steps tied to NCA releases	Climate Hubs, ARS; NOAA, NWS, and other Federal agencies contributing to NCA, NRCS Partners including Local Work Groups and State Technical Guide Committee	Climate stressors identified and correlated with NRCS resource concerns; Number of engagement opportunities completed; Updates to planning implementation and processes have been made	Initial review of 4th NCA was done to correlate stressors to NRCS resource concerns.
	Address existing gaps in NRCS assessments for evaluating climate change impacts, including through integration of climate trends information into planning process and IT applications such as business tools.	Some initial activities ongoing, but mostly proposed	CPTAD, S&T (NDLs, Economists), SSRA (RIAD)	2022-2024, then ongoing	Climate Hubs, USFS, ERS, RMA, NASS; Land Grant Universities, NOAA, NWS, DOI, FWS, Army Corps, and other agencies involved with environmental compliance, National Laboratories/ DOE, Tribes, Urban Centers	Assessment methodologies have been developed, evaluated and adapted; Number of trainings delivered; Planning process and related tools have been updated to incorporate identified data	Initial improvements have been made to the Conservation Practices Date Entry System to enable future CSAF modifications; Software development has begun to incorporate COMET into Conservation Assessment and Ranking Tool and Conservation Desktop

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 3: Shifting climate trends and increasing variability require nimble and comprehensive business processes that support adaptive conservation	Provide support to make climate-smart practices economically feasible for the producer in order to make their operation adaptable and resilient to climate change.	Ongoing and Proposed	CPTAD (inc. Local Conservation Planners and Trainers), S&T (inc. NDLs, Economists), M&S, Environmental Markets	2023-2024, then ongoing	Climate Hubs, USFS, ARS, ERS; Land Grant Universities, NOAA, NWS, DOI, FWS, Army Corps, and other agencies involved with environmental compliance, National Laboratories/ DOE, Tribes, Urban Centers	Processes or assessment methodologies have been developed; Number of trainings delivered at the field level	Initial long-term conservation practice effects have been evaluated in relation to Available Water Capacity, Carbon Storage, and Soil Organic Matter, which can inform economic analyses
Vulnerability 4: Climate change impacts threaten the viability and longevity of current and future applied conservation investments	Increase the presence of climate change information in professional certifications and provide examples of applying climate change information to conservation planning on agricultural lands under a variety of scenarios.	Proposed	All Deputy Areas, with CPPD, S&T, SSRA in the lead for certain actions	1-5 years	Climate Hubs, ARS and Forest Service; technical federal agencies including NOAA, NASA, USGS, EPA	Number of certifications/trainings/ planning scenarios developed or reviewed with current climate information and resources, percent completion of multiple-benefit (whole system) plans with long term scenarios that include environmental benefits for climate adaptation	Proposed action not yet initiated
	Integrate the science and understandings of climate change impacts to agriculture into the discussions and framework of NRCS's State Technical Committees.	Proposed	Regional Conservationists	1-2 years	FSA, federal agency State Technical Committee members	Engagement with all states and needs assessed	Proposed action not yet initiated

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 4: Climate change impacts threaten the viability and longevity of current and future applied conservation investments	Clarify policies that serve to evaluate the benefits of a long-term investment to be sure that climate change impacts and opportunities are addressed in addition to traditional ecological benefits.	Proposed	All Deputy Areas, with CPPD, S&T in the lead for certain actions	FY 22-FY23	ARS, FS as needed; coordination w/ federal land management agencies approach for local coordination as applicable.	Updates to all relevant policy will be completed	Proposed action not yet initiated
	Maximize the impact of NRCS funding investments by identifying areas of need that overlap for the priorities of environmental justice, climate adaptation needs, and vulnerable populations.	Proposed	CPPD, M&S, S&T, SSRA	FY23 for initial metrics and incorporation into EQIP/ WRE allocations; ongoing work for multiple years	Climate Hubs, USFS, ARS; technical expertise and data from federal agencies including NOAA, NASA, USGS, EPA	Number of metrics incorporated into allocations	Allocation conversations and integration into EQIP allocation recommendations have already begun for climate mitigation, which can be leveraged for climate adaptation/ resilience
	Maximize local flexibility for using Conservation Practices to address natural resource issues by sharing examples, integrating new technologies, and prioritizing national review of practices that will have the most impact helping producers adapt to climate changes.	Planned and Proposed	CPPD, S&T including NDLs/ SDLs, M&S, Hub liaisons	Fy22-FY26, with certain actions completed by FY23	FSA, OCE, ARS, RMA; External coordination through existing venues (State Technical Committee, State and local governments, universities)	Percentage of practices reviewed and revised to include climate adaptation and resiliency information.	An initial GIS extension has been developed which overlays planned practices with the current Drought Monitor Map.
	Develop criteria and data that can be used to describe and evaluate the success of NRCS investments to the general public.	Ongoing and proposed	SSRA, S&T, CPPD	2-4 years, FY 22-23	Climate Hubs, USFS, ARS; coordination w/ federal land management agencies approach for local coordination as applicable.	Investment successes defined at both farm and landscape scales; completion of easement benefits annual report.	Investment successes defined at both farm and landscape scales; completion of easement benefits annual report.

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 5: Climate change disproportionately impacts vulnerable communities	Understand, strengthen, measure, and evaluate ecosystem services specific to vulnerable communities to protect livelihoods	Ongoing, Proposed, and Planned	SSRA, FPAC-BC, S&T, PMC, NWCC, Programs, and RCs.	Starting immediately through 2025	FPAC-BC, ARS, NASS, FS, FSA, ERS, FAS, RMA, NIFA, Office of Tribal Relations, HUD, EPA, SBA, USGS/BLM, local NGO groups, universities, community colleges	Progress metrics include establishment and tracking of goals contracts, agreements, obligations, urban Ecological Site Descriptions (ESDs) created, acres treated, urban soil surveys completed, and other data as necessary according to annual goals/KPMs	NRCS has provided proof of concept by creating several urban ESDs. Detailed soil survey data is available for urban areas, including the cities of Baltimore, Chicago, Cincinnati, Detroit, Los Angeles, New York, San Diego, San Jose, St. Louis, Washington, D.C., and surrounding suburban areas.
	Support food production and associated conservation activities in vulnerable communities	Ongoing and Proposed	Chief's Office, RC, States, S&T, SSRA, and Programs.	Starting immediately through 2025	FPAC-BC, ARS, NASS, FS, FSA, ERS, FAS, RMA, NIFA, Office of Tribal Relations, NOAA	Progress can be measured by partnerships developed to promote protection of natural resources and importance of conservation practices to human health	NRCS has purchased multiple portable X-ray Fluorescence devices to conduct technical soil services in urban areas for food production and conservation considerations.
	Assess and tailor responses to extreme weather events specific to vulnerable communities	Ongoing and Proposed	Chief's Office, RC, States, S&T, SSRA, and Programs.	Starting immediately through 2025	FS, RD, FEMA, BIA, BOR, ACOE, State Forestry departments and Tribes – Tribal Historic Preservation Office (THPO) and State Historic Preservation Offices (SHPO).	Progress metrics include number of watershed projects contracted and implemented, measurements from the BAER report such as soil burn severity, engineering assessment for flood potential / landslides, cultural resources affected, forestry / tree damage report, other report metrics as needed.	NRCS invested \$10 million to Support Climate-Smart Agriculture and Forestry through Voluntary Conservation including resources targeted to ensure equity and historically underserved producers. NRCS invested \$50 million in 118 partnerships to expand access to conservation assistance for climate-smart agriculture and forestry.

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 5: Climate change disproportionately impacts vulnerable communities	Increase awareness, skills, and abilities of NRCS staff and clients on equity and environmental justice issues.	Ongoing and Proposed	Chiefs Office, FBC, States, M&S, and S&T	Starting immediately through 2023	FSA, ARS, NIFA, DOI, EPA, WHEJAC	Possible metrics include tracking number of employees taking training, number of producers signed up for soil testing, and percentage of states with urban ag or vulnerable sub-committees.	NRCS has made the USDA Climate, Agriculture, and Forestry Seminar Series available to key staff. Topics include Climate Justice, Food Systems, Food Security, and Global Linkages, and Complex Socio-Ecological-Economic System.
	Ensure outreach and meaningful engagement with vulnerable communities and that recommendations they provide are used to update and revise policy where possible.	Ongoing and Proposed	Chief's Office, M&S, and S&T	Starting immediately through 2023	FSA, RMA	Progress metrics include number of additional outreach coordinators, number of consultations with vulnerable communities, outreach campaign roll outs, and documented recommendations from targeted communities incorporated into policy.	NRCS, through the Office of Urban Agriculture and Innovative Production has updated the evaluation criteria on its Notice of Funding Opportunities to include climate, equity, and environmental justice considerations. An Outreach Coordinator has been designated for all States and the 2 Territorial Areas. Environmental Justice - GIS Map Layers have been added for States to target underserved or disadvantaged communities.

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 5: Climate change disproportionately impacts vulnerable communities	Increase technical and financial assistance for vulnerable communities	Ongoing and Proposed	Chief's Office, SSRA, S&T	Starting immediately through 2024	Primarily internal to NRCS	Progress metrics include number of additional outreach coordinators, number of consultations with vulnerable communities, outreach campaign roll outs, and documented recommendations from targeted communities incorporated into policy.	NRCS has created national risk and gap maps for historically underserved, urban, and climate analysis to inform the allocation process. SRA strategic budgeting tool will allow states to align resource concerns and target LRA or HU communities using a locally led component key tool to link targeted work with funding needs. STCs will be provided direction to consider underserved communities when deciding how to distribute their state allocation of funds as request for underserved communities will be a priority for funding
	Increase familiarity with the state/local climate change "landscape" in order to design and implement more effective and efficient programs and facilitate improved, targeted, communication.	Ongoing/ proposed (depending on the state)	State Conservationist / Area Director	Within first 90 days	Information could be collected in collaboration with other USDA agencies and shared	Number of state-level reports submitted	Ongoing effort
Vulnerability 6: The scale and complexity of climate change demands broad and diverse partnerships	Expand existing partnerships and build new and essential partnerships to integrate all aspects of socio-economic and natural resource considerations into the agencies approach to addressing climate change.	Ongoing/ planned/ proposed	Climate office, STCs, PAS, National Priority Leads, allowance holders	Ongoing - can start immediately	Ongoing - can start immediately	Examples of actions taken to expand and build partnerships	Ongoing effort

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 7: Increasing frequency, severity, and extent of disturbances pose risks to current agency infrastructure	Explore alternative communication systems to have multiple forms available.	Proposed and ongoing	M&S, FPAC	2022/23	FPAC; DoD, FCC	Once current forms of communication are inventoried by location, identify gaps in redundant systems, consult with other agencies on possible alternatives, purchase and train staff.	Ongoing effort
	Ensure national and regional datasets used in identification and assessment of climate change impacts are protected from loss.	Proposed and ongoing	M&S, FPAC	2022/23, ongoing	FPAC, OCIO	Consult with FPAC	Ongoing effort
	Work with HSD and FPAC-BC to ensure one FPAC resilience portfolio to provide a unified mission area framework for tracking, evaluating, and managing risks to facilities and accessibility, including via COOP plans.	Proposed and ongoing	M&S, NCGC, FPAC, Chief, RC's, STC's	2022-2024, then ongoing for many actions; Some action timelines contingent on FPAC	FPAC	Consult with FPAC	Ongoing effort
	Increase resilience of data collection and monitoring sites through additional sites and various measurement sensors, enhanced equipment, and functional redundancy in physical IT infrastructure	Ongoing, planned, proposed	NWMC, SSWSF, SCAN	2023	N/A	Identify locations of greatest need, secure additional funds and implement.	Ongoing effort

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 7: Increasing frequency, severity, and extent of disturbances pose risks to current agency infrastructure	Continually update Dam Watch dam monitoring tool as new climate data becomes available and enable watershed project sponsors to monitor their small watershed dams	Ongoing	CPPD (Watershed Planning)	2023	N/A	Secure additional funds and implement	Ongoing effort
	Support fleet resilience through improved tracking of utilization standards, service center enhancements, use of mobile workstations, and improved fuel efficiency and procurement.	Ongoing, planned, proposed	M&S, FPAC	2022/23, ongoing	FPAC	FPAC Vehicles Dashboard data and related policy	Ongoing effort

ACRONYM DEFINITIONS

ACRONYM	DEFENITION	ACRONYM	DEFENITION	ACRONYM	DEFENITION
ACOE	Army Corps of Engineers	FSA	Farm Service Agency	RD	Rural Development
ARS	Agricultural Research Service	FWS	US Fish and Wildlife Service	REE	Research, Education and Economics Mission Area
BAER	Burned Area Emergency Response	HSD	Homeland Security Division	RIAD	Resource Inventory and Assessment Division
BIA	Bureau of Indian Affairs	HU	Historically Underserved	RMA	Risk Management Agency
BOR	Bureau of Reclamation	HUD	Housing and Urban Development	S&T	Science and Technology Deputy Area
CIG	Conservation Innovation Grants	M&S	Management and Strategy Deputy Area	SBA	Small Business Administration
COOP	Continuity of Operations Plan	NASA	National Aeronautics and Space Administration	SCAN	Soil Climate Analysis Network
CPPD	Conservation Planning and Program Delivery (Programs) Deputy Area	NASS	National Agricultural Statistics Service	SDL	State Discipline Lead
CPTAD	Conservation Planning and Technical Assistance Division	NCA	National Climate Assessment	SHPO	State Historic Preservation Offices
CSAF	Climate Smart Agriculture and Forestry	NDL	National Discipline Lead	SPSD	Soil and Plant Science Division
DOD	Department of Defense	NGCE	National Geospatial Center of Excellence	SRA	State Resource Assessment
DOE	Department of Energy	NIFA	National Institute of Food and Agriculture	SSRA	Soil Science and Resource Assessment Deputy Area
DOI	Department of Interior	NOAA	National Oceanic and Atmospheric Administration	SSWSF	Snow Survey and Water Supply Forecasting
EPA	Environmental Protection Agency	NWCC	National Water and Climate Center	STC	State Conservationists
EQIP	Environmental Quality Incentive Program	NWMC	National Water Management Center	SWAPA+HE	Soil Water Air Plants Animals + Humans Energy resources
ERS	Economic Research Service	NWS	National Weather Service	THPO	Tribal Historic Preservation Office
ESD	Ecological Site Description	OCE	Office of the Chief Economist	USGS	United States Geological Survey
FCC	Federal Communications Commission	OEEP	Office of Energy and Environmental Policy	WHEJAC	White House Environmental Justice Advisory Committee
FEMA	Federal Emergency Management Agency	OCIO	Office of the Chief Information Officer	WRE	Wetland Reserve Easements
FPAC	Farm Production and Conservation Mission Area	OUAIP	Office of Urban Agriculture and Innovative Production		
FPAC-BC	Farm Production and Conservation Business Center	PMC	Plant Materials Centers		
FS/USFS	United States Forest Service	RC	Regional Conservationists		



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[July 2022]





CLIMATE CHANGE **ADAPTATION PLAN**

July 2022





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INTRODUCTION

The Farm Service Agency (FSA) is committed to empowering farmers, ranchers, and foresters to become more resilient in the face of climate-induced disasters while helping drive innovative solutions to the climate crisis. Through the agency's price support, safety net, conservation, disaster assistance, and loan programs, FSA staff interface with producers and stakeholders across the country, providing FSA the unique opportunity to help shape a more sustainable future for American agriculture and forestry.

FSA's history traces back to 1933, when agricultural producers were struggling to survive the Great Depression. Although the agency has gone through several name changes, it has always been defined by its commitment to market stabilization and resource conservation.

Today, FSA's responsibilities are organized into three deputy areas: Farm Programs, Farm Loan Programs, and Field Operations. Each of the deputy areas, along with their divisions and program areas, play a critical role in helping producers and landowners conserve natural resources.

FSA Deputy Areas

FSA's Deputy Administrator for Farm Programs (DAFP) oversees three policy divisions and one automation division. The three policy divisions (Conservation, Safety Net, Price Support) along with the Program Delivery Division are responsible for overseeing and implementing policies and procedures that regulate the delivery of FSA farm programs. These programs help agricultural producers manage market risks, recover from disasters, and conserve and protect America's natural resources.

When it comes to FSA's work on climate adaptation, each Deputy Area plays a key role. Notably, DAFP's divisions each administer a wide variety of programs, each with unique climate change adaptation and mitigation opportunities. Notable, DAFP's Conservation Division administers FSA's flagship conservation program, the Conservation Reserve Program. Under the CRP umbrella, the Conservation Division oversees several distinct programs; beyond CRP, the Conservation Division also administers key emergency conservation programs,

3 DEPUTY AREAS



Farm Programs



Farm Loan
Programs



Field Operations

including the Emergency Conservation Program and the Emergency Forest Restoration Program.

DAFP's Safety Net Division administers commodity price support activities, including the Agriculture Risk Coverage and Price Loss Coverage Programs, along with several key programs focused on providing assistance to livestock producers impacted by disasters. The Safety Net Division also administers the Noninsured Crop Disaster Assistance Program (NAP), which provides financial assistance to producers of non-insurable crops, to ensure these producers can also receive assistance in the face of natural disasters that impact crop planting, production, and yield. DAFP's Price Support Division provides assistance through marketing assistance loans for key commodities, loan deficiency payments, and programs targeted towards building resilience in the dairy sector. DAFP has also administered—and continues to implement and administer—several billions of dollars in ad hoc disaster assistance and economic assistance programs.

FSA's Deputy Administrator for Farm Loan Programs (DAFLP) leads the Direct and Guaranteed Farm Loan Programs. Through the work of this deputy area and its Loan Making, Loan Servicing and Property Management, and Program Operations and Appraisal Divisions, FSA County Offices make and service direct and guaranteed farm ownership and operating, and emergency loans to family-sized farmers and ranchers who cannot obtain commercial credit from a bank, Farm Credit System institution, or other lenders. Guaranteed conservation loans are also available regardless of the availability of other credit. FSA loans can be used to purchase land, livestock, equipment, feed, seed, and supplies. The loans can also be used to construct buildings, make farm improvements, and promote soil and water conservation and protection. FSA loans are often provided to beginning and underserved farmers who cannot qualify for conventional loans because they have insufficient financial resources. FSA also helps established farmers who have suffered financial setbacks from natural disasters, or whose resources are too limited to maintain profitable farming operations.

FSA's Deputy Administrator for Field Operations (DAFO) is responsible for the supervision and oversight of Farm Service Agency State and County Offices and serves as the primary liaison between field and headquarters offices on agency-wide issues. DAFO staff play a critical role in the efficient, effective, and consistent delivery of FSA programs, along with essential administrative operations.

When FSA state and county staff directly help producers navigate the diversity of the agency's farm programs and farm loan programs, they establish a critical line of customer service. With more than two thousand state and county offices throughout the United States, FSA staff are the agency's most important asset to achieving its mission and vision. Only through this nationwide network of staff can FSA leverage its footprint across rural America to help promote climate smart solutions to producers. FSA field office staff work closely with producers and stakeholders daily across the country, and with the proper marketing and outreach, FSA has a unique opportunity to help reshape messaging that will help educate our farmers, ranchers, and foresters.

FSA staff across the county, state, and headquarters offices also work closely with USDA's Farm Production and Conservation Business Center (FPAC-BC), which is responsible for acquisition, human resources, information technology and administrative support for program implementation, economic and policy analysis, budget, reporting, and communications.

FSA's Mission and Vision

FSA is guided by a mission to equitably serve all farmers, ranchers, foresters, and agricultural partners through the delivery of effective, efficient programs. FSA strives to be a customer-driven agency with a diverse and multi-talented work force dedicated to support an abundant, market-oriented, safe, and affordable food and fiber supply while sustaining quality agricultural commodities and achieving an economically and environmentally sound future for American agriculture. The foundation of FSA's mission and vision rests upon the USDA's long-standing core values of strong ethics, customer service, teamwork, inclusive decision-making, and fiscal responsibility.

As the impacts of climate change become more frequent and intense, FSA can empower producers to both adapt to climate change and develop solutions for climate change mitigation. By empowering producers to invest in the health of their soil, water, and other natural resources, the long-term sustainability of the land can be maintained and continue to provide benefits of soil health and carbon sequestration for future generations of producers. Reducing the vulnerability and increasing the adaptive capacity of producers, ranchers, and foresters to climate change is what is needed to maintain competitiveness and sustainability in the future. FSA's Climate Adaptation Plan discusses the ways in which the agency intends to increase resilience and achieve its goals.

In January 2022, FSA established a steering committee comprised of employees from all deputy areas to revise the agency's 2014 Climate Adaptation Plan and expand upon USDA's Action Plan for Climate Adaptation and Resilience. The committee worked to determine existing and future vulnerabilities, along with actions the agency can take to develop an ambitious but feasible 2022 Climate Adaptation Plan. The steering committee carefully reviewed FSA's mission, operations, and infrastructure to determine the agency's capacity to support producers facing increasingly frequent and intense climate-induced disasters. The steering committee also assessed its goals in the context of several cross-cutting issues, including environmental justice and climate literacy. Notably, FSA

also evaluated its work within the context of the USDA Climate Hubs, which work to support USDA's department-wide Climate Adaptation and Resilience Plan.

As the steering committee developed this plan, it remained focused on FSA's commitment to serving all of its customers, including those who have been historically underserved by the USDA. Ultimately, as FSA works to address current and emerging challenges attributable to climate change, the agency is striving to help producers and landowners manage natural resources in ways that support climate change mitigation and adaptation while building both on-farm and financial resilience to future environmental challenges.



CLIMATE CHANGE EFFECTS AND VULNERABILITIES

6

VULNERABILITIES



Need to address climate literacy and FSA's capacity to make programs adaptation centered.



FSA infrastructure faces risks from climate change.



Increased need for improved science, research, and data for understanding, measuring, and tracking climate-related impacts and outcomes.



Current FSA procedures do not fully integrate climate vulnerability assessment and adaptation planning into customer-facing services; and current investments need to be more adaptable to the impacts of climate change.



FSA does not fully leverage partnerships, networks, and collaboration within the Department to address existing climate change adaptation needs and innovate when considering future actions.



Disproportionate impacts on underserved farmers and ranchers, and underserved communities.





Vulnerability 1: Need to address climate literacy and FSA's capacity to make programs adaptation centered.

With over 10,000 employees located in state and county offices spanning the United States, FSA is uniquely positioned to act as a frontline responder when producers feel the immediate and often unexpected impacts of climate change. To address Vulnerability 1, FSA must prioritize efforts to train, empower, and retain its employees. Today, FSA employees across the country face heavy workload driven by new pandemic and disaster assistance efforts. To this end, FSA will invest in training and supporting its employees to deliver programs efficiently and effectively while maintaining customer service. This will allow employees to maintain a sustainable workload over time.



Vulnerability 2: Increased need for improved science, research, and data for understanding, measuring, and tracking climate-related impacts and outcomes.

As FSA works to empower its staff with the knowledge and tools to respond to climate change, the need for more improved science, research, and data will increase. FSA staff across divisions and Deputy Areas will need to coordinate practices and procedures to effectively assess, measure, and track data that can help both the agency and its customers better respond to climate-related impacts and develop forward-thinking solutions.

Notably, FSA's Conservation Reserve Program (CRP), is one of the largest private-lands conservation programs in the United States. Lessons learned from this program can improve the agency's understanding of climate-related impacts and outcomes. Specifically, several Monitoring, Assessment, and Evaluation (MAE) projects have been used to assess the impacts of CRP enrollment on soil health, wildlife habitat, water quality, and carbon sequestration. The existing and future data collected from these projects, along with future MAE projects, will play a substantial role in further understanding these linkages and directing the practices that are offered under CRP.

Additionally, as the impacts of climate change intensify, data gaps will either emerge or become more apparent around crops, price volatility, and yields. FSA must work to address data gaps that persist across programs – to support both its employees and its customers. For FSA, part of the solution lies in working closely and collaboratively with its sister agencies, including the Risk Management Agency (RMA) and the Natural Resources Conservation Service (NRCS), along with other USDA agencies and entities like the National Institute of Food and Agriculture (NIFA). As FSA works with its partners across the Department to better align data, FSA must also consider opportunities to build flexibility into its programs to better respond to climate stressors. As weather patterns continue to change across the country, FSA must critically assess certain practices and policies that may be tied to historical realities that no longer exist. For instance, increasing variability of early-season weather conditions may require re-assessment of the feasibility of specific planting date requirements and timelines.

FSA also recognizes the benefits of tracking climate-related impacts and outcomes through the DAFLP information technology and modernization efforts. FSA is currently researching opportunities to increase data collection and identify and track Farm Loan Program funding opportunities that can be specifically geared towards achieving environmental benefits.



Vulnerability 3: Current FSA procedures do not fully integrate climate vulnerability assessment and adaptation planning into customer-facing services; and current investments need to be more adaptable to the impacts of climate change.

All program areas will need to review their programs and services to find ways to better compensate and reward producers for climate-smart investments. As climate actions and ecosystem services become revenue streams for producers, FSA needs to look for ways to provide protection for those revenue streams, similar to processes by which the agency provides protection from market volatilities through its commodity programs.

As adverse weather events become more frequent and extreme, the damage to farmland and forestland increases. Increased weather extremes will have significant budget implications for both ad hoc and standing disaster programs, such as the Emergency Conservation Program (ECP) and the Emergency Forest Restoration Program (EFRP), as damage costs increase above historic norms.

Today, disasters are no longer aberrations but rather part of the regular cadence of agricultural production; given this new reality, FSA must work to adapt its programs and services to address this challenge and ensure producers have the tools they need to build resilience.

One way to begin supporting this work is through pilot projects and programs. FSA's Conservation Division has experience piloting programs in key geographic regions before releasing them nationwide, through both the Clean Lakes, Estuaries, And Rivers (CLEAR30) pilot and the Soil Health and Income Protection Program (SHIP) pilot. These pilots have demonstrated the value of first testing technology and automation before programs are released nationwide to all county offices. Pilots also provide the opportunity to gain insight from stakeholders, participating producers, and FSA employees to determine what should be repeated and what should be amended in future, more expansive iterations of the pilot. As FSA looks to expand its efforts to empower producers to be part of the climate solution, the agency can look to developing additional pilot projects and programs.



Vulnerability 4: FSA infrastructure faces risks from climate change.

A changing climate with more intense storms and changing weather patterns puts FSA current and future infrastructure at risk. This infrastructure includes physical structures and facilities, communications systems, information technology (IT) systems and components, and vehicles within the FSA fleet. Much of the physical structures will require a coordinated effort with USDA's Office of Property and Environmental Management (OPEM) along with other FPAC agencies, since many locations are co-located with NRCS, RMA, Rural Development, and state conservation district offices.

FSA will focus ongoing efforts to improve climate adaptation and resilience on several current investments. FSA will work towards achieving these goals by investing in energy and water efficiency, net zero energy facilities, and

renewable energy projects. The agency is also focused on transitioning away from traditional sources of electrical energy generation to those originating from agricultural products and other renewable sources.

FSA also has an opportunity to improve its sustainability through its vehicle fleet. FSA is interested in incorporating alternative and renewable fuel sources into the fleet composition and is committed to reducing the overall number of conventional fuel vehicles, while increasing the percentage of low-greenhouse gas emitting sub-compact and compact sedans and mid-size SUVs.



Vulnerability 5: FSA does not fully leverage partnerships, networks, and collaboration within the Department to address existing climate change adaptation needs and innovate when considering future actions.

Climate adaptation is a relatively new subject for many FSA staff, partners, and customers. As a result, the agency needs to work to ensure each of the Deputy Areas and their divisions have opportunities to collaborate and help define FSA's approach to addressing climate change mitigation and adaptation. Close partnerships across Deputy Areas and divisions will be necessary to continue to promote efforts to both reduce greenhouse gas emissions and increase carbon sequestration on working lands, while ensuring that producers are building resilience to a changing climate. FSA also has the potential to collaborate with a wide array of groups and producers to better coordinate responses to climate change.

Beyond its own staff, partners, and customers, FSA must also commit to stronger and more creative partnerships with other USDA agencies and entities to address existing climate change adaptation needs and shape future actions. FSA must work closely and collaboratively with existing partners such as RMA, NRCS, and the USDA Climate Hubs to develop proactive versus reactive strategies to support producer-led climate adaptation. Much of this work will hinge on improving and aligning data collection, and subsequently making sure data analyses are shared across USDA agencies.



Vulnerability 6: Disproportionate impacts on underserved farmers and ranchers, and underserved communities.

Underserved farmers and ranchers, and underserved communities in general, are often disproportionately impacted by environmental stressors, including pollution, increased exposure to extreme weather events, poor air quality, habitat fragmentation, and poverty.

For example, according to the 2017 Agricultural Census, Hispanic producers are more likely to raise specialty crops.¹ These crops are generally more sensitive to extreme weather relative to grain crops. More than other commodities, specialty crop production also often requires hand-harvesting; farmers continue to face challenges accessing a stable workforce, and farmworkers face increasing challenges as extreme heat and other climate-induced conditions impact their ability to work safely. Climate change has a multiplier effect on these and other stressors, so FSA must be prepared to support farmers, including underserved farmers, and their workforce, to ensure they have equitable access to FSA programs and resources.

FSA programs need to be structured in ways that serve more diverse types of farmers, farms, and markets, and that encourage ongoing and new climate resilient practices for producers, particularly in underserved communities. To that end, FSA has established several working groups, including a working group specifically focused on studying diversity, equity, and inclusion issues within Farm Loan Programs. In addition, through increased outreach efforts, FSA has the opportunity to increase employee and producer education on existing barriers to diversity, equity, and inclusion, with the goal of ultimately improving both program delivery and program participation.

In 2021, Executive Order 14008 established the Justice40 Initiative to deliver at least 40 percent of the overall benefits from federal investments in climate and clean energy to historically underserved communities. FSA is treating this initiative as an opportunity to think broadly about equity in the agency's programs. FSA is working across its entire portfolio to consider program policy, procedure, and outreach changes to increase access to its resources, reduce barriers and pain points for underserved producers, and improve overall customer experience. FSA is also considering how its programs impact underserved communities as a whole—not just the impact the agency has on its customers, but also the downstream economic, soil health, and water quality effects that its programs have on the communities in which people live.



CLIMATE ADAPTATION ACTIONS

6 ACTION AREAS



Enhance FSA climate literacy and capacity to make programs adaptation centered.



Address the risk that FSA infrastructure faces from climate change.



Improve science, research, and data for understanding, measuring, and tracking climate-related impacts and outcomes.



Integrate climate vulnerability assessment and adaptation planning into customer-facing services



Leverage partnerships, networks, and collaboration to address existing climate change adaptation needs and innovate when considering future actions.



Address disproportionate impacts on underserved farmers and ranchers, and underserved communities.



The following section includes actions that FSA is proposing to address the vulnerabilities discussed above. The action areas are organized around each of the six vulnerabilities and will support FSA staff and producers to better adapt to climate vulnerabilities.



Action Area 1: Enhance FSA climate literacy and capacity to make programs adaptation centered.

Vulnerability: Need to address climate literacy and FSA's capacity to make programs adaptation centered.

Key Actions

- ▶ Develop climate trainings so that employees can build their climate-related resources.
- ▶ Develop universal curriculum for onboarding and training new employees.
- ▶ Develop virtual jump teams to be activated to help with disasters.

FSA has a large footprint in rural America and works with the agricultural sector on a regular basis. Thus, FSA can make significant progress towards its climate goals by providing its employees with the knowledge and training they need to better discuss climate-smart practices—the economics of implementing these practices with producers. FSA's employees are the agency's greatest assets, and an educated employee can be a trusted advisor with producers in their county. If FSA staff have the opportunity to engage in climate trainings and work with the USDA Climate Hubs, they will be better empowered to develop climate literacy and serve as a resource to producers interested in being part of the climate solution.

FSA also has an opportunity to build climate literacy into new employee onboarding and training. To this end, FSA plans to provide a universal curriculum for new employees' during onboarding; this training can then be tracked in AgLearn. Employees and supervisors can then work together to determine specific goals and metrics related to climate literacy; and together monitor success through completed trainings.

FSA also plans to develop virtual jump teams to be activated in the wake of natural disasters. These teams will add additional personnel and resources when county offices need them most. These teams will be vital resources

to address workload challenges and relieve stress during disaster events. In order to support these virtual jump teams, FSA will need to develop a process by which requests from local offices are flagged for state and national leadership.



Action Area 2: Improve science, research, and data for understanding, measuring, and tracking climate-related impacts and outcomes.

Vulnerability: Increased need for improved science, research, and data for understanding, measuring, and tracking climate-related impacts and outcomes.

Key Actions

- ▶ Continue to use Monitoring, Assessment, and Evaluation (MAE) of CRP to improve science, research, and data.
- ▶ Pursue ongoing efforts to quantify the greenhouse gas reduction benefits of CRP and subsequently use this data to inform a department-wide dashboard on CRP greenhouse gas mitigation potential to help measure and track the climate-related impacts of the program.
- ▶ Pursue research opportunities with existing software and through future technology and modernization to increase data collection and data analyzation with a focus on climate-change efforts and the impacts that Farm Loan Program participation has on the climate.
- ▶ Pursue opportunities to better understand the relationship between FSA's standing disaster programs (including LFP, LIP, and NAP, along with its ad-hoc disaster assistance programs) and FSA's broader goals around climate change adaptation and mitigation.
- ▶ Review climate data to determine if dates (such as planting dates) in policy are still relevant and if they can become more flexible to changing climate needs.

Monitoring, Assessment, and Evaluation (MAE) projects help build resilience to climate change across landscapes with investments in soil and forest health on Conservation Reserve Program (CRP) land. In Fiscal Year 2021, three Carbon Monitoring Projects were funded that will assess grasslands, forests, and wetlands to measure and monitor

soil carbon and climate resilience impacts on CRP. Projects will begin soil carbon sampling in 2022, and we plan to expand on this work toward the buildout of a national soil carbon monitoring network. The information gained from these studies will help support USDA tools, including DayCent and COMET, that county offices and partners can then use to assess carbon sequestration and greenhouse gas emissions. FSA will continue to use MAE projects to develop new ways to utilize CRP for climate adaptation and greenhouse gas mitigation. Ultimately, the data collected through the MAE projects will help strengthen current estimates on the potential to reduce greenhouse gas emissions through climate-smart practices; and FSA will work with USDA's Office of the Chief Information Officer (OCIO) to visualize these estimates through a Tableau-powered climate dashboard. This dashboard will more effectively communicate the climate-related outcomes of CRP to the Office of the Secretary.

FSA also plans to partner with its sister agencies to educate and provide information to field staff and producers related to ways that Farm Loan Programs can be utilized for climate adaptation and the resulting benefits to producers' operations. FSA is researching and developing strategies to utilize existing technology, along with potential future technology and modernization, to collect more data, which can then be analyzed to measure and better understand the relationship between Farm Loan Program participation and climate outcomes.

Within FPAC, opportunities exist for DAFP to collaborate with EPAD and other agencies to pursue climate-related research within several farm programs, including the Livestock Indemnity Program (LIP), the Livestock Forage Program (LFP), and the Non-insured Crop Disaster Assistance Program (NAP). LIP looks at death losses in livestock; LFP assesses forage drought loss; and NAP determines crop production losses due to natural disasters. Research on these programs could be focused on investigating how climate impacts affect livestock and crop losses; by better understanding current trends, FSA program staff may be better equipped to propose and develop program flexibilities to better respond and adapt to climate stressors.

FSA will also review climate data to determine if dates delineated in policy are still relevant under changing climate needs. This may include the dates that define grazing seasons, along with planting and harvest dates for all crops that are affected by disasters. Additionally, all FSA Deputy Areas and divisions are interested in accessing and understanding data on the specific crops and crop varieties

most impacted by climate changes, along with prices and yields for those crops. FSA plans to work with USDA partners to determine the possibility of providing more program eligibility and enrollment flexibility in these circumstances.



Action Area 3: Integrate climate vulnerability assessment and adaptation planning into customer-facing services

Vulnerability: Current FSA procedures do not fully integrate climate vulnerability assessment and adaptation planning into customer-facing services; and current investments need to be more adaptable to the impacts of climate change.

Key Actions

- ▶ Review all programs to see where policies and can incentivize climate-smart agriculture practices, provide protection of revenue received from climate actions and ecosystem services, and allow FSA to become proactive versus reactive to climate events, while identifying which programs have the flexibility to integrate or enhance climate considerations into their work, and which programs will require Congressional action to enhance their climate focus.
- ▶ Create learning environments within deputy areas using pilots.

FSA will review all programs to see where policies and procedures may assist with climate-smart agriculture practices, provide protection of revenue received from climate actions and ecosystem services, and allow programs to become proactive versus reactive to climate events. FSA will evaluate policy flexibilities that can be implemented to address acute climate events. For example, FSA will amend the policy handbook for Farm Storage Facility Loans (FSFL) to include a change to the FSFL application form, CCC-185, to ask the producer if the FSFL project will include energy efficient activities. FSA will investigate decreasing the FSFL application fee, through a regulation update, for producers using energy efficient equipment.

Pilot programs can also help create learning environments within Deputy Areas and divisions. FSA staff can develop programs and receive feedback from producers and employees to determine if a given program would be useful

nationwide. FSA has already begun exploring collaboration with RMA to use NAP data for developing new crop insurance policies, including the creation of a pilot policy to provide an “on-ramp” for Whole Farm Revenue crop insurance coverage. FSA and RMA are also discussing possible models of risk management that recognize the risk benefits of climate-smart practices. Increasing NAP and RMA crop insurance participation would result in improved resiliency in the event of large-scale natural disasters by providing producers with more recovery assistance. In turn, producers would have more resources to then invest in additional climate smart practices. Conservation Division has already been successful with piloting programs such as CLEAR 30 and SHIPP, so these pilots could be used as an example for other pilot programs.



Action Area 4: Address the risk that FSA infrastructure faces from climate change.

Vulnerability: FSA infrastructure faces risks from climate change.

Key Actions

- ▶ Support fleet resilience through improved tracking of utilization standards, service center enhancements, use of mobile workstations, and improved fuel efficiency and procurement.
- ▶ Explore alternative communication systems to have multiple forms available.
- ▶ Ensure national and regional datasets used in identification and assessment of climate change impacts are protected from loss.
- ▶ Work with FPAC-BC to ensure a comprehensive FPAC resilience portfolio exists to provide a unified mission area framework for tracking, evaluating, and managing risks to facilities and accessibility, including via COOP plans.
- ▶ Continue the focus on alternative energy sources for infrastructure improvements.

Critical to FSA’s continued effectiveness in responding to producers’ infrastructure needs. Whereas existing infrastructure may be taken for granted on a day-to-day basis, emergency circumstances tend to highlight the vulnerability of this infrastructure, not only for day-to-day activities, but also for carrying out activities that may

become necessary to respond to extreme weather events. Much of this infrastructure has shared needs by FPAC sister agencies, as well as partners, such as Conservation Districts.

Many of these recommendations will require a coordinated effort with NRCS, RMA, FPAC-BC, and the Office of the Chief Information Officer, and will rely on guidance from the Office of Contracting and Procurement and the Office of Property and Environmental Management where applicable. Although FSA recommends several actions in this area, the agency recognizes that it may not be the lead implementing agency for several of these activities and must instead offer its assistance and participation in activities that would be more appropriately handled by the FPAC-BC.

FSA has identified various aspects of infrastructure development and deployment that need to adapt to reduce ongoing and future vulnerabilities caused by climate change, including the importance of maintaining active communication channels during disasters. FSA proposes to review and identify not only alternative communication methods, but also where redundancy in systems can maintain communication in the event of loss of another. For instance, if communication is compromised, FSA must ensure that staff can continue communications with higher authorities via another means.

FSA maintains many sources of data housed within IT systems, including geospatial data, tabular data used in calculations, historical data used for databases, among others. Additionally, FSA has agreements with external entities that may be the main repository for similar data. Here, FSA’s action is twofold. First, data, regardless of format, needs to be updated regularly to keep pace with climate change. For FSA IT business tools to remain up to date, this data must also be updated by data keepers outside of FSA. Second, that data must be protected, particularly in the face of events that could potentially lead to loss of data. Achieving this goal will require not only updates and continued protections but also working with partners and other outside entities to make sure the same level of protection is consistently applied.

FSA proposes that physical structures, such as offices, be evaluated through a dashboard to identify vulnerabilities and what can be done to adapt. This will also include keeping an up-to-date Continuity of Operations Plan (COOP). Currently, the COOP is required to be reviewed annually. FSA recommends that sections of the COOP be identified that need a more frequent cadence of review and

update, such as points of contact. Like physical structures, vehicles are a large portion of FSA's property portfolio which can be improved upon. This not only includes purchase of alternative energy vehicles, but also careful consideration to other forms of transportation and emergency backup generators.



Action Area 5: Leverage partnerships, networks, and collaboration to address existing climate change adaptation needs and innovate when considering future actions.

Vulnerability: FSA does not fully leverage partnerships within the Department to address existing climate change adaptation needs and innovate when considering future actions.

Key Actions

- ▶ Partner with other USDA agencies to identify places that have been at a higher risk for adverse weather events (possibly utilizing loss claim and disaster program data) and pre-position assets to manage workload increases in those areas.
- ▶ Research opportunities for data collection, along with ways to incorporate technologies or software by sister agencies.
- ▶ Develop promotional campaign similar to the soil health campaign for climate-smart agriculture and forestry.

FSA can improve its services by partnering with agencies, such as RMA, NRCs, and USDA Climate Hubs, on several fronts, including data collection, as described above.

Additionally, FSA can leverage partners to promote its work and opportunities for producers to sign up for programs. USDA successfully established a promotional campaign focused on soil health for climate-smart agriculture and forestry, and FSA could pursue similar campaigns to elevate opportunities at the agency. In doing so, the agency can help ensure that messaging and outreach from both FSA and its partners are consistent and use common language. As part of these campaigns, FSA can share success stories, emails, blogs, radio spots, social

media posts, and fact sheets to promote principles of climate-smart agriculture. In any instance where FSA is promoting new information, agency headquarters should also ensure that program staff develop specific talking points for county and state office staff.



Action Area 6: Address disproportionate impacts on underserved farmers and ranchers, and underserved communities.

Vulnerability: Disproportionate impacts on underserved farmers and ranchers, and underserved communities.

Key Actions

- ▶ Create more cooperative partnerships with organizations that already have established trusted relationships with members of underserved communities, such as Tribal nations and third-party environmental education and outreach groups, which can provide technical assistance and increase the impact of FSA's outreach efforts.
- ▶ Recruit members of underserved communities and underserved farmers and ranchers to serve as FSA Committee members or as advisors to FSA Committees.
- ▶ Ensure outreach and meaningful engagement with vulnerable communities and that recommendations they provide are used to update and revise policy where possible.
- ▶ Increase awareness, skills, and abilities of FSA staff and producers on equity and environmental justice issues.

Climate change planning provides an opportunity to take immediate and long-term action to strengthen and create resilience in ecosystems services, food production, conservation, and emergency response in the most vulnerable communities, who are often disproportionately impacted because of climate change.

FSA will look at outreach efforts with underserved farmers and ranchers, and underserved communities as part of this plan. Outreach efforts can be strengthened by creating more cooperative partnerships and recruiting diversified

members and advisors for the FSA Committees, which in turn can result in recommendations and feedback to revise policies where appropriate.

Working through its outreach office, FSA will also be focused on providing employee training to increase employees' awareness related to advancing equity and

environmental justice. FSA will continue to review efforts and acknowledge further development on these topics as necessary, while working in close partnership with members of the FSA team leading the agency's Justice 40 Initiative.





WHAT FSA HAS ALREADY ACHIEVED: A DEEPER DIVE INTO THE CONSERVATION RESERVE PROGRAM

As noted above, CRP is one of the world's largest voluntary conservation programs with a long track record of preserving topsoil, improving water quality, sequestering carbon, and reducing nitrogen runoff, as well as providing healthy habitat for wildlife. The voluntary program contracts with agricultural producers so that environmentally sensitive agricultural land is not farmed or ranched, but instead devoted to achieving conservation benefits. CRP participants establish long-term, resource-conserving plant species, such as approved grasses and trees (known as "covers") to control soil erosion, improve water quality, and develop wildlife habitat. In return, FSA provides participants with rental payments and cost-share assistance for the length of the program being between 10 and 15 years. The covers established on private lands through CRP provides a unique opportunity for carbon sequestration on agricultural land. CRP is a powerful tool when it comes to climate mitigation, and acres currently enrolled in the program mitigate more than 12 million metric tons of carbon dioxide equivalent (CO₂e).²

FSA's Conservation Division have been innovative by adding climate solutions into the programs that they oversee. In fiscal year (FY) 2021 the division was able to release through the CRP general and continuous signups a Climate Smart Incentive that aims to increase carbon sequestration and reduce greenhouse gas emissions through increased enrollment in CRP. Climate-Smart CRP practices include establishment of trees and permanent grasses, development of wildlife habitat, and wetland restoration. CRP also increased payment rates from ten

percent to twenty percent for practices benefiting water quality, such as grassed waterways, riparian buffers, and filter strips. Conservation Division also moved its State Acres for Wildlife Enhancement (SAFE) program back into Continuous CRP to allow for year-round sign up. This same team also updated CRP to allow the Highly Erodible Land Initiative (HELI) to be available in both the general and continuous sign ups.

Grassland CRP is a working lands program, helping landowners and operators protect grassland, including rangeland and pastureland, while maintaining the areas as working grazing lands. Protecting grasslands contributes positively to the economy of many regions, provides biodiversity of plant and animal populations, and provides important carbon sequestration benefits to deliver lasting climate outcomes. In 2021, Conservation Division established a minimum Grassland CRP rental rate of \$15/acre across the country and had the largest signup in the program's history. In 2022, Conservation Division once again established a high minimum Grassland CRP rental rate of \$13/acre; signup is ongoing but the team expects strong numbers once again.

In 2021, FSA's Conservation Division expanded the Clean Lakes, Estuaries, And Rivers 30 Pilot Program, called CLEAR30, from the Great Lakes and Chesapeake Bay watersheds to a nationwide opportunity. This water-quality focused program allows producers to receive incentives for a 30-year commitment to water quality practices.



CROSS-CUTTING ADAPTATION ISSUES AND CONSIDERATIONS

Environmental Justice

Executive Order 14008 Tackling the Climate Crisis at Home and Abroad talks about securing environmental justice and spurring economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution and underinvestment in housing, transportation, infrastructure, and health care. These are all important considerations as part of the Climate Adaptation Plan. FSA is working to incorporate tools (i.e., a Climate and Economic Justice Screening Tool) that are being developed in response to this order. All Deputy Areas and divisions have been assessing opportunities to address environmental justice as part of the Justice 40 implementation process. Here are a few areas where overlap is occurring:

- ▶ FSA will work closely with FPAC Economic Policy and Analysis Division to support the agency's analysis of program impacts on underserved communities;
- ▶ Farm Loan Programs has started an IT modernization initiative that includes expanding its data collection and analytics capabilities. These capabilities will improve the ability of Farm Loans to analyze the participation level of underserved customers in programs that finance climate-smart practices and technologies, which may assist in targeting technical assistance and outreach.
- ▶ Farm Loan Programs is also developing outreach materials tailored to support climate-smart and precision agriculture initiatives, including materials targeted at increasing awareness on conservation loans for wind and solar energy investments. Under Direct Operating Loans, the maximum operating loan

term will be extended to allow additional flexibility for the adoption of climate-smart practices. The Farm Loan Programs team is also researching the pathways to and benefits of expanded use of Direct and Guaranteed Conservation Loan Programs, noting that use of the Direct Conservation Loan Program would require an appropriation.

- ▶ In coordination with the FSA Outreach office, the Agency will develop employee training on emerging agricultural issues and opportunities for working with small and diversified operations. All programs will look for ways to increase outreach and technical assistance to enable program participation;
- ▶ Conservation Division has proposed (and now implemented) increasing the ranking factor points in Grassland CRP for historically underserved producers and communities;
- ▶ FSA will work with its Outreach Office and sister agencies to advertise a notice of funding opportunity for the Transition Incentive Program. The program assists with the transitioning of expiring CRP land from an owner or operator to a beginning, veteran, or socially disadvantaged farmer or rancher that is not their family member, to return land to production for sustainable grazing or crop production;
- ▶ ECP will explore the opportunity to increase the ability of the program to help producers build more resilient operations. Potential activities include:
 - Conducting a design/research sprint with limited resource and historically underserved customers in a disaster-prone area that suffered a recent disaster. The learning from the sprint

could be used to pilot a streamlined advanced payment process following future disasters that result in expedited funds for producers.

- Training a virtual jump team to send out as surge capacity in areas where disasters strike to work alongside local county office staff. Training would involve ability to do rapid program implementations as well as cross-training on use of other USDA programs to help producers build a more resilient operation in the face of future disasters.

Workforce Climate Literacy

FSA considers its employees its greatest asset. Educating employees in climate resilience and climate issues facing producers and ranchers in their communities will strengthen awareness. FSA will work to provide resources to enable staff to be an advisor to our producers and ranchers. Climate literacy for all employees will be beneficial to deliver assistance when dealing with climate extremes, especially disasters.

The Office of the Chief Economist's Climate, Agriculture, and Forestry Seminar Series has been shared with staff to bolster their climate literacy throughout 2022. The series aims to inform USDA employees about the scientific foundation of climate. The Administration will consider providing training materials in AgLearn that educate employees on climate. FSA is also looking at developing employee materials and training to help staff understand climate issues and how loan products can be used to achieve a customer's environmental and conservation goals.



USDA Climate Hubs

USDA's Climate Hubs are a unique collaboration across the department's agencies. They are led and hosted by the Agricultural Research Service and Forest Service located at ten regional locations, with executive committee members from agencies such as NRCS, FSA, APHIS, and RMA. The Climate Hubs link USDA research and USDA agency programs to support regional delivery of timely and authoritative tools and information to agricultural producers and professionals. Through the Climate Hubs, FSA sees opportunities to integrate its work and data with existing Climate Hubs tools like Grass-Cast and AgRisk Viewer, to better forecast disaster impacts and the need for FSA assistance.

A national survey was conducted by the Climate Hubs, FSA, and the University of Vermont. The survey identified three potential areas of further collaboration between the Climate Hubs and FSA: (1) provide training and support for FSA employees to work with and understand weather and climate data, tools and resources; (2) better integrate specific weather and climate tools into specific FSA program areas; (3) hone outreach and education on climate- and weather-related issues by linking them to existing programs that help producers reduce climate-related risks on their land (such as the Conservation Reserve Enhancement Program).³

The Climate Hubs have science and data synthesis developed into regional assessments for all ten regions. The Climate Hubs and FSA can work together to support employees and producers as they adapt to more variable and extreme weather associated with climate change. FSA employees can access timely climate information out to their producers. The Climate Hubs have a vast library of resources that will provide climate literacy to our employees. FSA will assess where the Climate Hubs maps, tools, and technology may be integrated into FSA's programs, loans, and field operations. FSA supports the USDA Climate Hubs and will continue to work with them to develop tools, trainings, and products that are beneficial to our employees and our producers.

Footnotes:

¹ Census of Agriculture Highlights https://www.nass.usda.gov/Publications/Highlights/2019/2017Census_Hispanic_Producers.pdf

² Farm Service Agency news release April 21, 2021, USDA Expands and Renews Conservation Reserve Program in Effort to Boost Enrollment and Address Climate Change.

³ Wiener, S., Roesch-McNally, G.E., and Schattman, R.E. (2018). National survey of USDA Field Staff on Climate and Weather; Results from a survey of Natural Resources Conservation Service and Farm Service Agency Employees. Washington, DC: USDA Climate Hubs.

TABLE OF FSA ADAPTATION ACTIONS TO ADDRESS CLIMATE CHANGE EFFECTS AND VULNERABILITIES

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 1: Need to address climate literacy and FSA's capability to make programs adaptation centered.	Develop climate trainings so that employees can build their climate resources.	Ongoing	CD, Chief of Staff	2022 and continuous	OCE-OEEP, AgLearn		Distributed OCE climate seminar series to all employees
	Universal curriculum for onboarding and training new employees.	Proposed and Ongoing	DAFP, DAFLP	2022 and continuous	Internal	Develop committee to assess	
	Develop virtual jump teams to be activated to help with disasters.	Proposed and Ongoing	DAFP, DAFLP, DAFO	2023 and continuous	Internal	Develop committee to assess	
Vulnerability 2: Increased need for improved science, research, and data for understanding, measuring, and tracking climate-related impacts and outcomes. (continued on next page)	Continue to use Monitoring, Assessment, and Evaluation (MAE) of CRP to improve science, research, and data.	Ongoing	CD, EPAD	2022 and continuous	ARS, NRCS	Incorporate results of projects into CRP program.	Multiple projects have been completed to bolster climate adaptation and mitigation with CRP. Currently assessing soil carbon through three projects.
	Pursue ongoing efforts to quantify the greenhouse gas benefits of CRP and subsequently use this data to inform a department-wide dashboard on CRP GHG mitigation potential to help measure and track the climate-related impacts of the program.	Ongoing	CD, EPAD	2022 and continuous	OCE, NRCS	Incorporate results of projects into CRP program and USDA	
	Pursue research opportunities with existing software and through future technology and modernization to increase data collection and data analyzation with a focus on climate-change efforts and the impacts that Farm Loan Program participation has on the climate.	Proposed and Ongoing	DAFLP	2022 and continuous	FPAC, RMA, Climate Hubs	Incorporate results into programs and loan process where feasible	

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
<p><i>(continued)</i></p> <p>Vulnerability 2: Increased need for improved science, research, and data for understanding, measuring, and tracking climate-related impacts and outcomes.</p>	Pursue opportunities to better understand the relationship between FSA's standing disaster programs (including LFP, LIP, and NAP, along with its ad-hoc disaster assistance programs) and FSA's broader goals around climate change adaptation and mitigation.	Proposed and Ongoing	DAFP, EPAD	2022 and continuous	FPAC, RMA, Climate Hubs, REE	Incorporate results into programs and loan process where feasible	
	Review climate data to determine if dates (such as planting dates) in policies are still relevant and if they can become more flexible to adapting to changing climate needs.	Proposed and Ongoing	DAFP, DAFLP	2023 and continuous	FPAC, RMA, NRCS, Climate Hubs	Incorporate results into programs and loan process where feasible	
<p>Vulnerability 3: Current FSA procedures do not fully integrate climate vulnerability assessment and adaptation planning into customer-facing services; and current investments need to be more adaptable to the impacts of climate change.</p>	Review all programs to see where policies and procedures may assist with climate-smart ag practices, provide protection of revenue received from climate actions and ecosystem services, and allow programs to become more proactive versus reactive to climate events, while identifying which programs have the flexibility to integrate or enhance climate considerations into their work and which programs will require Congressional action.	Ongoing	All	Continuous	Internal	Incorporate results into programs and loan process where feasible	Regular Maintenance, Now on Regular Cycle
	Create learning environments within deputy areas using pilot programs.	Planned and proposed	DAFP	2022 and continuous	Internal	Incorporate results into programs and loan process where feasible	CD used pilot programs with CLEAR30 and SHIPP

(continued)

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 4: FSA infrastructure faces risks from climate change.	Support fleet resilience through improved tracking of utilization standards, service center enhancements, use of mobile workstations, and improved fuel efficiency and procurement.	Proposed and Ongoing	DAFO and FPAC	2022 and Ongoing	FPAC		
	Explore alternative communication systems to have multiple forms available.	Proposed and Ongoing	DAFO and FPAC	2022 and Ongoing	FPAC		
	Ensure national and regional datasets used in identification and assessment of climate change impacts are protected from loss.	Proposed and Ongoing	DAFO and FPAC	2022 and Ongoing	FPAC		
	Work with FPAC-BC to ensure one FPAC resilience portfolio to provide a unified mission area framework for tracking, evaluating, and managing risks to facilities and accessibility, including via COOP plans.	Proposed and Ongoing	DAFO, OMS and FPAC	2022 and Ongoing	FPAC		
	Continued focus on alternative energy sources for infrastructure improvements.	Proposed and Ongoing	DAFO and FPAC	2022 and Ongoing	FPAC		

(continued)

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 5: FSA does not fully leverage partnerships, networks, and collaboration within the Department to address existing climate change adaptation needs and innovate when considering future actions.	Partner with other agencies within USDA to identify areas that have been at a higher risk for adverse weather events. This could be based upon loss claims and program participation. Pre-position assets to manage increases in workloads related to loss adjustments and requests for assistance.	Proposed and Ongoing	All	2022 and Ongoing	FPAC, RMA, NRCS, Climate Hubs	Incorporate results into programs and loan process where feasible	
	Research opportunities for data collection, and ways to incorporate technologies or software by sister agencies.	Proposed and Ongoing	All	2022 and Ongoing	FPAC, RMA, NRCS, Climate Hubs	Incorporate results into programs and loan process where feasible	
	Develop promotional campaign similar to the soil health campaign for climate-smart agriculture and forestry.	Proposed and Ongoing	Outreach and Public Affairs	2022 and Ongoing	FPAC	Develop committee to assess	

(continued)

VULNERABILITY	ACTION TITLE/ DESCRIPTION	TYPE OF ACTIVITY	LEAD OFFICE	TIMEFRAME	COORDINATION	PROGRESS METRICS	ACCOMPLISHMENTS TO DATE
Vulnerability 6: Disproportionate impacts on underserved farmers and ranchers, and underserved communities.	Create more cooperative partnerships with organizations that already have established trusted relationships with members of underserved communities, such as Tribal nations and third-party environmental education and outreach groups, which can provide technical assistance and increase the impact of FSA's outreach efforts.	Proposed and Ongoing	All	2022 and Ongoing	FPAC, FSA		
	Recruit members of underserved communities and underserved farmers and ranchers to serve as FSA Committee members or as advisors to FSA Committee.	Proposed and Ongoing	All	2022 and Ongoing	FPAC, FSA		
	Ensure outreach and meaningful engagement with vulnerable communities and that recommendations they provide are used to update and revise policy where possible.	Proposed and Ongoing	All	2022 and Ongoing	FPAC, FSA		
	Increase awareness, skills, and abilities of FSA staff and producers on equity and environmental justice issues.	Proposed and Ongoing	All	2022 and Ongoing	FPAC, FSA		



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[July 2022]





Risk Management Agency Climate Adaptation Plan

June 2022



About RMA

The United States Department of Agriculture's (USDA) Risk Management Agency (RMA) serves America's agricultural producers through effective, market-based risk management tools to strengthen the economic stability of agricultural producers and rural communities. RMA is committed to increasing the availability and effectiveness of Federal crop insurance as a risk management tool. RMA manages the Federal Crop Insurance Corporation (FCIC) to provide innovative crop insurance products to America's farmers and ranchers. Approved Insurance Providers (AIP) sell and service Federal crop insurance policies in every state and in Puerto Rico through a public-private partnership with RMA. RMA reinsures the AIPs who share the risks associated with catastrophic losses due to major weather events.

RMA's vision is to secure the future of agriculture by providing world class risk management tools to rural America.

History

As climate impacts the nation's weather, there will be greater needs for agricultural risk management. Over the last 80 years, the Federal government's involvement has evolved into one of the largest programs within the USDA to serve these needs.

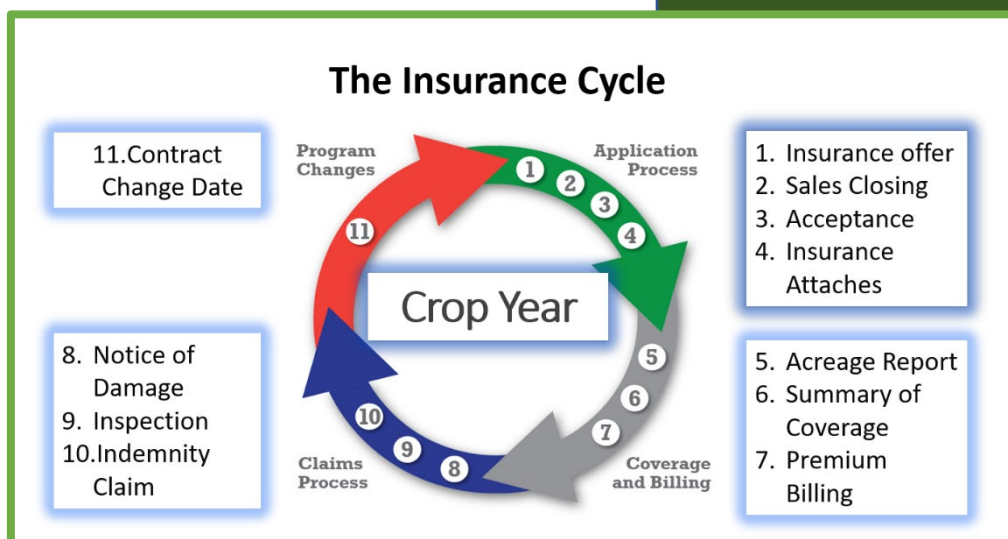
Non-government backed crop insurance has developed in several forms over the years. However, a consistent problem arose where large disaster events like droughts caused extreme losses to occur across the risk pool, thus private insurers were unable to carry the capital to weather such events. Congress first authorized Federal crop insurance in the 1930s along with other initiatives to help agriculture recover from the combined effects of the Great Depression and the Dust Bowl. The FCIC was created in 1938 by the Federal Crop Insurance Act (FCIA or Act) to carry out the program. Initially, the program was started as an experiment, and crop insurance activities were mostly limited to major crops in the main producing areas. Crop insurance remained an experiment until passage of the Federal Crop Insurance Act of 1980. The 1980 Act expanded the crop insurance program to many more crops and regions of the country. It encouraged expansion to replace the free disaster coverage offered under Farm Bills of the 1960s and 1970s. To encourage participation in the expanded crop insurance program, the 1980 Act authorized a subsidy to offset premium costs, which has been expanded over the last four decades. RMA was created in 1996 to administer FCIC programs and other non-insurance-related risk management and education programs that help support U.S. agriculture.

By 1998, more than two-thirds of U.S. field crops were insured under the program and reaching nearly 90% of those crops insured today. In 2000, Congress enacted legislation that expanded the role of the private sector

allowing entities to participate in conducting research and development of new insurance products and features. With the expansion of the contracting and partnering authority, RMA can offer contracts or create partnerships for research and development of new and innovative insurance products. Private entities may also submit unsolicited proposals for insurance products to the FCIC Board of Directors (Board) for approval. If approved by the Board, these unsolicited insurance products could receive reimbursement for research, development, and operating costs, in addition to any approved premium subsidies and reinsurance. This provides an avenue for the private sector to introduce innovative crop insurance products targeting grower needs and has been critical to expanding insurance offerings to new crops, growing practices, and risks faced in modern agriculture.

Crop Insurance 101

A crop insurance contract is a commitment between insured farmers and their insurance providers. Under the contract, the insured farmer agrees to insure all the eligible acreage of a crop planted in a particular county. This choice is made county by county and crop by crop. The insurance provider agrees to indemnify the insured farmer against losses (such as lower than expected yield or price, a low-quality crop, or the inability to plant a crop) that occur during the crop year. Losses generally must be due to unavoidable natural perils beyond the farmer's control. Availability varies by crop and location and there are many different types of insurance, each with its own unique features, requirements, inclusions, and exclusions. Producers work with a licensed crop insurance agent to find the right coverage for them. Most policies follow an annual cycle from sales/renewal to an acreage report to a claim/production report to contract changes for the next year (pictured).



Climate Adaptation Introduction

While weather events are becoming more common and more severe, it translates to aggregate production changes in unpredictable ways. However, that is exactly what insurance is for, cover those that were unlucky to be hit by adverse weather, while those that have a good year pay into the system with their premium dollars. As long as the risk pool includes both groups consistently, the insurance program will stay viable.

Technology is also playing a major role in mitigating production losses due to climate change. Modern genetics, changing growing regions, precision agriculture, farm information management systems, and university extension research all have been highly successful in maintaining production and profitability in the face of volatile weather. Farmers, long lauded for their ability to innovate and adapt, have continued that success. It is critical to understand that, over time, overall production risk has gone down. Although that overall risk may have declined, some individual regions or crops have not. The asymmetric impacts of climate change should not be discounted and are critical to program adaptation. It is also unclear on the sustainability of the overall trend in the face of potential exponential or tipping-point style climate effects. Using current and well-researched science¹ is critical in that endeavor.

Risks associated with climate changes depend on the rate and severity of the changes and the ability of producers to adapt to changes.

- Fourth National Climate Assessment

RMA's fundamental strategy in adapting to climate change is to adapt the program along with the innovation of America's farmers and ranchers. Predicting how successful future technology will be in adapting to climate change, or the full extent in production risk increases due to such changes are difficult to quantify. Therefore, ensuring the program is built to naturally adapt to any outcome is the most likely way to succeed in the face of uncertainty.

¹ Unless otherwise stated, climate models come from the Fourth National Climate Assessment (FNCA), Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.) (2018)

Climate Impacts and Vulnerabilities

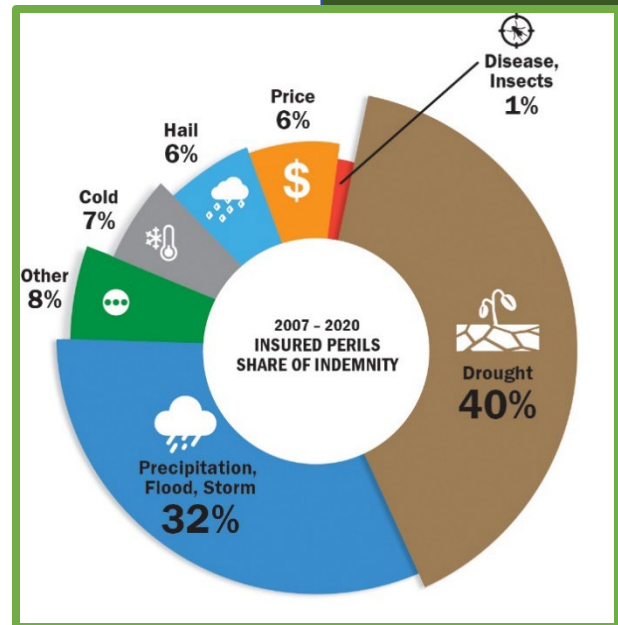
A large and growing literature has documented the likely impacts of climate change and warming temperatures on agricultural crops. Warmer temperatures are often associated with large, negative effects on crop yields at regional and global scales through both direct (e.g., heat stress) and indirect (e.g., soil moisture deficit) mechanisms. In general, this literature provides evidence that climate change has strong negative impacts on expected mean yields.

At the regional level, climate impacts are likely to cause production shocks to be correlated. At the producer level, the choice of input depends on the expectation of future revenue. When crop yields become more variable producers may use fewer inputs. Both effects will increase the probability of crop shortfalls and increase premium rates. This will increase the producer share of insurance costs and governmental subsidy.

Drought

Drought is the most common cause of loss (see graph, right) for the current Federal crop insurance program, accounting for nearly half of all indemnities. Moreover, most of the largest program 'loss' years are related to major U.S. drought events. 2012, which saw a widespread drought across the country remains the largest aggregate program payout to date. This effect impacts insurance the most since drought impacts large geographic footprints, where other perils are confined to smaller areas or mitigated by other factors (e.g., higher elevation land may lessen flooding risks).

The literature strongly suggests that climate change is expected to reduce mean yields and increase yield variability (risk). A decrease in mean yields holding yield variance constant implies greater likelihood of a yield shortfall and therefore indemnity payments. The increased yield risk will increase premium rates and the costs to producers and the government. However, producer adaptation will mitigate some of these risks. For example, one low-cost adaptation to climate change induced yield risk and loss is to lengthen the growing season. On average, across eight states, research has demonstrated² moving the planting date back by



Source: USDA RMA

² Ortiz-Bobea (2013)

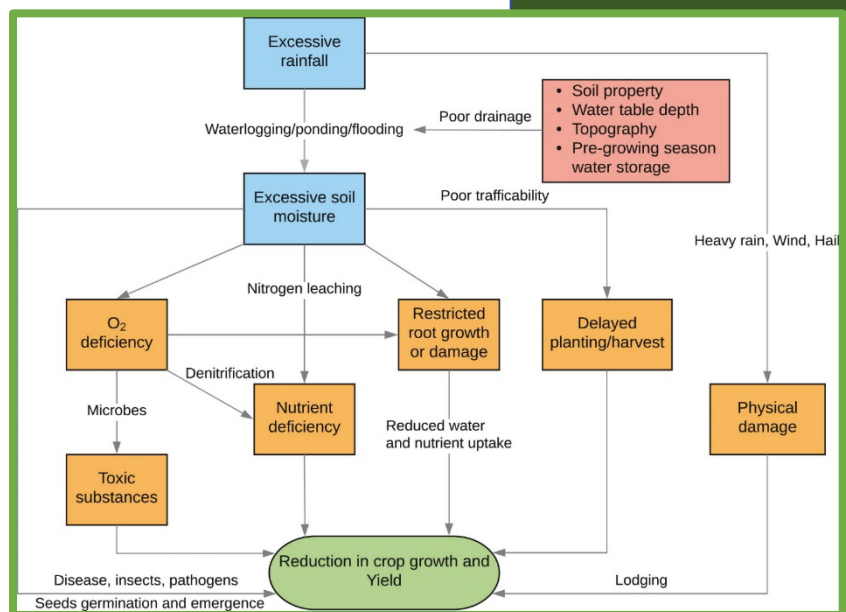
approximately two-weeks would reduce about half of the impact on expected yields. These types of adaptations may require insurance rules to evolve with them to prevent other unintended consequences.

Flooding and Excess Moisture

Crop insurance losses to flooding and excess moisture are the second most common cause of loss. The 1993 flood is still one of the largest loss events in program history relative to program size at the time. In 2019, widespread flooding across the Heartland prevented over 20 million acres of crops from being planted, triggering program losses and an additional public policy response of supplemental disaster payments on top of crop insurance.

The effects of excessive rainfall on crop yields are demonstrated by Rosenzweig et al. (2002), shown in the accompanying figure. Excess rainfall can directly damage crops due to flooding and physical damage or indirectly through anoxic conditions, increased risk of plant disease and insect infestation, or delayed planting or harvesting due to inability to operate machinery.

According to Rosenzweig (2002) the climate change caused increase in precipitation probability of crop damaging events (see figure, right). They expect that the probability of events causing damage comparable to, or greater than, the 1993 U.S. Midwest floods will double by 2030 and quadruple by 2090. Shirzaei (2021) found in the Midwest an increasing trend in both frequency and magnitude of floods and associated crop losses.



Source: Rosenzweig et al. (2002)

Tropical Cyclones

Tropical cyclones, the catch-all term for hurricanes, tropical storms, and tropical depressions, pose some risk to agricultural production. However, they do present several unique aspects that complicate their impacts. First, they often produce significant rain, but depending on the speed of the storm, the rainfall amount can often be a positive along the storm tract. Localized flooding is likely to produce some crop losses, but most areas in

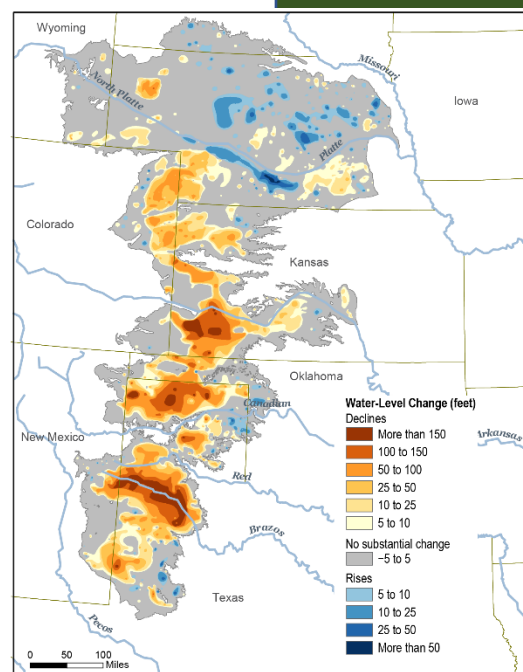
which tropical cyclones are common are highly adapted to major rainfall. Second, windspeed is often the more troublesome risk. Most crops are susceptible to high winds, whether by collapsing, losing buds or fruit, or losing limbs. However, RMA research suggests most tropical depressions and even tropical storms do not produce high enough sustained winds to cause widespread damage. Thus, RMA's focus in recent years has been on hurricanes, especially through the introduction of a new insurance option, Hurricane Insurance Protection – Wind Index (HIP-WI).

HIP-WI is a product that covers a portion of an underlying crop insurance policy deductible when the policyholder's county, or adjacent county, is hit by a hurricane. The product is both simple, and fast paying, leading to high sales volume among eligible producers. Although the product itself is a major achievement for RMA, more relevantly for this discussion, it shows producers have major risk management needs for hurricane risk.

Water

"Water systems face considerable risk even without anticipated future climate change," according to the FNCA. Growing population and declining infrastructure already threaten water security. Add in disruption due to changes in climate and its clear water availability could cause concern. Moreover, it is likely public policy will prioritize water availability to human populations over agriculture, especially water-hungry luxury crops such as some tree nuts, in both allocation and infrastructure funding.

According to NASS³, about a quarter of U.S. farmland (55.9 million acres in 2018) is irrigated. Additionally, this is disproportionally true for California, which represents about 15% of irrigated acreage, but nearly 30% of all agricultural water applied. Another example of a significant area of concern is the Ogallala Aquifer (pictured, right) which supplies water for about a quarter of irrigated acreage in the Great Plains. Aquifers refill from the natural water cycle, thus changes in rainfall could have dramatic effects on the



Source: Adapted from
McGuire 2017

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https://www.nass.usda.gov/Publications/Highlights/2019/2017Census_Irrigation_and_WaterManagement.pdf

ability to use that water. Ogallala has already seen significant decline in total storage since the mid-20th century⁴.

RMA data indicate that irrigated acreage generally tends to yield between 20% and 60% more than non-irrigated acreage depending on crop and location, thus loss of water supply could cause major production declines in the future. Many crops are exclusively grown under irrigated practices such as rice, many citrus crops, and many of the tree nuts, which could mean a direct loss of acreage in such circumstances.

Public policy around water quality could also affect agricultural production systems as regulations could limit the methods and use of fertilizer and other chemicals. Even if not directly tied to climate change, it seems plausible that carbon intensive practices could presumably be targeted, and producers will need to adapt. It is unclear on what the possible production effects such changes could have but RMA should monitor and consider such potential risk factors.

Emerging Risks

Several other risks are worth monitoring, but currently are not major drivers of crop insurance losses and production risk.

In general, it is expected that warming will increase the distribution of warm season weeds to areas that have not experienced such weeds. Agronomic weeds increase competition with crops for light, nutrients, and water. The increase in weed pressure and decline in yields will increase premium rates and decrease producer revenue.

Increasing air temperature is also beneficial to insect pests. With more pests shifting northward, management costs are expected to increase due to more frequent application of pesticides. The decrease in expected net revenue will affect producers' choice in crops and insurance choices.

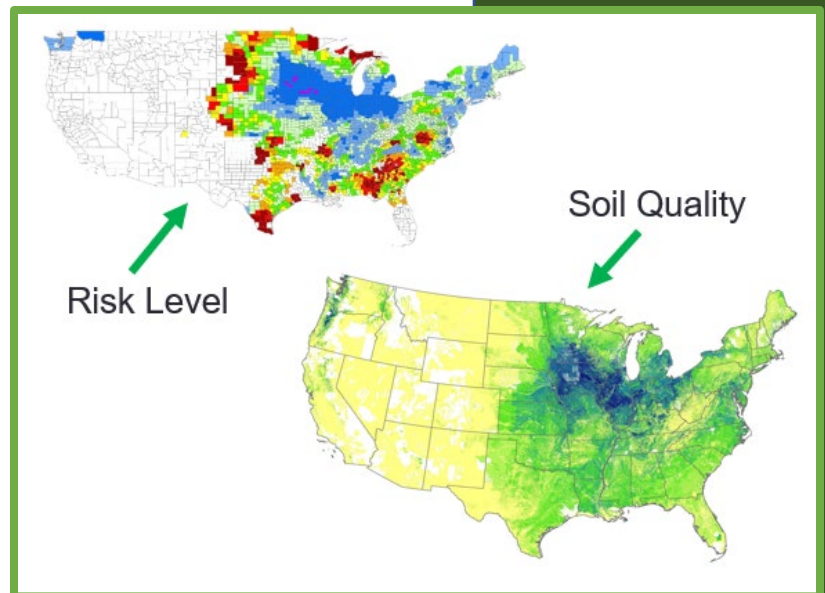
Plant diseases are likely to increase yield losses and quality degradations. Increased temperature, drought, changing rainfall patterns and intensity, and change in cropping practices are likely to increase pathogen growth and changes in the geographic growth of pathogens.

Additional to all three of these risks is the potential for mitigation to be increased use of chemical treatments. Although such chemicals may be effective at solving one issue, the increase of chemical usage could cause other unknown effects.

⁴ McGuire, V.L. (2017)

Soil quality, a defining characteristic to successful farming (see graphic), is additionally at risk to erosion. The FNCA notes, “increasing soil erosion rates have the potential to not only reduce agricultural productivity but also accelerate climate change effects through the loss of large stocks of carbon and nutrients stored in soil.

Warmer temperatures lead to reduced yields and reduced biomass increasing the likelihood of soil erosion. Increased CO₂ can enhance stomatal resistance, suppress transpiration, and lead to a moister soil, conducive to greater runoff-induced erosion^{5&6}. Simulation⁷ of climate change and management practice in the Midwest found that runoff increase by 10 to 310 percent and soil loss increased by 33 to 274 percent for 2040-2059 relative to 1990-1999.



Source: USDA RMA & NRCS

These risks can be heightened by poor soil conservation. Although most USDA soil conservation is spearheaded by the Natural Resources Conservation Service (NRCS), RMA partnerships with NRCS programs are likely to increase over time. Past actions with conservation compliance (requirements for highly erodible land and wetland conversions to receive certain Federal benefits including crop insurance premium subsidies) are part of a larger mitigation strategy, as are promotion of conservation tillage, cover crops, and grassed waterways. Regardless of, or in absence of, that mitigation, productivity losses are still ever present and may be one of the more general effects encountered due to climate change. Unlike droughts, floods, and hurricanes, soil quality degradation would have persistent and long-term effects. RMA will need to consider such a risk structure, as that is more difficult to insure in many ways than acute weather events.

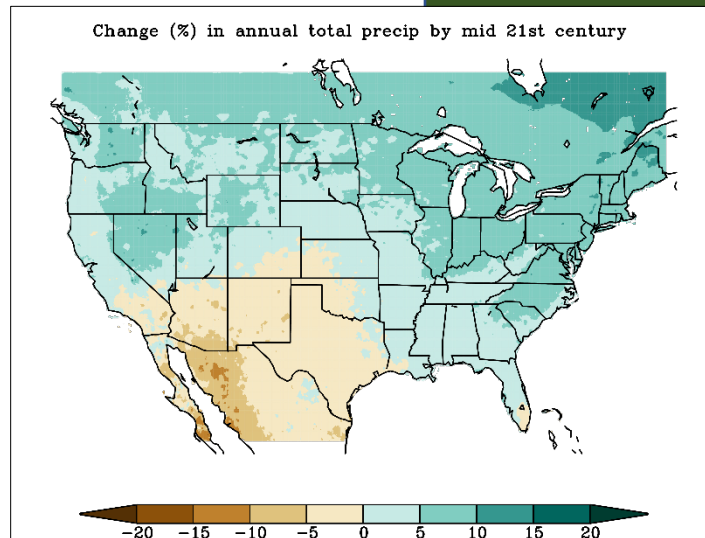
⁵ Schulze (2000)

⁶ Pruski and Nearing (2002)

⁷ O'Neil et al. (2005)

Asymmetric Impacts and Equity

The effects of climate change on crop production vary by region, some of which have already been felt by producers around the country. The maps on this page and the next highlight models showing how impacts are projected to vary across the country. Importantly, specialty crops are generally more sensitive to climatic stressors such as increasingly variable weather and require more comprehensive management compared to traditional row crops. Perennials such as grapevines and nut trees represent a major investment and, unlike annual field crops, cannot be abandoned or fallowed in the event of a severe drought, storm, or heat wave, in addition to commonly facing higher replacement and maintenance costs regardless. Further, many areas most at risk for major impacts from climate change are where specialty crops are the dominant agricultural activity. Much of the climate change impacts are increasing challenges for underserved producers in these regions. Such producers often lack access to specialized training or knowledge to explicitly address these challenges in their farm planning. Often, U.S. agriculture focuses on the vast acreage of grain crops across the Corn Belt, or the picturesque fields of cotton in bloom in the South. However, below is highlighted other critical agricultural regions that will be impacted by climate change and may, in fact, have a greater economic significance if not properly considered.



Source: Fourth National Climate Assessment - Higher Emissions simulated change for 2036–2065, compared to 1976–2005

West

The western region, stretching from Oregon to Idaho and Washington to California, is home to incredible crop diversity. The highest value commodity groups in the region include fruit, tree nuts, and berries (\$17.9 B); and vegetables, melons, and potatoes (\$7.2 B). California is the number one U.S. producer of specialty crops and accounts for more than half of specialty crop production nationwide, with a total of over 400 different crops recorded.

Drought

Southwestern agriculture is defined by water scarcity. More than 92% of the region's cropland is irrigated. The region produces many high-value perennial crops, including apples, blueberries, cherries, and wine grapes that rely heavily on irrigation from surface and groundwater sources

during the dry season. Water is a precious commodity across the west and is at risk of declining due to climate change. Drought affects the market value of fruits and vegetables because sales depend on good visual appearance. Perennial plants live for decades and are thus at a disadvantage in terms of adapting to climate change because of the time and costs required to re-plant and produce strong yields.

About 90 percent of crops harvested in California are grown on farms that are entirely irrigated, so a sustained decrease in the amount of water available for irrigation would force farmers to either reduce the acreage under cultivation or shift away from the most water-intensive crops.

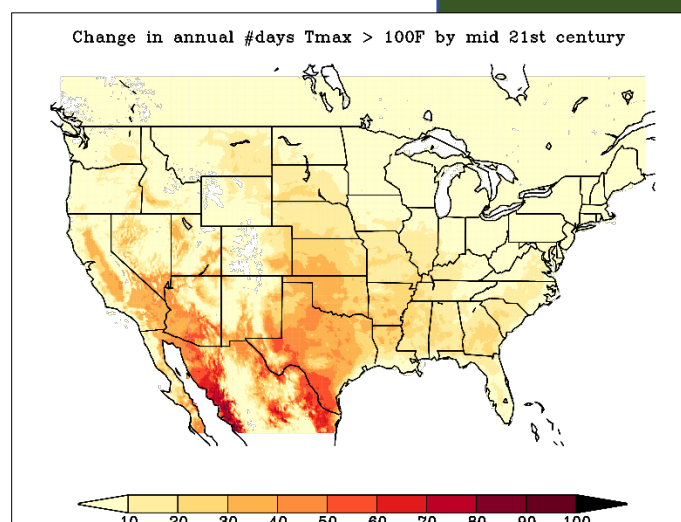
Rising Temperatures

Climate change projections for the southwest suggest an increase in extreme heat. Hotter climate conditions may reach temperature thresholds for warm-season vegetable crops, thereby limiting growth and viability. More frequent heat waves accelerate crop ripening and maturity and reduce yields of tree fruit and wine grapes. These impacts are projected to continue and intensify, possibly displacing existing growers and affecting farming communities.

Rising temperatures could transform California's agriculture. Fruit trees and grape vines need a certain number of chilling hours in the winter before they can flower. Projections show that chilling requirements for fruit and nut trees in California will not be met by the middle to the end of this century. In fact, the area capable of consistently producing grapes for the highest-quality wines is likely to shrink by more than 50 percent during the next 75 years. Likewise, extreme heat has led to damaged blueberries and apples in Washington. Warmer temperatures may also prevent stonefruit (such as peaches and cherries) from experiencing the chill-hours needed for proper flowering.

Wildfires

Increased heat, drought, and insect outbreaks, all caused by or linked to climate change, have increased wildfires in the Southwest. Fire models project more wildfire and increased risks to communities across extensive areas.



Source: Fourth National Climate Assessment - Higher Emissions simulated change for 2036–2065, compared to 1976–2005

On average, 4 percent of the land in California has burned per decade since 1984. The combination of more fires and drier conditions may expand deserts and otherwise change parts of California's landscape. Wildfire smoke has damaged California grown grapes and affected the state's \$40 billion wine industry.

Northeast

Drought and Rising Temperatures

The northeast region ranks high nationally for production of many high-value fruit, vegetable, and specialty crops, such as apples, grapes, fresh market sweet corn, snap beans, cabbage, mushrooms, and ornamental nursery plants. Increased drought frequency in the Northeast, together with warmer growing season temperatures will result in perennial specialty crops having reduced yield and quality. Midwinter warming can lead to early bloom of some perennial plants, resulting in frost damage when cold winter temperatures return. Yields will be negatively affected if the chilling requirement is not completely satisfied because flower emergence and viability will be low.

An added challenge is the high prevalence of direct marketing sales channels in the area. This increases the financial pressure on producers as weather events may trigger losses on many non-production related value-add activities that would normally be absorbed by other parts of the supply chain for most commodities elsewhere.

Southeast

Hurricanes

Hurricanes and tropical storms have become more intense during the past 20 years. Such events are important drivers of flooding events in the Southeast. The frequency and intensity of hurricanes is expected to increase under projected climate change scenarios, stressing agricultural crops, triggering replacement costs for downed trees, and decreasing yields.

This particularly impacts Florida, which is the second highest producing state of annual specialty crops, ranging from citrus groves and nurseries in Central and South Florida, to vegetables in various regions around the state. In 2019, Florida ranked first in the U.S. in the value of production for bell peppers for fresh market, grapefruit, oranges, fresh market tomatoes, and watermelons.

Drought and Rising Temperatures

Although the Southeast often receives excessive precipitation, drought conditions can develop rapidly across the region from lack of tropical cyclone activity and warm season rainfall variability. La Niña is associated

with negative precipitation anomalies and increased risk of drought across the region. Yields of citrus fruits could decrease with warmer temperatures in the southernmost part of Florida because of a lack of a sufficient dormant period.

Environmental Justice

Although not all encompassing, the above highlights how communities will be disproportionately impacted by the various climate changes that will occur over time. Producers in areas that face greater, or importantly, more rapid change are likely to face greater economic impacts that may lead to maladaptation. Communities that are dependent on monoculture agriculture are also at risk. Commonly, the Midwest corn and soybean growing areas are referred to in that context, but from citrus production in Florida to Native American communities in California that produce acorns for food, there are countless other examples. Further, tribal areas may be especially vulnerable to drought as most tribal agriculture is livestock/pasture based. Assessing insurance needs for specialty crops will be critical in promoting equity within the program.

Additionally, in the event of climatic shifts that impact the productivity or location of agriculture, the low-skilled and seasonal workers would be the first to lose their jobs. Employment would be affected by two different ways. First, increases in the frequency and the intensity of extreme weather events will yield risks and revenue losses that could lead to layoffs. Second, changing weather and precipitation patterns could require investments in adaptation measures, changing crops, and increase in inputs⁸. Climate change is also likely to have a disparate impact on beginning farms and those with little or no capital reserves. Ideally, crop insurance will be able to mitigate revenue impacts and allow producers time to invest in climate adaption measures.

Departmental Alignment

These vulnerabilities are consistent with the overarching threats USDA has identified in its Climate Adaption Plan. Each weather event directly correlates to the Department's first risk of "decreased agricultural productivity." Many of the same concerns and responses mentioned in the plan are repeated here in more detail. The USDA's third identified vulnerability, "disproportionate impacts on vulnerable communities," also aligns with RMA's concern with asymmetric impacts of climate. RMA's work with specialty crops will have the most relevance for crop insurance's contribution to climate adaption for those communities. Finally, "shocks

⁸ Shonkoff et al. (2011)

due to extreme climate events,” is relevant in that many insurance products are directly tied to providing support after such events. In a way, the crop insurance program exists for these impacts. So as those shocks become more frequent, crop insurance will become more relevant. Moreover, the same shocks could impact RMA’s internal operations, thus the actions to promote continuity of operations become paramount to properly controlling that risk.

Action

Create products that promote Climate-Smart Ag

Action A - Implement Incentives to Encourage Cover Crop Planting

Cover crops have the potential to provide multiple benefits in a cropping system. They can prevent soil and wind erosion, improve soil's physical and biological properties, supply nutrients, suppress weeds, improve the availability of soil water, and break pest cycles along with various other benefits. Although those benefits extend well beyond climate adaptation, the soil conservation value is critical to maintaining strong productive capacity, and thus viable crop insurance products.

Beginning in 2017, RMA entered into an agreement with the State of Iowa to incentivize cover crops by applying up to \$5 per acre of additional premium subsidy on a policyholder's insured crop that followed a cover crop. The program enrolled approximately 170,000 acres the first year and was a major success in promoting an agronomic practice with climate and environmental benefits. The funding is provided by the state, as is the enrollment process and eligibility information. The program was also adopted by the State of Illinois the next year, followed the year after by the State of Indiana for a targeted watershed. Building upon that, in response to the pandemic, RMA launched the Pandemic Cover Crop Program (PCCP) that was a nationwide implementation of the cover crop premium support based on reported acres to FSA.

These programs have achieved several key advantages. First, they have changed widespread perceptions that cover crops could cause insurance claims to be denied. By officially endorsing the practices, producers understand that cover crops can be a part of a producer's overall agronomic plan. Second, the direct financial support helps incentivize more producers to adopt cover crops and reap their benefit. With these already-issued program regulations and existing design, should resources again become available, RMA will prioritize this program so more producers could adopt cover crops and reap the climate benefits, while maintaining a strong linkage with Federal crop insurance and sound risk management practices.

Action B - Implement Incentives to Encourage Smart Water Use

As discussed earlier, water availability is already a major challenge in some regions, and those stresses are likely to continue as the climate changes. Being proactive and encouraging the use of water-saving practices could

lessen program risk due to lack of water availability. For example, systems like drip or subsurface irrigation reduces water usage considerably by targeting the irrigation more precisely and limiting (or eliminating) loss to evaporation. Water recycling systems lessen the need for water simply by not wasting water the producer already has available. Certain crops have

water efficient practices, such as intermittent flood irrigation for rice. There are many other examples as well.



Like cover crops, should resources and data become available, RMA will prioritize such a program within existing authorities to help incentivize the practices and strengthen the link between such practices and crop insurance as a full-featured risk management strategy. Smart water usage also has the added effect of potentially reducing drought risks, thus the program could be used in conjunction with premium rate adjustments.

Action C - Implement Incentives to Encourage Other Climate Smart Practices

Of course, the first two proposed actions with cover crops and smart water use are the most well understood today. However, it stands to reason that new research, technology, or public policy outcome will provide other avenues to allow crop insurance to promote such a practice within the existing program. RMA will continue to explore other options to implement incentives for climate smart agriculture, especially where there is known risk reducing effects.

Reducing premium costs for these causes is advantageous because it does not conflict with legal requirements for the program to be actuarially sound. Rates will still reflect the proper risk; policyholders will simply have cheaper insurance if they choose to engage in the targeted practice. Another option is bonus payments for losses, which does have the advantage of being popular with producers because they would receive money (as opposed to smaller premium bills). That approach does have drawbacks. The first is simple accounting, as RMA would need to separate losses associated with base insurance and whatever program incentive is being designed. This administrative burden provides no value to taxpayers, the government, or the policyholder and creates budget uncertainty in the face of variable weather. Second, an additional loss payment would incur increased administrative costs, may have tax implications, and potentially

lead to debt issues should claims ever be revised. Last, permanent programs in this area could incentivize producers to incur greater losses and make insurance more expensive in the long run.

Another potential incentive is reducing paperwork. Policyholders typically like the least amount of paperwork required. Perhaps a future technology associated with a climate-smart practice is so automatic, that once a producer proves they engage in the technology, no other records are required. This is, of course, speculative; however, it is a common request from stakeholders and RMA should be willing to adapt if such a development occurs.

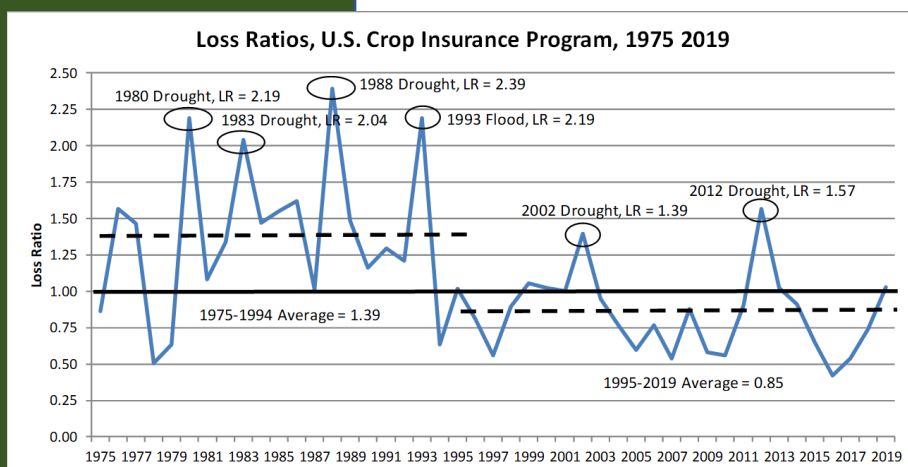
Another avenue for this support is the Agricultural Management Assistance (AMA) program, which helps agricultural producers manage financial risk through diversification, marketing, or natural resource conservation practices. AMA is available in 16 states where participation in crop insurance is historically low (primarily the Northeast). RMA has partnered with NRCS since 2017 to provide funding for financial assistance to producers who implement or improve select conservation practices such as watershed management or irrigation structures, soil erosion control, integrated pest management, and organic farming. RMA is currently apportioned \$4M annually for this program.

This action has no immediate implementation plan, outside of the existing AMA support, and is rather a catch-all for unknown developments. However, given the power of additional insurance subsidy on behavior, it should be called out as a valuable public policy tool available to RMA and the USDA to promote climate-smart practices as they develop.

Evaluate and monitor climate risks and update program parameters

Action D – Continue Updating Program Premium Rates to Reflect Changes in Risk Due to Climate Change

RMA continuously reviews and revises its premium rating methodology. Changes include using a shorter historical timeframe to measure risk, and the introduction of a process that explicitly considers weather variables in calculating premium rates. This makes premium rates more responsive to any changes in agronomic risks, whether due to climate change or other factors. Actuarial reviews consist of evaluating and updating the factors used to calculate premium rates, generally based on historical experience. Several review categories exist: Actual Production History (APH), dollar



Source: RMA

plan, pilot program, and specialty plans of insurance. Full actuarial reviews for APH-based programs are generally conducted on a three-year cycle by RMA staff. These reviews have maintained the program in an actuarially sound manner effectively, as seen on the accompanying chart showing loss ratios (Indemnity / Premium) over time.

RMA uses well established methods and a past research

study on rating methodology⁹ to set premium rates, that is the percent of liability representing the expected loss plus a reasonable reserve. The study defined a weather index methodology and a methodology to adjust insurance experience prior to 1995 to, in a broad manner, account for changes in underwriting and policy improvements as well as the mix in business. The study based this adjustment on a comparison between the loss performance of the program in the pre- and post-1995 periods, accounting for differences in weather. Given the use of the weather index and pre-1995 adjustment, the study also recommended the adoption of a rolling 20-year timeframe for calculating the variable portion of the rate (the county unloaded rate). Despite shortening the time-period used to calculate the county unloaded rate, RMA maintains the entire history back to 1975 for calculating the catastrophic load or fixed portion of the rate. The indemnities, more than the 90th percentile loss cost ratio for each county, form the basis for the catastrophic load. In general, RMA pools the excess indemnities at the weather district level and assigns the resulting load to each county within the district as a fixed rate.

In addition to the weather district catastrophic load, the fixed rate is also comprised of the prevented planting load, replant load, and quality adjustment load. In general, RMA calculates prevented planting and replant loads as the average frequency of occurrence (prevented planting acreage or replant acreage divided by total insured acreage) multiplied by the payment rate established in the policy provisions. The quality adjustment load was introduced in 2001 following modifications to the quality adjustment procedures. Over time, this load is being phased out

⁹ <https://www.rma.usda.gov/en/Topics/Publications>

given the proportion of years within the 20-year base rate period that reflect the adjusted procedures.

Critical in all this, the program will naturally update its measures of risk under current methods to address increases or decreases in risk for each crop insurance offer. RMA will also continue to periodically review its methodology for enhancements due to new technology, methods, or external drivers such as climate change.

Action E - Continue Updating Program Yields to Reflect Changes in Output Due to Climate Change

Like rates, program yields also undergo regular review to keep them relevant in the face of changing weather, climate, genetic, technology, and production practices. The reference yield (in combination with the producer's average yield and exponent) provides a means to classify production risk. As a producer's yield increases relative to the county, the premium rate charged decreases. Conversely, as a producer's yield decreases relative to the county, the premium rate charged increases. Generally regarded as the average yield, RMA previously updated reference yields based on transitional yields (T-yields) under the premise that this moved reference yields in a direction more consistent with the average yield of producers in the county. However, this process ignored the latency effect resulting from the full T-Yield reviews that occurred every 4 to 5 years at that time. Beginning with the 2011 crop year, RMA developed and implemented a more appropriate reference yield methodology for those commodities undergoing an actuarial review. In general, the methodology bases reference yields on the acre-weighted average of average yields reported by crop insurance participants for the most recently available crop year. In addition, RMA considers various levels of aggregation or statistical models in limited data scenarios. These reviews now occur on the same cycle as rates, that is, every 3 years, and use the most recent 10 years of yield data.

The exponent determines the amount of the rate increase or decrease warranted given the relationship between the producer's average yield and the reference yield. For determining exponents, RMA structures data hierarchically, pooling individual data within counties, then nests it within climate regions, then nests it within states. This leads to using explicit multilevel modeling methods to take advantage of the data structure. Such models are a compromise between no pooling (where the exponent is estimated separately for each geographic area) and total pooling (where a single, common exponent for all geographic areas is developed). Instead, RMA matches producer average yields and actual realized yields through

the available history to estimate the exponential relationship between the unit-level yield ratio and the loss cost ratio.

Again, these methods are regularly reviewed and conducted to naturally adapt to any agronomic change and keep crop insurance yields appropriate into the future.

Action F - Continue Updating Program Dates to Reflect Changes in Agronomic Practices to Climate Change

RMA regional offices review key dates, rates, and yield information for all crops at least once every 5 years. For example, to review planting dates, regional offices use climate data such as growing degree days available in a county, average frost and freeze dates, and key weather causes of loss by dates. They also work with university extension experts and other industry experts to make sure dates are adaptive to changing climates, new crop hybrids, and new farming practices down to the county level. In addition to the climate data and agronomic experts, they also use RMA and FSA data to identify when the crop was mostly planted, when yields start to increase or decrease, impacts to loss ratios by planting date, and causes of loss by planting date. Using this combined information gives the regional offices a well-rounded approach to see crop production, climate, and insurance performance all be considered on a consistent basis. Similar processes can be used to look at appropriate acreage reporting dates, which must be early enough to prevent moral hazards, but late enough to ensure all the crop is planted.

RMA will continue this approach, using the expertise of regional experts on staff to maintain appropriate dates in the face of temporal changes caused by climate change.

Action G - Continue Updating Program Map Areas to Reflect Changes in Risk Due to Climate Change

Most program offer data is at the county level geographically. However, crop insurance defines specific areas within counties when conditions suggest an area has significant variance in risk, yield, price, growing time, etc. from the rest of the county. The most common use of these are flood-prone areas around major waterways. These map areas, or sub-counties, need to be aggregated to ensure the risk pool is properly segregated to ensure a fair actuarial offer.

In 2022, regional offices will review all actuarial maps, including flood prone maps on a 5-year recurring cycle. Advancements in technology have

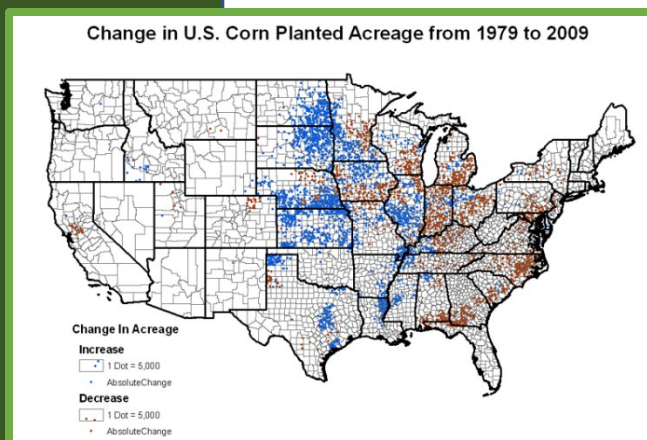
allowed regional offices to review these more quickly than was possible historically as there is a lot of new climate and insurance information available to them to be able to get a clearer picture of the different crop risks within a county in a faster amount of time. In the example of flood prone ground, regional offices identify where land is impacted by flood occurrences that create insurance experience that is different than the rest of the county. To do this, they use a combination of geospatial and insurance data, including satellite imagery, topographic maps, flood gauge data, and written agreement insurance experience to name a few. They compare the timing of these events to when they might commonly impact crop production and create an elevated risk that is not representative of the rest of the county. This allows higher risk ground to have different actuarial components that do not impact others in the rest of the county, creating a fairer insurance offer for all producers involved.

RMA will continue this approach, using the expertise of regional experts on staff to maintain appropriate map areas as climate change impacts different geographic regions in disproportionate ways. RMA will also incorporate new data, especially those indicators of climate change, where appropriate

Action H - Continue Updating Program Availability and Procedures to Reflect New Growing Areas and Agronomic Practices Due to Climate Change

Expanding and reducing the availability of insurance is also critical as climate change will change the viability for certain crops in certain areas. RMA uses its regional offices to approach this in a couple of ways. First is the use of written agreements, which are individually underwritten offers of insurance for producers that would not normally be available in the county they farm. RMA uses this demand to identify and target

appropriate expansion based on insurance experience. Regional offices engage stakeholders at all levels including producers, AIPs, agents, universities, and other ag experts to identify these changes in growing areas and farming practices. In general, stakeholder engagement is central across RMA, but regional offices offer localized contacts and relationships that have proven valuable over time. The map shows a good example of how that data impacts different regions and can be used to support changing program



Source: USDA NASS

availability. When improvements are identified, they then work within RMA to make sure policy, procedure, and insurance offers are adaptable and available with these changing practices and growing areas while still maintaining sound insurance principles.

For example, this may include changes to farming practices and irrigation methods. For 2022, RMA's regional offices have implemented a regional review program of climate smart agricultural practices to determine whether these practices should be covered, or whether existing coverage should be modified or enhanced. This year's reviews include skip row cotton with extra wide skips, relay cropping, which is interplanted crops harvested separately, and cover crops. These reviews will also aid in RMA compliance efforts as up-to-date practice information will ensure resources are efficiently allocated to maintain program integrity.

Action I – Improve Production Reporting to Enhance Yield Data Quality for Research and Program Support

Currently, a producer files a production report at the beginning of the insurance year recording the previous year's crop production. This means the previous year's production data is organized and aggregated according to the optional unit structure of the current year and is used to establish an APH for the current year's policy. However, this also limits RMA's ability to match production to the actual location where it was produced since optional unit structure may differ year-to-year. RMA is planning on changing production reporting to be based on the optional unit structure in effect the year it was produced. This change would require production reports be tied to the location where it was produced as an "end" step to a crop insurance policy. By having this direct connection to the insured acreage, RMA could do more advanced analysis of the data.

This is critical to maintain quality data for the program to adapt to changes in yield at low levels. It enables specific targeting of analysis at the field level, whereas previously it was heavily limited to county aggregates. For example, it stands to reason that climate change may have disparate effects to low-lying areas (perhaps more prone to flooding) versus higher elevations (more susceptible to drought). By having data that can differentiate yield effects at that level is critical for programs and research to solve future policy needs. Not only should this help RMA programs, but Farm Service Agency (FSA) programs would also benefit from this. Currently, programs such as Agriculture Risk Coverage (ARC) and Price Loss Coverage (PLC) use county level data. However, future versions of ARC/PLC or other yet-to-be-created farm programs may find it valuable to better target sub-county areas. Advancements in precision agriculture should

also hasten the integration of this data into the program, which RMA policy should support.

This change would be implemented via updated regulations for the basic provisions of varying crop insurance policy documents. Further, IT implementation would be required. Both steps would seem straightforward.

Action J - Conduct Research on the Impact of Conservation Practices on Yield and Risk

RMA is assembling data for a joint Economic Research Service, NRCS, and RMA product to conduct internal research on yield and risk impacts from practices such as cover crops. RMA is also examining the effects of soil types and other environmental factors on the impact to yields. RMA is engaged with the University of Illinois via AGree and Meridian Institute to share detailed insurance data, in conjunction with FSA and NRCS conservation data, to analyze yield and risk impacts of conservation practices on prevented planting losses. These efforts have been aided advances by RMA's data science work to allow data to be better geolocated for analysis. This also requires setting up narrow research contracts and protecting confidential data.

For example, county level data shows a strong correlation between soil quality and risk for corn. However, more precise data is necessary to continue the research. This will be aided greatly by the proposed changes to production reporting. Moreover, finding additional outside partners to support these lines of inquiry are critical to have a full understanding of these effects. With these relationships more fully understood, insurance rates would be able to more adequately price changes in risk as a result in changes to these effects on soil.

Promote and expand products that support climate-smart ag

Action K – Support Climate Literacy Among Agents and AIPs

RMA should ensure the insurance industry maintains the foresight necessary to tackle a broad range of climate issues. This could take the form of strengthening business strategy for an insurance company, or an agent advising a client based changing weather patterns. For example, climate effects may make parts of an operation more susceptible to certain

flood risks than others. To properly prepare for this, a producer may want to maintain historical production records in a manner to separate out vulnerable areas. Although this may be more work in the near term, it could greatly expand risk management options to the producer in the future. Educating stakeholders to understand how climate may impact operations would lead to more efficient and better targeted risk management plans.

RMA and the industry have many standing committee meetings that are ideal to share this type of information. Additionally, there are large industry meetings with the AIPs to ‘train the trainers’ that then train agents and staff on the upcoming changes to policy and procedure. Any issues, improvements, and opportunities are often addressed very closely with the industry to make sure policy and procedure effectively address what is happening on the ground. RMA also regularly receives email questions on specific events and instances. RMA coordinates responses within its work units to make sure procedure addresses the situation and issues clarifications if needed.

RMA could work with the USDA Climate Hubs to develop climate literacy and training plans to better assist with these operational risks. The Climate Hubs 2020 5-year review explicitly targeted greater engagement in this area, with the goal, “... can develop additional resources to prepare a climate-smart workforce nationwide.”¹⁰ Although this was likely envisioned for the USDA workforce, translating it to RMA’s insurance industry partners ought to be straightforward and worthwhile. In the past, the Southwest Climate Hub worked with RMA to understand how weather and causes of loss change over time and spatial areas. In 2017, RMA assisted in the collection and analysis of cause of loss data. From the analysis conducted, a dynamic online tool¹¹ called AgRisk Viewer, was developed allowing users to examine county-level RMA cause of loss data and trends. To further these types of projects, funding would need to be allocated and objectives more precisely defined. Curriculum would seem straightforward, and RMA could distribute and integrate many of the outputs within the industry via existing avenues.

Action L – Specialty Crop Outreach

RMA is investing up to \$2 million in cooperative agreements in 2022 for risk management education and training programs that support historically underserved producers to help them better understand how to

¹⁰ Steele, R., Zycherman, A., Wiener, S., Hernandez, C., Wilson, M., Johnson, R., & Steele, C. (2020).

¹¹ <https://swclimatehub.info/rma/>

manage risk in the face of volatile weather. These funds will be awarded to organizations, such as universities and nonprofits among others, to provide risk management training to historically underserved producers, specialty crop operations, and others. The outreach will emphasize managing risks in the face of volatile weather and climate smart solutions that improve the profitability and resilience of producers.

RMA's overarching goal is to ensure Federal crop insurance meets customer needs and is available to as many producers as possible. To meet

this goal, producers need to know how to access Federal crop insurance and how it works. Therefore, outreach and education will continue to be an agency priority. By providing opportunities for risk management education, we aid in further strengthening the farm safety net for agricultural producers. Outreach conducted by RMA Regional Offices aligns with their role as RMA's eyes in the field, keeping in close contact with local producers and grower groups. This work is especially important given the asymmetric risks identified earlier.



Effective outreach is necessary to offer education and information that specialty crop producers need to effectively manage their risk and remain productive. Additionally, outreach is an opportunity to provide producers with the latest news and updates regarding crop insurance programs and climate smart initiatives, identify attributes of the program that are working well and the aspects that need to be changed to improve efficiency, effectiveness, and responsiveness to industry adaptations to climate change. Workshops are popular with farmers and have proven to be a catalyst for development of risk management skills in limited-resource communities. The training equips the agricultural community with tools beneficial to minority farming operations and illuminates for the industry and its partners the challenges faced by socially disadvantaged producers. RMA can also utilize other industry meetings, presentations, and information booths to maintain this outreach. RMA should continue to engage in these activities utilizing the RMA Specialty Crop Coordinator and the Specialty Crop Liaisons at each RMA Regional Office.

Action M - Promote Whole Farm Revenue Protection to Support Crop Diversification to Reduce Risk

Although difficult to predict what production crop systems may look like over the coming years, many speculate greater use of diversification seems

likely to occur. Research supports the idea that such practices may help mitigate impacts of climate change.

Crop diversification can improve resilience in a variety of ways: by engendering a greater ability to suppress pest outbreaks and dampen pathogen transmission, which may worsen under future climate scenarios, as well as by buffering crop production from the effects of greater climate variability and extreme events¹².

RMA can support these producers who choose to diversify by promoting the Whole Farm Revenue Protection (WFRP), Micro Farm, or other ‘to-be-developed’ products that specifically target small and/or diversified operations.

WFRP provides a risk management safety net for all commodities on the farm under one insurance policy. This insurance plan is currently tailored for any farm with up to \$8.5 million in insured revenue, including farms with specialty or organic commodities (both crops and livestock), or those marketing to local, regional, farm-identity preserved, specialty, or direct markets. WFRP provides protection against the loss of insured revenue due to an unavoidable natural cause of loss which occurs during the insurance period and will also provide carryover loss coverage if you are insured the following year. Critically, WFRP provides additional premium subsidy when including multiple crops, thus is specifically tailored for diversified operations.

Micro Farm is a product based on WFRP which is limited to producers with less than \$100,000 (or \$125,000 for carryover insureds) in allowable revenue. These smaller, usually local, producers have a high prevalence of diversification in their operation, thus Micro Farm automatically provides the diversity discounts. The product also includes revenue from value-added products (e.g., an apple producer selling pies at a farmer’s market), which is an important aspect of their business.

Of course, these two products currently exist, but many other new products could be developed that provide targeted support for diversified operations. Regardless, crop insurance support for producers that are adapting to climate change via diversification will need targeted insurance policy options to help them manage their production risk.

Action N - Support Private Submitters on Expansion of the Climate-Smart Products

¹² Lin, B (2011)

The FCIA allows private parties to develop and submit crop insurance products to the Board for consideration of approval. By submitting a concept proposal prior to full development, these private parties may request advanced funding to cover a portion of their expected research and development costs. If advanced funding is provided, the private party must deliver a fully developed crop insurance product by an agreed upon date.

Following the submission of a fully developed crop insurance product, RMA and independent expert reviewers evaluate these products and the findings are presented to the Board. Products approved by the Board for implementation are eligible for Federal reinsurance and premium subsidies. Submitters of the privately developed product are also eligible for reimbursement for research and development and up to four years of maintenance costs if the products are approved for implementation.

An example of this product was the introduction of the Post Application Coverage Endorsement (PACE) in 2022. The product, initially for non-irrigated corn in select midwestern counties, provides coverage for producers who split-apply nitrogen to their crop. If a weather event prevents the in-season application of the nitrogen, the policy pays an indemnity equal to the lost potential production that could have been achieved with a complete nitrogen treatment. The product was developed privately and went through the rigors of the above process, critical in refining it for a proper pilot and introduction to growers. Moreover, the process will continue to be available for further modifications, enhancements, and expansions if warranted.

This privately developed product submission process provides a means for those within the public that have an interest in climate-smart agriculture to introduce and develop crop insurance products. From grower organizations to university researchers, anyone who follows the process established in the FCIA can submit a privately developed product. These private submitters act as a resource extension for the Federal government. Having an expanded pool of resources helps ensure innovative and adaptive approaches to address climate change through crop insurance can be adopted timely and efficiently. RMA can and will continue to support this process for climate-smart products for producers who are using new and different agronomic practices to adapt to climate change.

Action O – Engage USDA Climate Hubs for Product Development

Given the breadth of expertise employed by the USDA Climate Hubs, RMA could utilize cutting edge research to better design or review new

products. For example, if new products make claims about new agronomic practices or crop varieties, RMA could request the Climate Hubs to assist in ground-truthing those claims. Moreover, during research and development phases, RMA could leverage the Climate Hubs for data, contacts, and ideas for innovation in the climate-smart space. Those types of activities will increasingly be valuable as climate change accelerates and has new impacts across the country. The regional design of the Climate Hubs ought to aid in the asymmetries previously discussed to ensure RMA considers the proper solutions and science. The Climate Hubs could also aid in RMA staff climate literacy unique to newly proposed products. Admittedly, this will be a challenge, as often RMA product development timelines may not fit into the current business models of the Climate Hubs. However, RMA should strive to find ways integrate the processes to ensure valuable feedback is not missed.

Maintain continuity of operations during weather-related disasters

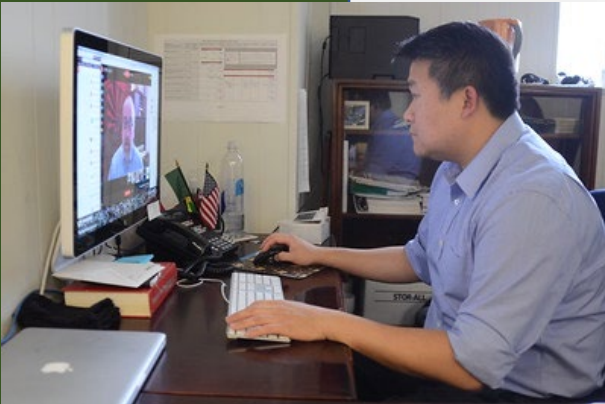
Action P – Maintain a 100% Telework-Ready Workforce

In the past, RMA has utilized a “brick-and-mortar” based approach to disaster response where a team of subject matter experts would meet in a government facility in a conference room that had been quickly converted into an emergency operations center. Decisions regarding the actions that the organization would take to respond to the disaster/emergency would be made by personnel in the emergency operations center and then relayed out to the organization’s personnel via the available communications technology, typically telephone or two-way radio. As communications technology advanced, changes were made to RMA’s emergency response and recovery process.

Recently, the need to adapt and overcome the negative impacts of the COVID-19 pandemic have caused a significant change in how RMA is approaching performing the emergency response and recovery process. With meeting in-person at a government facility not being a viable option, RMA components that are responsible for conducting disaster response operations quickly transitioned to using the latest virtual technology to organize and coordinate the response to disaster/emergency situations such as extreme weather events or conditions. Working entirely virtually, the Agency is now able to perform the vital decision-making and information sharing activities effectively and efficiently that were necessary in support of the response to weather-related disasters such as

wildfires, drought, and hurricanes. Key to the overall success of disaster response and recovery efforts was the ability for leadership personnel and subject matter experts that were located at numerous home worksites throughout the country to communicate in real-time.

By successfully performing real-world disaster response and recovery responsibilities while operating entirely in a virtual environment, RMA was able to demonstrate that having a team of dedicated professionals that are capable of performing their duties in a 100% remote (i.e. virtual) work environment is not only a valuable component of the continuity of operations program, maximizing virtual capabilities is also how the federal government will be looking to streamline disaster response operations. Being able to leverage the flexibilities that are inherent in a remote approach to performing disaster response and recovery operations has rapidly become recognized as the



way of the future when it comes to attaining, maintaining, and managing a state-of-the-art continuity of operations program. RMA is transitioning to a near 100% remote workforce. However, even if situations change and some employees are brought back to physical locations, the ability to ad hoc telework is vital to performing tasks under any situations. Therefore, RMA will continue to pursue technology, training, and infrastructure needed to maintain a full telework-ready workforce.

Action Q – Support Cloud-Based IT Processing

RMA's role in maintaining a functioning crop insurance system is increasingly an information technology (IT) endeavor. Therefore, maintaining IT functions in the face of natural disasters is critical. Logically, if those natural disasters become more commonplace, the need grows to prioritize system design that is resilient to such concerns and create protocols and contingencies for disaster recovery. RMA currently defines its recovery time and outcomes objectives via normal processes, which is a critical step in understanding computing needs.

Cloud-computing means systems are hosted at external sites in a distributed nature. That means services can be spread out to different servers in different geographical locations, essentially providing complete protection against local natural disasters. It also means for disaster recovery that data backups are not maintained by RMA directly on disks or

physical hard drives. This makes cloud better in that it both reduces the likelihood and severity of disaster events damaging IT processes. Combined with the cost-effective nature of the process, it is a win-win for the Agency to migrate to cloud-based processing.

RMA, partnering with the FPAC Business Center, is already in the process of putting some pilot applications, services, and data into cloud-based systems. The escrow mission essential function has been cloud based for nearly a decade and new services are being migrated over the next couple years. RMA will continue this process over the next several years to fully retire local server-based systems. Moreover, this will synergize with efforts already underway to modernize RMA's data mining tools within the Compliance mission which limits waste, fraud, and abuse to keep the program affordable to taxpayers and producers in the long run.

Action R - Maintain Network of Regional Offices to Respond to Unique, Geographic-Centric Issues

Too often, assumptions are made that insurance can largely be designed, maintained, and regulated centrally. However, as many of the ongoing actions previously covered, on-the-ground local expertise is critical to maintaining actuarial soundness in the program. Contextualizing data and events, staying ahead of changing farming methods and practices, and outreach and education are all tasks best done with local expertise. Combined with the ability to enable remote work, long-term, having staff to cover each region far exceeds any perceived efficiency gain of a centralized workforce. Moreover, when disasters do strike, responsiveness

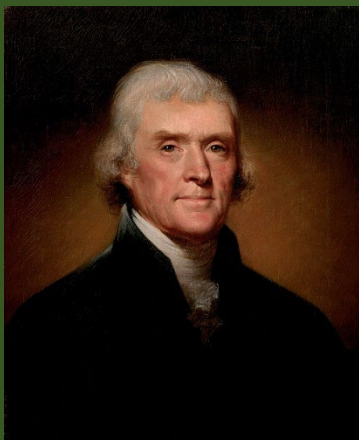
is critical. Regional offices allow RMA to have local experts engage with customers on an ongoing basis, who understand the unique challenges producers face. They assess the situation on the ground, collaborate on policy needs, clarify how the policy handles the situation, providing immediate response and actions to our customers where it occurs. Regional Compliance Offices ensure program integrity, and they too increase their effectiveness by understanding local risks and potential for waste, fraud, or abuse.



Resources, Measurement, and Sustaining Adaptation

The attached table specifies the core metric(s) to track each action, if applicable. Several are naturally dependent on each other, as most program maintenance actions all will get summarized into the ultimate test of crop insurance effectiveness, do producers buy it and is it actuarially sound? Several metrics will need to be developed from existing data (e.g., production reporting or cloud-based IT), while several others are already commonly reported (e.g., cover crop benefits and climate-smart insurance products). The table also outlines the area of RMA that will lead each action, a timeframe on how each is implemented/will be implemented, and other stakeholders that may require coordination or collaboration.

Internally, RMA's structure already supports these actions, leadership merely needs to maintain its commitment to each. All actions, even those engrained in current processes, will vary heavily based on emphasis placed on each by leadership. Given the long-term timeframe of this adaptation plan, it is likely there will be an ebb-and-flow to several actions, as funding for subsidy benefits, science of conservation practices, market forces, Agency budget constraints, and other factors impacts the value proposition of each. This need not be seen as a problem, but rather the natural adaptation of the plan itself.



Laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths discovered and manners and opinions change, with the change of circumstances, institutions must advance also to keep pace with the times.

-Thomas Jefferson

Actions Overview

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Timeframe	Coordination	Progress Metrics	Accomplishments to Date
Soil	Incentives to Encourage Cover Crop Planting	Ongoing/Proposed	DAPM	Annual Funding	FSA	Acres Covered	State programs, PCCP 21 & 22
Water	Incentives to Encourage Smart Water Use	Proposed	DAPM	Annual Funding	TBD	Acres Covered	-
Any	Incentives to Encourage Other Climate Smart Practices	Proposed	DAPM	Annual Funding	TBD, ARS	Acres Covered	-
All	Update Program Premium Rates	Ongoing	DAPM	3-Year Cycle	Internal	Participation Rate & Loss Ratio	Regular Maintenance
All	Update Program Yields	Ongoing	DAPM	3-Year Cycle	Internal	Participation Rate & Loss Ratio	Regular Maintenance
All	Update Program Dates	Ongoing	DAIS	Continual	Internal	Participation Rate & Loss Ratio	Regular Maintenance
Flooding	Update Program Maps	Ongoing	DAIS	5-Year Cycle	Internal	Participation Rate & Loss Ratio	Regular Maintenance, Now on Regular Cycle
All	Update Program Availability and Procedures	Ongoing	DAIS/DAPM	Continual	Internal	Participation Rate & Loss Ratio	Regular Maintenance
All	Improve Production Reporting	Planned	DAPM	2023 CY	Internal	Percent of Acreage	-
Any	Conduct Research on the Impact of Conservation	Ongoing	DAPM	1-3 Years	ERS, NRCS, Universities	-	Engagement with U of I, NRCS, ERS
All, especially Asymmetries	Support Climate Literacy Among Agents and AIPs	Proposed	DAIS	Continual	Climate Hubs	-	-
All, especially Asymmetries	Specialty Crop Outreach	Ongoing	DAPM	Continual	Internal	Participation Rate & Loss Ratio	Website, RO Liaisons, Board Submission Requirements

Water, Pests/Disease	Promote WFRP to Support Crop Diversification	Ongoing	DAPM	Continual	Internal	Participation Rate & Loss Ratio	Regular Maintenance
All, especially Flooding & Soil	Support Private Submitters on Expansion of the Climate-Smart Products	Ongoing	DAPM	Continual	Internal	Number of Climate- Smart Products	Regular Outreach
Any	Engage Climate Hubs for Product Development	Proposed	DAPM	1-2 Years	Climate Hubs	Number of Engagements	-
Flooding, Tropical Cyclones	Maintain a 100% Telework-Ready Workforce	Ongoing	OA	Continual	Internal	Percent of Employees	Accelerated due to Pandemic
Flooding, Tropical Cyclones	Support Cloud-Based IT Processing	Ongoing	OA	Continual	FBC	Percent of Systems	Investments Underway, Multiple Systems Migrated
All	Maintain Network of Regional Offices	Ongoing	DAIS/DAC	Continual	Internal	Number of ROs and RCOs	Current State



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

FS-1196 | July 2022



USDA FOREST SERVICE
**CLIMATE
ADAPTATION
PLAN**

**“CARING FOR THE LAND
AND SERVING PEOPLE.”**

FOREST SERVICE MOTTO

LEADERSHIP MESSAGE

Conservation and service, core values of the USDA Forest Service, are embodied in our motto— “Caring for the land and serving people.” We, as the Forest Service, are committed to sustaining the Nation’s forests and grasslands in ways that encourage lasting ecological, economic, and social vitality. Our core values of conservation and service; joined by safety, diversity, and interdependence; drive us to adapt to the challenges posed by a rapidly changing climate on behalf of the American people.

Adaptation isn’t easy. By its very nature, it involves difficult truths and hard choices. It also spurs opportunities as it intersects with related efforts, such as the 10-year Wildfire Crisis Strategy, Shared Stewardship strategy, and the Equity Action Plan. All of these efforts inspire us to think carefully about how and where we do our work, engage in partnerships, and provide services. Success requires the engagement, creativity, and professionalism of the Forest Service workforce—not just a few of us, but all of us. The “USDA Forest Service Climate Adaptation Plan” presents a holistic approach to climate adaptation that works across the Forest Service and at all levels so we can all help shape how the plan will apply on national forests and grasslands and in our workplaces and communities.

The Forest Service has been actively engaged in climate adaptation for many years. This adaptation plan grows from lessons we’ve learned, even as it challenges us to fill gaps in knowledge and take meaningful climate actions. The plan clarifies and elevates discussion about climate change and accelerates the pace of our collective preparations and response. It recognizes that we are not in this alone, nor are our actions isolated. This plan calls for a whole-of-government response through building partnerships, advancing environmental justice, and creating economic opportunities for communities that have been historically marginalized even as they are disproportionately affected by climate change.

I ask that each employee of the Forest Service support this plan by reflecting on how you can apply your ingenuity and experience to our work as you consider the climate threats described and strategic actions recommended. These are demanding times, but there is no obstacle we can’t face if we face it together.




Chief Randy Moore



Smoke from the Taylor Fire sets into an inversion and envelops the Rogue River-Siskiyou National Forest, OR. USDA Forest Service photo by Cecilio Ricardo.

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CLIMATE CHANGE IMPACTS AND VULNERABILITIES

The Forest Service identified key risks to the agency's mission in six categories:

1. Shifting fire regimes and resulting effects on ecological integrity, multiple uses, human safety and well-being, and wildland fire management operations.
2. Extreme events and disturbances, including the effects of flooding, drought, insect outbreaks, invasive species, and severe storms.
3. Chronic stressors to watersheds and ecosystems, such as altered productivity and composition, changes in habitat for plants and animals, and implications for the agency's ability to manage these systems over time.
4. Disruption in the delivery of ecosystem products and services, including clean water, carbon uptake and storage, forest and rangeland products, and recreation opportunities.
5. Disproportionate impacts on disadvantaged communities and Tribal Nations, including human health impacts, loss of cultural resources, and threats to economic prosperity and equity.
6. Threats to the agency mission, infrastructure, and operations from disruption to operations, strains on workforce capacity, more complex public engagement, and fewer resources.

ADAPTATION ACTIONS

To reduce these risks, the Forest Service will take six overarching adaptation actions that correspond to the six categories above:

1. Adapt to changing fire regimes.
2. Prepare ecosystems and watersheds for extreme events and intensifying disturbances.
3. Sustain and improve ecosystem and watershed function in the face of chronic stressors.
4. Support the delivery of ecosystem products and services in a changing climate.
5. Deliver environmental justice through adaptation actions.
6. Increase agency capacity to respond to climate change.

CLIMATE ADAPTATION PLAN

Executive Summary

Climate change threatens the ability of the USDA Forest Service to fulfill its mission by undermining the health, diversity, and productivity of the Nation's forests and grasslands. A robust climate change response aligns with the agency's core values of conservation, interdependence, safety, diversity, and service. The "USDA Forest Service Climate Adaptation Plan" outlines key climate risks to the agency's operations and critical adaptation actions to reduce these risks and help ensure that the Forest Service continues to meet the needs of present and future generations.

Figure 1 shows the focus areas associated with these adaptation actions. The focus areas reflect more specific activities that the agency can undertake across its programs to implement the overarching actions and reduce the greatest risks to the agency's mission and operations. Tribal engagement, environmental justice, workforce climate literacy, and the USDA Climate Hubs will serve as foundations for adaptation and guide how we implement the corresponding actions to achieve the desired outcomes. The Forest Service will annually evaluate progress on adaptation actions and focus areas using the Climate Action Tracker. Actions will align with other USDA and agency programs and initiatives on climate change, environmental justice, and wildfire risk.

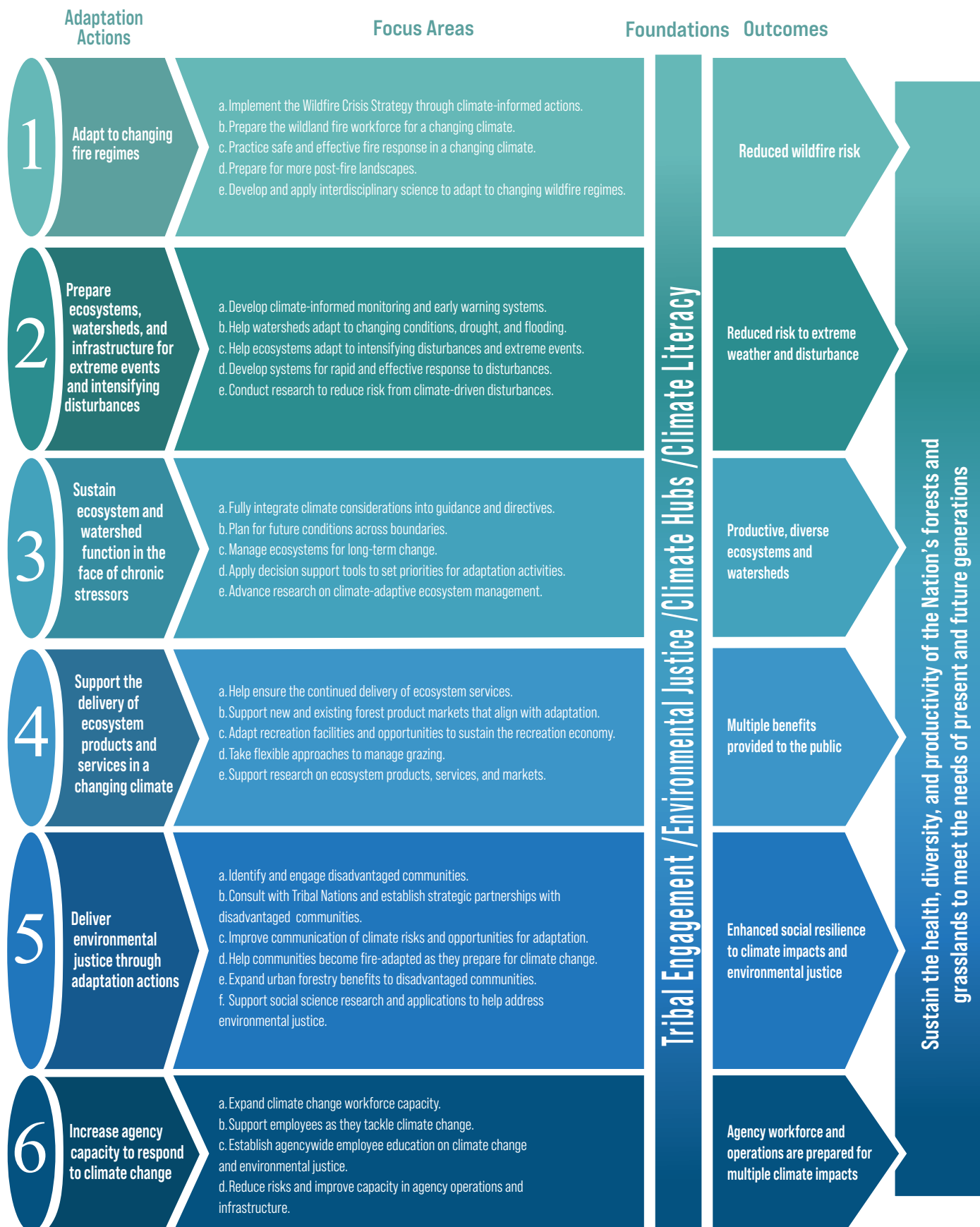


Figure 1. Overview of Agency Adaptation Actions.

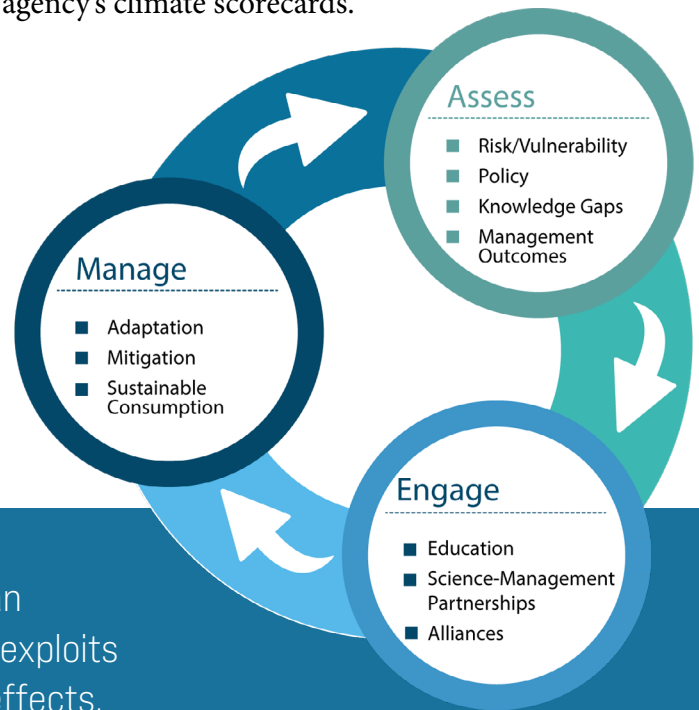
INTRODUCTION

The “USDA Forest Service Climate Adaptation Plan” presents a vision for integrating climate change adaptation into the Forest Service’s operations and mission. The plan is part of the Forest Service’s response to [Executive Order 14008: Tackling the Climate Crisis at Home and Abroad](#), which calls on Federal Departments and agencies to develop climate adaptation plans that secure environmental justice and spur economic opportunity. In October 2021, the U.S. Department of Agriculture (USDA) released its [Action Plan for Climate Adaptation and Resilience](#) to describe how the USDA is preparing for and responding to current and future impacts of climate change. As part of developing its plan, USDA issued a new departmental regulation (DR 1070-001), directing each of its agencies to update its adaptation plans. The “USDA Forest Service Climate Adaptation Plan” describes the top risks to the agency’s mission, responsibilities, and operations and outlines key actions to manage these risks.

The adaptation plan builds on the modes of action outlined in the Forest Service’s “National Roadmap for Responding to Climate Change”:

- Assessing current risks, vulnerabilities, policies, and gaps in knowledge.
- Engaging employees and stakeholders to seek solutions.
- Managing for resilience, in ecosystems and well as in human communities, through adaptation, mitigation, and sustainable consumption strategies.

These three modes of action continue to drive the agency’s work on climate change. The adaptation plan incorporates the knowledge gained and progress made in the decade since the launch of the climate change roadmap but places a new emphasis on environmental justice. To evaluate progress under the adaptation plan, the Forest Service will use a new Climate Action Tracker, which builds on previous iterations of the agency’s climate scorecards.



ADAPTATION - The adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects.

The adaptation plan builds on the modes of action outlined in the Forest Service’s “National Roadmap for Responding to Climate Change”:

Assessing current risks, vulnerabilities, policies, and gaps in knowledge.

Engaging employees and stakeholders to seek solutions.

Managing for resilience, in ecosystems and well as in human communities, through adaptation, mitigation, and sustainable consumption strategies.



The Pioneer Fire, Boise National Forest, Idaho,
2016. USDA Forest Service photo by Kari Greer.

FOREST SERVICE MISSION

The mission of the Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. The Forest Service balances the short- and long-term needs of people and nature by:

- Working in collaboration with communities and agency partners.
- Delivering world-class science, technology, and land management.
- Providing access to resources and experiences that promote economic, ecological, and social vitality.
- Connecting people to the land and one another.

The Forest Service delivers on its mission via four deputy areas: National Forest System, State and Private Forestry, Research and Development, and Business Operations. The adaptation plan identifies the risks posed by climate change to the agency's mission, reduces the impact of climate change on the agency's ability to effectively conduct its activities across all four deputy areas, and indicates ways in which the agency can adapt its actions to fulfill its mission most effectively. By taking the actions outlined in the plan, the Forest Service will also support the long-term stability of carbon in ecosystems and harvested wood products as well as reduce greenhouse gas emissions from agency operations and mitigate climate change.



The Four Forest Restoration Initiative in the Kaibab, Coconino, Apache-Sitgreaves, and Tonto National Forests, Arizona. Photo from the Mogollon Rim Ranger District of the Coconino National Forest. USDA Forest Service photo by Brady Smith.

ENVIRONMENTAL JUSTICE

The “USDA Forest Service Climate Adaptation Plan” is part of a whole-of-government approach to deliver environmental justice and spur economic opportunity for overburdened and marginalized communities. By meaningfully involving these communities in cocreating climate adaptation actions and treating them fairly, the Forest Service will help ensure that they do not suffer disproportionate adverse impacts from agency decisions and that they benefit equitably from climate adaptation activities. Executive Order 14008 emphasizes environmental justice for historically marginalized communities, including low-income, minority, Indigenous, and other disadvantaged communities. The executive order launched the Justice40 Initiative, which aims to deliver 40 percent of the overall benefits from Federal investments in climate and clean energy to disadvantaged communities. The executive order refers to “disadvantaged communities” but interim implementation guidance for departments and agencies notes that community members prefer different terms, such as “overburdened and underserved communities.”¹ The Forest Service can use the USDA Climate Hubs and new and emerging

partnerships to build capacity in communities disproportionately affected by climate change. Low-income, minority, and Indigenous communities have experienced decades of disinvestment and institutional inequities that contribute to their vulnerability to climate change. The vulnerabilities include housing insecurity; preexisting health conditions; higher rates of poverty and unemployment; the higher likelihood of living near environmental hazards and contaminated lands; and a lack of access to healthcare, clean air and water, healthy foods, green space, and transportation.

“Our mission is to sustain the health, diversity, and productivity of the Nation’s forests and grasslands to meet the needs of present and future generations—the needs of everyone, from every background and walk of life. Communities of color as well as Tribal, low-income, and minority communities already live with more environmental burdens, and they are disproportionately affected by climate change. Fulfilling our mission means instilling the principles of equity and environmental justice into all of our policies, programs, and practices, including every step we take to reduce climate-related risk.”

Chief Randy Moore

¹ See footnote 4, “<https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf>.”

ENVIRONMENTAL JUSTICE (EJ) - The fair treatment and meaningful involvement of all people regardless of race, color, culture, national origin, income, and educational levels with respect to the development, implementation, and enforcement of protective environmental laws, regulations, and policies.

FAIR TREATMENT - The principle that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences from industrial, municipal, and commercial operations or the execution of Federal, State, local, and Tribal programs and policies. In implementing its programs, the U.S. Environmental Protection Agency (EPA) has expanded the concept of fair treatment to include not only consideration of how burdens are distributed across all populations but the distribution of benefits as well.

MEANINGFUL INVOLVEMENT - Potentially affected community residents have an opportunity to participate in decisions about a proposed activity that will affect their environment and/or health. The public’s contribution can influence the regulatory agency’s decision and the concerns of all participants involved will be considered in the decision-making process. The decision-makers seek out and facilitate the involvement of those potentially affected.

TRIBAL ENGAGEMENT

In addition to the Forest Service's formal government-to-government relationships with Tribal Nations, the agency's ability to adapt to climate change depends on building trust and developing strong collaborations with Tribal Nations and other Indigenous peoples. The adaptation plan aligns with actions outlined in the upcoming publication "2022-2024 Forest Service National Tribal Relations Action Plan," a national strategic document that gives agency employees direction and assistance to help them fulfill the Forest Service's Federal Trust responsibility, honor treaty obligations, and support Tribal self-determination. The "USDA Forest Service Climate Adaptation Plan" also supports the [2021 Memorandum on Indigenous Traditional Ecological Knowledge and Federal Decision Making](#) by paving the way for collaboratively

developing climate adaptation actions that advance equity with and for the benefit of Indigenous peoples, including American Indians, Alaska Natives, Native Hawaiians, and Indigenous peoples of the U.S. territories. Traditional Ecological Knowledge, a form of Indigenous Knowledge, makes important contributions to scientific, technical, social, and economic progress in the United States. The Forest Service is committed to using this knowledge to shape its climate adaptation policies. Tribal Nations and the Forest Service can work together using their collective knowledge, experience, and resources to costeward Federal lands and contribute to the long-term sustainability of ecological and cultural resources of both Federal and Tribal lands in the face of climate change.



Yavapai-Apache Youth Dancers at Archaeology Discovery Days at V Bar V Heritage Site, Coconino National Forest, Arizona, March 2017. USDA Forest Service photo by Deborah Lee Soltesz.

RELATED INITIATIVES

The adaptation plan builds on and aligns with other department and agency policies, strategy documents, and initiatives at the interface of climate change, sustainability, and environmental justice (appendix 1). In particular, the plan aligns with key actions outlined in the [USDA Action Plan for Climate Adaptation and Resilience](#) and the [Climate-Smart Agriculture and Forestry Strategy: 90-Day Report](#). The “USDA Forest Service Climate Adaptation Plan” is supplemental to the Department’s goals to build resilience to climate change. By investing in ecosystem health, expanding education and outreach, and continuing research and development, the agency will build on the goals

established in USDA’s action plan. The Forest Service adaptation plan will use the USDA Climate Hubs to support adaptation science, technology, and tools, as called for in the USDA action plan. The Forest Service plan also echoes the need for a forest and wildfire resilience strategy highlighted in the USDA climate-smart strategy. In addition, the Forest Service plan aligns with key actions described in two recent strategic documents: the “Forest Service Equity Action Plan” and “Confronting the Wildfire Crisis: A New Strategy for Protecting Communities and Improving Resilience in America’s Forests.”



Pike Mountain Overlook, Minidoka Ranger District, Sawtooth National Forest. October 2015. USDA Forest Service photo by Nancy Brunswick.

OLD-GROWTH AND MATURE FORESTS

Old-growth and mature forests, and other forests with similar characteristics, are an ecologically and culturally important part of the National Forest System. They reside within a continuum of forest age classes and vegetation types that provides for a wide diversity of ecosystem values. Many forests with old-growth characteristics have a combination of higher carbon density and biodiversity that contributes to both carbon storage and climate resilience. They are often viewed as ideal candidates for increased conservation efforts, and are frequently found within areas designated as wilderness or roadless or other management areas where timber harvest is precluded. Even so, as climate continues to deviate from historical norms, many of these forests are expected to be at increasing risk from acute and chronic disturbances such as drought, wildfires, and insect and disease outbreaks. As a result, climate-amplified disturbances like these have become the primary threat to old-growth stands on national forests. In response, Executive Order 14072 *Strengthening the Nation’s Forests, Communities, and Local Economies* emphasizes the climate-informed stewardship of mature and old-growth forests on Federal lands, as part of a science-based approach to maintain valued characteristics and reduce wildfire risk. There is no single “right answer” in addressing the complex problem, but the spirit and practice of shared stewardship can help us generate the frank discussions necessary to consider values and risks as we find the best paths forward.

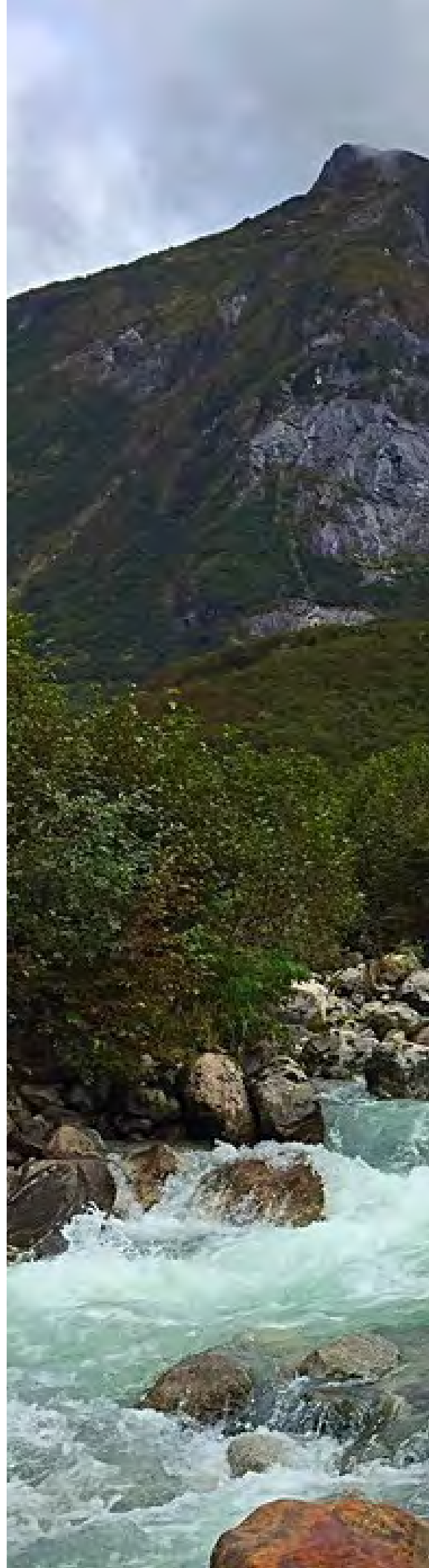
CLIMATE CHANGE IMPACTS AND ADAPTATION ACTIONS

Climate change threatens the Forest Service's ability to fulfill its mission. The wide-ranging impacts of climate change reflect the complexity of the landscapes that the Forest Service manages and the diversity of the communities that the agency serves. The Forest Service's ongoing ability to care for the land and serve people depends on its ability to adapt to climate change. Adaptation requires coordination across the Forest Service's four Deputy Areas in working toward science-based land management solutions. Adaptation actions will build on the agency's existing programs while also requiring new approaches that focus on climate change adaptation.

The Forest Service has identified six key climate-related vulnerabilities that affect its mission, grounded by the most recent [National Climate Assessment](#):

1. **Shifting wildfire regimes**
2. **Extreme events and disturbances**
3. **Chronic stressors to watersheds and ecosystems**
4. **Disruption in provisioning of forest products and services**
5. **Environmental injustice and social vulnerability**
6. **Threats to agency workforce and operations**

The first three themes represent physical and ecological threats to the agency's natural resources; the latter three reflect the social, economic, and organizational implications of those threats. Results from an agencywide survey of 648 employees, 4 workshops involving about 250 Forest Service employees, and 3 Tribal and partner engagement sessions expounded on the agency risks related to climate vulnerabilities and the potential adaptation actions (appendix 2). The six key vulnerabilities and the corresponding adaptation actions provide a framework for organizing the agency's work across Deputy Areas. Progress on these actions will be tracked annually using the agencywide Climate Action Tracker (appendix 3).



Creek into Shakes Lake Stikine Wilderness.
USDA Forest Service photo by Karen Dillman.



SHIFTING WILDFIRE REGIMES

As fire regimes shift in a warmer and potentially drier climate, the agency will face challenges in reducing risks and realizing benefits from fire. Fire season length and area burned have increased in recent decades, and these trends will likely continue as the climate further warms. With increases in area burned, there will be more high severity fires, which presents particular challenges for ecosystems and communities. In dry forest types that historically experienced frequent fires, over a century of fire exclusion and other land management practices have contributed to increased stand densities and higher fuel levels, making them vulnerable to larger and uncharacteristically severe fires. Fire is an important ecological process and a useful management tool. However, warmer and drier conditions may hinder the Forest Service's ability to manage fire for social and ecological benefits in some areas. Recent fire years offer examples of the types of historically rare fire events expected to occur more frequently under climate change, including fires burning through communities, frequent fires in forest types that historically burned infrequently, fires occurring outside of the historical fire season, and extreme fire behavior at night.

Effects of Changing Fire Regimes on Ecological Integrity

The ecological integrity of many ecosystems depends on specific fire regimes, and climate-induced changes in fire regimes will affect ecological integrity. Increases in fire may benefit some ecosystems; however, high-severity wildfires over large areas can harm old-growth forests, decrease structural and biological diversity, degrade wildlife habitat, remove soil organic matter, and leave large patches that lack surviving trees as seed sources. Fires in rangeland vegetation can facilitate the spread of nonnative grasses at the expense of native species. These effects can increase the Forest Service's reforestation workload and demands on its nursery system. Climate-intensified wildfire also affects ecological integrity by interacting with other extreme events, disturbances, and chronic stressors such as drought.

Consequences of Shifting Fire Regimes for Multiple Use

The effects of climate change on wildfire have consequences for the delivery of goods and services from the Nation's forests and grasslands. For

example, uncharacteristically large and severe fires affect watershed function, increasing erosion and vulnerability to landslides. Downstream water users may experience decreases in water quality and increased costs of removing sediment and debris from reservoirs, and these impacts can persist years after a fire. These types of fires can have adverse effects on habitat for some wildlife species, especially those that rely on old-growth forests and other late-successional habitats. Burned landscapes present hazards to recreationists, and the increasing area burned is adding to the workload for agency staff in providing safe and desirable recreational opportunities.

Impacts of Changing Fire Regimes on Communities

Changing fire regimes affect people and their well-being. More people are moving into areas at high risk from wildfire, which elevates the threat to lives and property. Smoke from wildfires adversely impacts public health in urban and rural communities located near and far from wildfires, especially for people with preexisting health conditions and limited access to high-quality healthcare. Wildfires and postfire flooding can damage homes; pollute drinking water; and imperil roads, electrical transmission systems, and other critical infrastructure. Fire damage to local infrastructure imposes a higher burden on low-income, minority, and Indigenous peoples who are less likely to be mobile than the general population. For Indigenous peoples and others with spiritual connections to the landscape, catastrophic wildfires can damage sacred sites, cultural resources, and the fabric of communities. Cultural survival is further threatened because the identity and spirituality of Tribal Nations and Indigenous peoples are inextricably tied to ancestral homelands.



Caldor Fire aftermath on Lake Tahoe Basin, California. USDA Forest Service photo by Cecilio Ricardo.

Impacts of Changing Fire Regimes on Mission and Operations

Fires and threats associated with extreme fire danger may hinder the agency's ability to deliver on its mission. As droughts become more frequent and severe in some areas, managers may need to place temporary limits on public access to national forests and grasslands to reduce risks from human-caused ignitions and avoid evacuating visitors when fires occur. Extreme fire danger and longer, more intense fire seasons can also keep the Forest Service from conducting mechanical treatments and from using both planned and unplanned ignitions to reduce wildfire risk and restore ecological integrity.

Longer fire years and more unpredictable wildfires are taxing for all Forest Service employees and especially

for wildland firefighters. Climate change can exacerbate existing stress from economic and housing insecurity faced by firefighters and create additional stress of a longer and more active fire season. Changes in fire behavior also present risks to wildland firefighter safety. In areas affected by insect outbreaks, hazards may include more downed fuels and standing snags. Higher summer temperatures elevate the health and safety risks faced by firefighters. The Forest Service's reliance on a primarily seasonal firefighting workforce complicates preparations for longer fire years. As fires rise in number and duration, employees from across the Forest Service are increasingly called upon to support wildland fire suppression and Burned Area Emergency Response (BAER), taking employees away from fulfilling their primary duties and completing other mission-critical work.



Firefighters march into action to provide hose laying support in the Rogue River-Siskiyou National Forest, Oregon. USDA Forest Service photo by Cecilio Ricardo.

ACTION 1

ADAPT TO CHANGING FIRE REGIMES

Climate change intensifies the need for the Forest Service and the communities it serves to determine how to safely coexist with wildfire. Realizing the benefits of fire for ecosystems and communities while reducing the risks will mean helping landscapes, communities, and the wildland fire workforce adapt to novel fire regimes, longer fire years, and more area

burned. Adaptation will build on existing plans and programs for reducing wildfire risk, including the measures described in the Forest Service's Wildfire Crisis Strategy and funded through the Bipartisan Infrastructure Law. Adaptation will also benefit from innovation in light of rapidly changing landscapes and emerging science.

1a: Implement the Wildfire Crisis Strategy through climate-informed actions

In early 2022, the Forest Service released the Wildfire Crisis Strategy, with the 10-year goal of treating an additional 20 million acres on the National Forest System and an additional 30 million acres on other lands for fuels and forest health. The strategy responds to the effects of climate change in degrading forest health and elevating wildfire risk, especially in the Western United States, by funding activities aligned with climate adaptation goals related to wildfires. The agency will integrate climate change considerations into landscape prioritization, treatment design, and implementation of wildfire risk reduction activities funded by the Bipartisan Infrastructure Law. Treatments can help prepare landscapes for the impacts of other climate-intensified disturbances, including insect outbreaks.



The 2022 Interagency Wildland Fire Briefing. USDA Forest Service photo.

1a SUPPORTING ACTIVITIES

- Explicitly consider how climate change affects fire regimes and other disturbances when identifying treatment locations and types at scale.
- Increase the use of planned and unplanned ignitions across shared landscapes while accommodating seasonal shifts in burning opportunities and other implementation challenges brought on by climate change.
- Carry out thinning treatments that reduce near-term wildfire risks and allow landscapes to accommodate beneficial fire, thereby facilitating long-term adaptation to climate-related changes in wildfire and other disturbances and stressors.
- Collaborate with Tribal Nations and Indigenous peoples to practice cultural burning to reduce risks to communities and cultural resources, integrating Indigenous Traditional Ecological Knowledge into Forest Service land management practices, as appropriate.

1b: Prepare the wildland fire workforce for a changing climate

Changing fire regimes directly affect the daily work of wildland firefighters, and a central element of adapting the Forest Service to climate change involves preparing the wildland fire workforce for climate-driven fire years. The Bipartisan Infrastructure Law provides support by raising firefighter pay in certain regions, shifting positions from seasonal to permanent, and spurring the development of a wildland firefighting job series. However, sustained efforts are necessary to recruit, train, and retain skilled wildland firefighters and offer them nonfire opportunities in the agency should they choose to take them. Continuity of professional experience will enable continued improvement in approaches for managing fire under changing conditions. The Forest Service will grow its year-round workforce capacity to conduct prescribed fire and other activities at the appropriate scale to effect meaningful change.

Two firefighters with the Blue Ridge Hot Shots, climb a steep mountain with arduous lava rocks to battle the Dixie Fire in Lassen National Forest. USDA Forest Service photo by Cecilio Ricardo.

1b SUPPORTING ACTIVITIES

- Help ensure that pay structures, benefits, and promotion opportunities support wildland firefighters and their families enough to retain them in the agency, in part for their experience and institutional knowledge.
- Expand the Forest Service's capacity for year-round fire response and fuels treatments through actions such as creating more year-round wildland firefighting positions, providing firefighters sufficient time off between assignments to rest and recuperate, or developing a separate workforce dedicated to prescribed fire and fuels treatments.
- Expand the capacity of incident management teams to prepare for more complex fire events happening concurrently around the country and the need to use planned and unplanned ignitions to reduce wildfire risk.
- Through training and support, expand the capacity of the agency's non-firefighter workforce to conduct critical elements of suppression and post-fire recovery such as resource advisors and BAER personnel.



1c: Practice safe and effective fire response in a changing climate

Climate change is escalating the occurrence of extreme fire conditions, threatening firefighter and public safety and presenting challenges to effective fire management. Climate change is also contributing to the increasing size and severity of wildfires each year. Adapting to change requires processes and structures that enable safe and effective fire responses across a wide range of conditions and allow managers to use wildfires to achieve management objectives when possible.

1c SUPPORTING ACTIVITIES

- Prepare for synchronized large fire events across multiple regions in the Western United States as temperatures rise and some of these become drier.
- Integrate climate change into prefire planning, decision support tools, and risk management approaches (such as potential operational delineations and the Wildland Fire Decision Support System) to help ensure that wildland fire response is safe and effective and helps ecosystems adapt to climate change.
- Improve understanding of fire behavior and fire effects in forests and other ecosystems that historically have not burned frequently but may experience increased fire due to climate change.

The 2022 Interagency Wildland Fire Briefing. USDA Forest Service photo.



1d: Prepare for more post-fire landscapes

As fire behavior changes, the Forest Service needs new approaches to managing postfire landscapes. In some instances, fires may help reduce fuel loads, creating landscape mosaics with different forest structures that encourage regeneration. The Forest Service will capitalize on such outcomes to move landscapes towards conditions that are adapted to climate change while reducing wildfire risk and delivering ecosystem goods and services. In other situations, uncharacteristically large and severe fires may have adverse impacts on ecological integrity, soils, watersheds, and the ability of postfire landscapes to recover enough to continue providing ecosystem services. Such landscapes may need restoration, reforestation, and postfire fuels management. Adaptation in these contexts will involve reducing risks from postfire hazards and facilitating the recovery of postfire landscapes.



Tree planters planting Whitebark pine seedlings in Skyland area, Flathead National Forest, MT. USDA Forest Service photo by Erika Williams.

1d SUPPORTING ACTIVITIES

- Increase the capacity of the BAER program and its workforce; including soil scientists, hydrologists, and other specialists; to immediately treat severely burned large landscapes and reduce risks to safety, access, water quality, and critical natural resources.
- Implement the Burned Area Recovery program to address nonemergency postfire restoration needs and adapt recovering ecosystems to changing climate conditions.
- Quickly and effectively remove hazardous trees to improve access to burned landscapes shortly after wildfires.
- Implement fuels treatments, including planned ignitions, to reduce risks of reburns and take advantage of the beneficial effects of wildfires for ecological integrity.
- Carry out longer term postfire restoration, regeneration, and planting, including strategies based on the best available science to facilitate transitions to ecosystems that are adapted to future climates where appropriate.
- Use partnerships to increase nursery capacity, native seed collection, and other activities that support reforestation and restoration.

1e: Develop and apply interdisciplinary science to adapt to changing wildfire regimes

The Forest Service has a strong track record of actionable science on fire behavior, fire ecology, and risk management. Continued research will give managers the information they need to understand drivers of wildfire change, prepare for changing wildfire conditions, and manage for landscapes resilient to damaging fire. Social science research on fire will help the agency understand how managers approach wildfire in a warming world, how the public and communities perceive the topic, and how to bring together these different perspectives.

Fire behavior packages positioned by Bret Butler of the Rocky Mountain Research Station capture data from flaming front as it curled over the ridge top. USDA Forest Service photo by Roger Ottmar.

1e SUPPORTING ACTIVITIES

- Collaborate with managers and Tribal Nations on research that advances understanding of wildfire risk to ecosystems and communities, supports effective fuel treatments, and enables adaptation to changing wildfire fire regimes, including participatory research with Tribal Nations and Indigenous peoples that incorporates Indigenous Traditional Ecological Knowledge.
- Deliver science that facilitates safe and effective wildfire response, including tools that project wildfire probability and behavior, smoke issues, and carbon emissions under a changing climate.
- Advance social science research to better understand perceptions of wildfire risk, fuels treatment options, and barriers to and opportunities for expanded use of planned and unplanned ignitions as management tools.
- Provide research to support managers in preparing for novel climate conditions, facilitating landscape transitions, and articulating emerging management objectives.



EXTREME EVENTS AND DISTURBANCES

Climate change will contribute to more frequent and intense extreme events and disturbances in addition to wildfire, including floods, drought, hurricanes, insect and disease outbreaks, and the spread of invasive species. These disturbances already affect the Nation's forests and grasslands but will likely increase in intensity and frequency because of climate change. Flooding may increase in many of the Nation's watersheds due to changes in precipitation patterns and hydrologic processes. Increased warming of the global system will likely result in more intense hurricanes and other storms, and increase the likelihood of extreme droughts in many parts of the United States. Biological disturbance agents, including insects, pathogens, and invasive plant and animal species, will contribute to the loss of ecological integrity through increased mortality and competition with native species. These extreme events and disturbances, including wildfire, can interact and be compounded by one another.

Flooding, Heavy Rains, and Geologic Hazards

Precipitation patterns are already changing and will likely change further because of climate change. In some parts of the country, rainfall is becoming more concentrated in fewer but more intense storms. Increases in ocean temperatures may result in more intense rain from hurricanes in the Southeast and atmospheric rivers and other storms along the West Coast. Coupled with earlier snowmelt from warmer weather, heavy rains are contributing to increased flooding in some areas. The effects can lead to landslides, debris flows, and other geologic hazards, especially in burned areas or areas with highly erodible soil. Flooding damages Forest Service roads and infrastructure, particularly near stream crossings and along streams. Many recreation sites are located along streams and rivers, where flash floods can endanger recreationists and damage recreation infrastructure. Hillslope erosion can remove soil, affecting long-term forest productivity.

Floods involving rivers and streams that originate in national forests have caused significant damage and loss of life in downstream communities. For example, the 2013 Colorado Front Range floods occurred in several river basins that transect national forest lands, resulting in the loss of lives, evacuations, and destruction of nearly 20,000 structures. In recent years, mudslides in burned areas following heavy precipitation have caused shutdowns of interstate highways in Colorado and Oregon and extreme rain has caused significant damage to Forest Service infrastructure in the Midwest and Northeast. These effects on transportation systems have impacted nearby communities and disrupted national and local economies. Such events may occur more frequently or be more severe because of climate change.

Intensified Drought and Heat Waves

Many ecosystems are having more frequent and severe droughts due to warmer temperatures, altered precipitation patterns, and reduced snowpack. Even in places with more annual precipitation, soil moisture may decline as evapotranspiration rises with higher temperatures. Drought elevates the vulnerability of ecosystems to disturbances, including wildfires and outbreaks of insects and some pathogens. Drought can result in forest mortality, decreased forest and rangeland productivity, and regeneration failures. Riparian areas and wetlands may have lower water levels, altering habitats for aquatic and terrestrial species. In some areas, increased demand for water from downstream communities and agricultural producers may lower water levels in streams as well as reservoirs and other water bodies on national forests, depriving visitors of water-based recreational opportunities. The ecological effects of drought may also affect valued cultural resources. For example, recent droughts in the Southwest have contributed to the large-scale mortality of piñon pine, a tree valued by communities for pine nuts and fuelwood. Intense heatwaves, like on the West Coast in 2021, may damage forests and cause fatalities and adverse health impacts on human communities. Without adaptation, the likelihood of annual water shortages is likely to rise in many parts of the United States, with disproportionate adverse impacts on water sources for disadvantaged communities and resources relied on by Tribal Nations and other Indigenous peoples.

Insect and Pathogen Outbreaks

Dry conditions amplified by climate change increase the likelihood of insect outbreaks. Warmer temperatures can directly influence population growth for many native and introduced insect species while reducing the chances of winter mortality that controls insect populations. Warmer, drier conditions increase stress on host trees, reducing their capacity to defend themselves against insect pests. Widespread tree mortality from drought and bark beetle outbreaks, such as that in the Sierra Nevada of California in the mid-2010s, can contribute to increased wildfire severity in some instances. Recent outbreaks of spruce beetle and mountain pine beetle have occurred throughout the Western United States during a multidecadal dry period that started in the early 2000s. Tree mortality from these outbreaks can reduce scenic qualities valued by recreationists. The outbreaks can create hazards for wildland firefighters, Forest Service employees, and visitors to national forests. In other parts of the country, wetter conditions may increase the presence of some fungal pathogens of insects, which can reduce populations of some defoliators and potentially benefit some tree species. Forest structural

changes from insect outbreaks also alter wildlife habitats and water availability for downstream users. As temperatures warm and bark beetles increase reproductive capacity at higher elevations or shift into new habitats, the agency may face increasing difficulty in restoring whitebark pine, a culturally and ecologically important species under consideration for listing under the Endangered Species Act.

Climate change may also exacerbate the impacts of native and introduced tree pathogens. Warmer, drier conditions in some parts of the country may support the success of some pathogens and limit the success of others, depending on their temperature requirements and water relations. Warmer, drier climates may also increase host susceptibility to tree pathogens, causing tree decline and mortality. Tree pathogens can also interact with other climate-related disturbance processes to reduce productivity and overall forest health. For example, water molds such as the fungus that causes sudden oak death may be less successful in drier conditions but thrive in areas with increased moisture, whereas white pine blister rust has moved upslope under warming conditions causing tree mortality in high-elevation forests.



Impact from ongoing spruce beetle infestation that has caused more than 50 percent mortality on Engelmann spruce as of 2021 at the headwaters of the Pecos River within the Pecos wilderness, Santa Fe National Forest. USDA Forest Service photo by Daniel Ryerson.

Invasive Species and Climate Change

More disturbances, coupled with warmer temperatures and changes in precipitation, facilitate the spread and establishment of invasive plant and animal species. Many invasive plant species can outcompete native vegetation, especially under changing climate conditions. In the Eastern United States, plants such as kudzu and other vine species are spreading under warmer and wetter conditions. In the West, annual grasses like cheatgrass benefit from increased wildfire, quickly spreading into burned areas where their high flammability increases the likelihood of recurring fires. The spread of invasive grasses in desert ecosystems increases fuel continuity, allowing fires to spread into areas where they historically would not have and where iconic species like saguaro are not tolerant of fire. Invasive plants can also affect wildlife habitats. For example, the spread of cheatgrass is increasingly affecting sensitive sagebrush habitats in the Great Basin, hindering efforts by the agency and its partners to conserve and restore sage-grouse populations.

In addition to invasive plants, the agency faces ongoing challenges from invasive aquatic and terrestrial animal species in connection with climate change. For example, native cutthroat trout throughout the Western United States will contend with the compounding effects of warming streams and invasive fish species that can outcompete native trout. Nonnative insect species, such as emerald ash borer and hemlock wooly adelgid, may also be able to spread northward and to higher elevations with warming winter temperatures, leading to tree mortality and reduction in ecological integrity.

Hurricanes and Sea Level Rise

Forests in tropical and coastal areas may face unique climate threats. Warmer sea surface temperatures contribute to higher winds and more rainfall intensity from tropical storms, even in areas far from coastal lands. Storms with high winds and torrential rains topple and damage trees; compromising ecosystem services and destroying communications, energy, and transportation systems relied upon by Forest Service employees and surrounding communities. Sea level rise may also make coastal areas more susceptible to storm surges, and standing water and salinity can reduce tree growth and kill trees.

In recent years, hurricanes have had significant impacts on national forests in the Southern Region. In 2017, for example, Hurricanes Irma and María occurred 2 weeks apart, damaging millions of trees over wide swaths of forest and resulting in the 4-year closure of the El Portal Visitors Center on Puerto Rico's El Yunque National Forest, the National Forest System's only tropical rain forest. Other national forests in the Southeast, including the Francis Marion National Forest in coastal South Carolina and the national forests in Mississippi, have also experienced devastating impacts from hurricanes in recent years. These events also demonstrate how hurricanes can increase the risks of landslides, flooding, and debris flows.

ACTION 2

PREPARE ECOSYSTEMS, WATERSHEDS, AND INFRASTRUCTURE FOR EXTREME EVENTS AND INTENSIFYING DISTURBANCES

Adapting to rapid shifts in disturbance regimes will involve building on the agency's ongoing work to restore and maintain functioning ecosystems and watersheds, while simultaneously coping with new and intensified stressors. The Forest Service will modify the design, intensity, location, and timing of ongoing management activities and pursue new approaches as conditions rapidly change. Flexible management will

become especially important, and managers will need to consider new ways of responding to disturbances, recognizing when restoring historical conditions is no longer possible. Managers and partners will need effective monitoring, research, and communication systems to manage risk and to rapidly and effectively respond to disturbances.

2a: Develop climate-informed monitoring and early warning systems

Integrating information on climate conditions with monitoring data will help managers allocate resources to areas most at risk and understand climate-driven changes in real-time. Monitoring and early warning systems will help managers anticipate rapid changes and respond to disturbances. Such systems will be tailored to detect the shifts and increased variability of disturbances associated with climate change. Robust forewarning and real-time information will help Forest Service managers to act quickly and reduce risks to landscapes and people.



The Healthy Homes Partnership is helping flood victims in Louisiana recover and rebuild. USDA Forest Service photo.

2a SUPPORTING ACTIVITIES

- Integrate satellite-based remote sensing into aerial and field surveys to broaden Forest Health Monitoring survey coverage for early detection and rapid response to climate-driven insect and disease disturbances.
- Use information on climate and disturbances for early detection and rapid response to invasive species in the areas most at risk.
- Work with partners to use flood forecasting and early warning systems to protect visitors on public lands and people in local communities, especially near burned areas.
- Integrate information on drought, rainfall, and temperature changes into the holistic monitoring, assessment, and reporting of wildfires, insect outbreaks, forest blowdowns, and other disturbances.
- Collaborate internally and externally in disaster planning, preparation, response, and recovery.
- Honor and incorporate Indigenous Traditional Ecological Knowledge to inform climate-related monitoring.

2b: Help watersheds adapt to changing conditions, drought, and flooding

Land managers will prepare streams, rivers, lakes, and reservoirs for climate change so that downstream communities continue to get clean and abundant water from the Nation's forests and grasslands, even after extreme events. Functioning watersheds can absorb large pulses of water from heavy rain and rapid snowmelt while also weathering the effects of intense droughts. The Forest Service has decades of experience in watershed restoration, including reconnecting streams to floodplains, adding wood structures to rivers, rightsizing culverts, and decommissioning unneeded roads. The agency will adjust these activities to incorporate the effects of climate change into project prioritization, planning, and implementation to increase the odds of success in a changing climate.

2c: Help ecosystems adapt to intensifying disturbances and extreme events

Land managers will help ecosystems resist the effects of disturbances and build resilience to enable recovery. In some forests, this may include treatments to reduce tree densities, maintain species diversity, or create heterogeneous landscapes that can withstand droughts and insect outbreaks while continuing to maintain forest cover at the landscape scale. In rangelands, managing for diverse native plant communities may help prepare ecosystems for drought and intensifying disturbances, including the spread of invasive species. As the Forest Service scales up vegetation management to reduce wildfire risk, treatments will need to reduce risks not only from wildfire but also from other disturbances.

2b SUPPORTING ACTIVITIES

- Implement projects that improve watershed function and prepare streams, rivers, and other water bodies for extreme events, flooding, and changes in hydrology.
- Design and maintain infrastructure, including roads, buildings, and stream crossings, to accommodate increases in flooding and geologic hazards such as landslides through the Legacy Roads and Trails Program and funding provided by the Great American Outdoors Act.
- Assess landscapes for geologic hazards (such as landslides) induced by heavy rains and reduce risks to priority areas.

2c SUPPORTING ACTIVITIES

- Design wildfire risk reduction and forest restoration treatments to account for multiple climate-driven disturbances.
- Increase the resistance of rangeland vegetation to invasive grasses through active management and research, considering vulnerability to climate change, increased fire, and other disturbances in prioritizing treatments.
- Manage for forest ecosystem structure and species composition adapted to disturbances such as sea-level rise, flooding, and high wind events such as hurricanes, tornadoes, and derechos. Manage for urban forests that are adapted to drought, heatwaves, insects, pathogens, and other disturbances.

2d: Develop systems for rapid and effective response to disturbances

The Forest Service will need systems for a rapid and effective response to disturbances. Quick and effective treatments will help stop the spread of insects, diseases, and invasive species before they become serious problems. Climate change may limit treatment effectiveness, especially for novel invasive species or for native insects introduced through climate-induced range shifts. Interdisciplinary approaches in collaboration with other Federal agencies, Tribal Nations, States, and other partners stand the best chance of success, especially when decisive, quick, and large-scale actions are needed.

2e: Conduct research to reduce risks from climate-driven disturbances

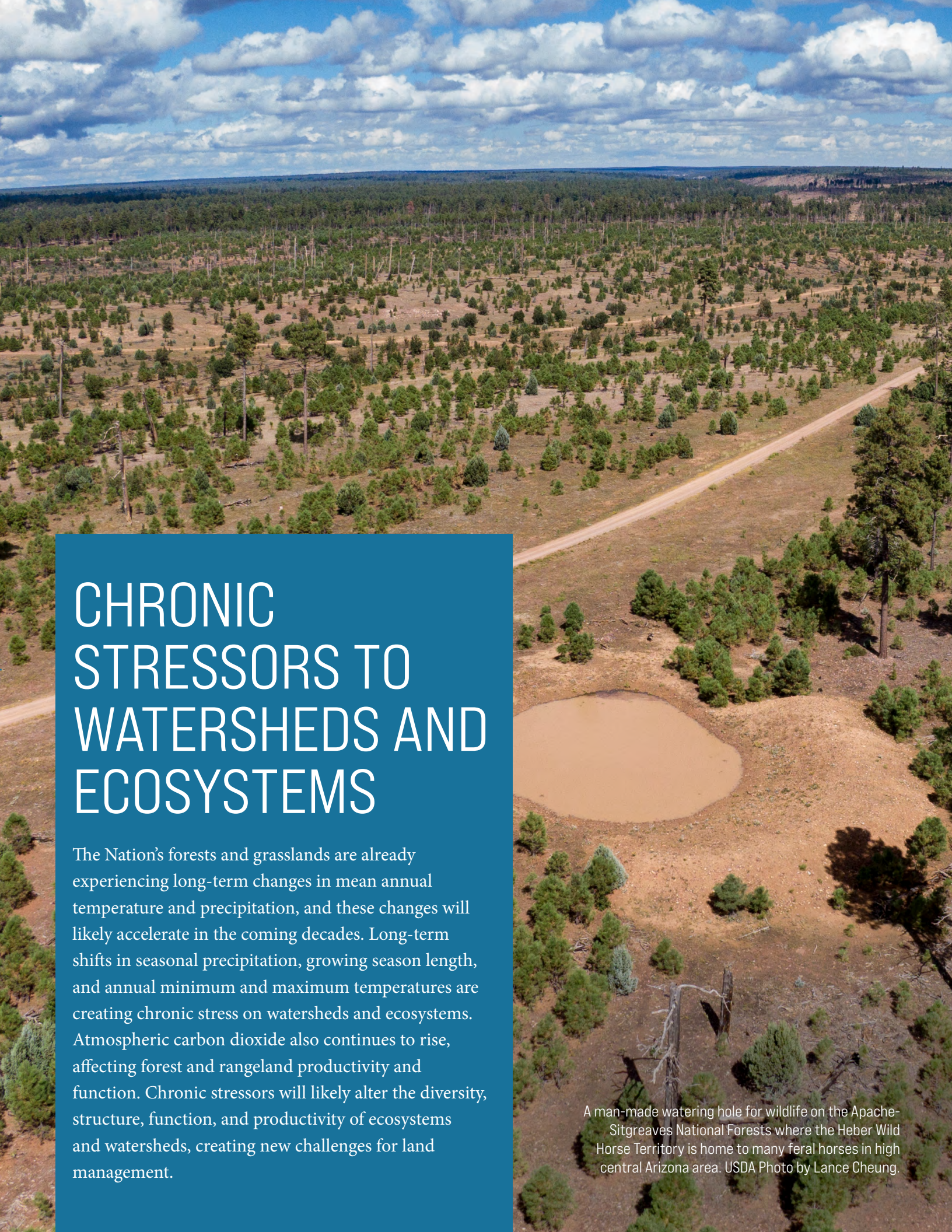
Through research, the Forest Service provides critical information on the extent and severity of disturbance effects and their implications for ecosystems and communities. Researchers will help the Forest Service understand the effects of climate-related disturbances, identify risks, and test mechanisms to prepare for and recover from these events. Studies of past disturbances, current research initiatives, and emerging techniques will help agency employees and partners learn how to support climate adaptation.

2d SUPPORTING ACTIVITIES

- Conduct National Environmental Policy Act analyses in a strategic manner and at the right scale, facilitating the expedited implementation of adaptation actions before and after disturbance events where appropriate.
- Aid urban and rural communities and nonindustrial private landowners in responding to insect outbreaks, pathogens, and severe weather events through the Urban and Community Forestry and Forest Stewardship programs.
- Manage permits for flexibility in timing and intensity of use to allow for agile responses to drought.

2e SUPPORTING ACTIVITIES

- Characterize disturbance processes and effects of new climatic conditions and identify disturbance-prone landscapes to support adaptive management.
- Develop science to support best management practices, frameworks, and tools to support the adaptation of species, ecosystems, communities, and landscapes to climate-related disturbances.
- Use inventory, monitoring, and long-term research at experimental forests and ranges to evaluate the effectiveness of management actions to help ecosystems adapt to the effects of climate-driven disturbances.
- Use social science and collaborative methods to assess risk, perceptions, barriers, equity, and the role of governance networks in climate adaptation and disaster planning and preparedness.

An aerial photograph of a vast, dry forest landscape. A dirt road winds through the middle ground, and a small, muddy watering hole is visible in the lower right. The sky is filled with large, white clouds. The foreground and middle ground are covered with numerous small, green trees and shrubs, interspersed with bare, brownish ground. In the background, a dense line of taller trees marks the horizon under a bright blue sky with scattered white clouds.

CHRONIC STRESSORS TO WATERSHEDS AND ECOSYSTEMS

The Nation's forests and grasslands are already experiencing long-term changes in mean annual temperature and precipitation, and these changes will likely accelerate in the coming decades. Long-term shifts in seasonal precipitation, growing season length, and annual minimum and maximum temperatures are creating chronic stress on watersheds and ecosystems. Atmospheric carbon dioxide also continues to rise, affecting forest and rangeland productivity and function. Chronic stressors will likely alter the diversity, structure, function, and productivity of ecosystems and watersheds, creating new challenges for land management.

A man-made watering hole for wildlife on the Apache-Sitgreaves National Forests where the Heber Wild Horse Territory is home to many feral horses in high central Arizona area. USDA Photo by Lance Cheung.

Changes in Forest and Grassland Productivity and Composition

Long-term shifts in annual precipitation and temperature contribute to changes in the productivity of—and the distribution of plant and animal communities on—our Nation’s forests and grasslands. In places where cold temperatures currently limit vegetation growth, increased warming may lead to rising productivity and the expansion of forests into higher elevations or latitudes. Places where moisture availability is a limiting factor may experience decreased forest productivity or lack of regeneration, sometimes leading to conversion from forests to grasslands or shrublands. Long-term changes in carbon dioxide and moisture availability will likely affect rangeland productivity and the quantity and quality of forage for livestock and wildlife grazing. As the agency revises land management plans under the 2012 regulations for the National Forest Management Act, planning teams will need to consider how these

long-term ecosystem shifts may push systems outside of the natural range of variability and, in turn, how these effects will impact ecological integrity.

Stress on Soils, Watersheds, and Aquatic Systems

Long-term changes in temperature and precipitation will also contribute to shifts in hydrologic cycles, affecting soils, watersheds, and aquatic ecosystems. In many parts of the United States, changes in the timing and nature of precipitation will lead to more variable streamflow, with higher peak flows and lower minimum flows. As temperatures warm, some watersheds will likely undergo shifts from snow-dominated to rain-dominated hydrology. Warmer water temperatures are affecting coldwater-dependent aquatic species that are important for ecosystems, Indigenous peoples, and recreationists. Altered precipitation regimes, earlier snowmelt, and reduced snowpack can affect water supplies for downstream communities. Long-term reductions in precipitation



A young horse and Angus bull take in the morning light on the Gravelly Mountain Range in the Beaverhead-Deerlodge National Forest. USDA Forest Service Photo by Preston Keres.

in some regions may also affect groundwater recharge, leading to long-term losses in water availability for municipal services and agriculture. Interactions between climate and wildfires also pose increased threats to watershed hydrology, soils, aquatic ecosystems, and riparian communities. Such dynamics can degrade soil and watershed condition and create obstacles to restoring high-priority watersheds.

Effects on Wildlife and Plant Biodiversity

Changes in ecosystem productivity, distribution, and water availability will affect plant and wildlife biodiversity, habitats, and abundance. Climate change impacts on aquatic and terrestrial ecosystems will alter ecological processes and amplify other anthropogenic threats to species and habitats, such as land-use conversion to developed uses. Managing for species with limited habitat requirements may become more challenging, especially for species in high-elevation or extreme northern habitats and species with narrow

habitat requirements and low tolerance or resistance to environmental change. Ecosystem changes may affect the distribution and viability of threatened, endangered, and other at-risk species. These impacts will test the agency's ability to conserve habitat and contribute to the recovery of species listed under the Endangered Species Act. More effort and investment may be required to stay in compliance with the Endangered Species Act, and more coordination may be needed with other agencies that have regulatory oversight of listed species.

Climate change threatens biodiversity as habitats shift, and species with wide habitat ranges, including nonnative invasive species, outcompete species with narrower requirements. Climate change may also alter wildlife migration patterns, create asynchronies between plants and pollinators, contribute to plant and wildlife disease, and lead to novel combinations of species that did not previously coexist. People who depend on these species for economic, cultural, or recreational purposes may lose species that they value in some places.



A Greater Sage-Grouse male in the Curlew National Grassland performs his mating display by spreading his plumage, strutting, and inflating his air sacks on his breast. USDA Forest Service photo by Kathleen Gorby.

ACTION 3

SUSTAIN AND IMPROVE ECOSYSTEM AND WATERSHED FUNCTION IN THE FACE OF CHRONIC STRESSORS

As chronic stresses mount in a changing climate, the Forest Service will help ecosystems and watersheds maintain their core functions and integrity. Unless the agency takes action, ecosystems and watersheds might adapt on their own, but core functions and

integrity might not persist. Integrating climate science and decision support tools into program and project planning, guidance, and implementation will help the Forest Service place the right adaptation actions in the right places.

3a: Fully integrate climate considerations into guidance and directives

Managers and decision-makers rely on guidance and directives to shape their actions. The Forest Service directive system serves as the primary basis for managing programs and the primary source of administrative direction for Forest Service employees. Directives will be revised, as appropriate, to provide direction for incorporating climate change into management decisions and allowing for management flexibility under rapidly changing conditions. In addition, the Forest Service has selection criteria for competitive funding for internal projects and assistance to State and private entities. Including climate change considerations in the selection criteria will enable projects to account for climate-related threats. The Forest Service needs to review and update its guidance to allow for and encourage adaptation actions.

3a SUPPORTING ACTIVITIES

- Update guidance and directives in the Forest Service directive system to facilitate climate change adaptation, where appropriate.
- Provide guidance and assistance to national forests and grasslands on the appropriate use of assisted migration as a management tool in partnership with other Federal agencies, Tribal Nations, States, and other partners.
- Integrate climate change adaptation into guidance and criteria for proposals for competitive funding, including through Cooperative Forestry programs, the Collaborative Forest Landscape Restoration Program, the Joint Chiefs Landscape Restoration Program in collaboration with the USDA, Natural Resources Conservation Service, and other programs authorized under recent legislation such as the Bipartisan Infrastructure Law and the Great American Outdoors Act.

3b: Plan for future conditions across boundaries

The pace and scale of climate change require the Forest Service to think at broader spatial scales and time horizons. Spanning jurisdictional and ecological boundaries, climate change will require planning to account for landscape-scale change. Planning for desired future conditions that accounts only for past climatic conditions leaves forests and grasslands at risk of no longer being able to sustain ecological integrity and provide multiple benefits to the public. Cross-boundary plans grounded in science on long-term landscape-scale trends and climate projections will help the Forest Service prepare for ongoing and anticipated changes.



Close-up view of hands surrounding a pine tree seedling freshly planted. USDA Forest Service photo.

3b SUPPORTING ACTIVITIES

- Fully integrate climate vulnerability assessments and adaptation strategies into land management planning and other planning across landscapes.
- Work with Federal agencies, Tribal Nations, States, and other partners to conserve, connect, and restore 30 percent of America's lands and waters by 2030, in alignment with the goals outlined in "Conserving and Restoring America the Beautiful."
- Use mechanisms such as the Tribal Forest Protection Act, Good Neighbor Authority, and Shared Stewardship agreements to work with Tribal Nations, States, and other partners to reduce climate-related risks to ecosystems.
- Honor Tribal sovereignty and respect for Tribal trust and treaty rights through consultations with Tribal nations on all actions affecting cultural, natural, and sacred sites on public lands.
- Provide science and technical assistance for climate adaptation planning in other countries through Forest Service International Programs.
- Use regional and national assessments, such as the Resource Planning Act assessment, to understand the effects of climate change, land use change, and other factors on the status and trends of renewable resources in long-term planning.

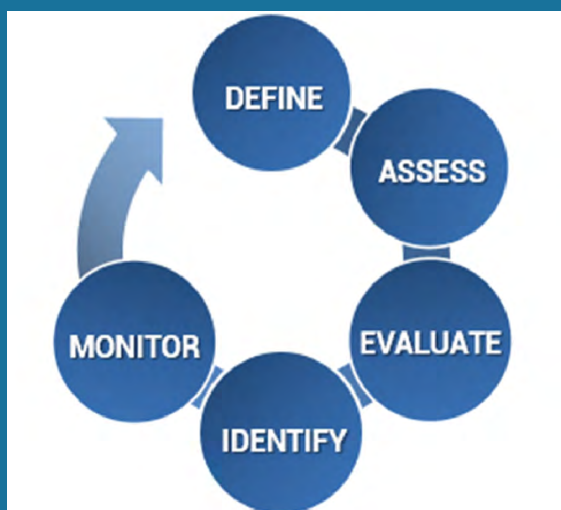
3c: Manage ecosystems for long-term change

On-the-ground management will require a wide range of actions to protect at-risk plant and animal species and ecosystems, improve ecosystem resilience, and in some cases facilitate transitions to more climate-adapted conditions. The Forest Service will employ tested, science-based adaptation actions to maintain ecosystem function in balance with other social, economic, and cultural values; not all actions will be appropriate everywhere. Actions will ultimately depend on local goals and objectives and will be guided by local expertise, Indigenous Traditional Ecological Knowledge, and scientific research.

3c SUPPORTING ACTIVITIES

- Support climate-informed reforestation and restoration, using climate decision support tools to assist in native seed sourcing and planting climate-adapted nursery stock where appropriate.
- Incorporate prescribed and cultural burning as well as the use of unplanned ignitions into land management practices, where appropriate.
- Increase conservation and recovery efforts for at-risk plant and animal species in partnership with other Federal and State agencies and in consultation with Tribal governments.
- Identify and protect climate refugia, such as coldwater streams and cool microclimates, as well as movement corridors for species migration.
- Help wildlife populations adapt to climate change by increasing redundancy and heterogeneity of habitat, decreasing other stressors, and improving connectivity.

ADAPTATION WORKBOOK



The [Adaptation Workbook](#) is a structured process to consider the potential effects of climate change and design land management and conservation actions that can help prepare for changing conditions. The process is completely flexible to accommodate a wide variety of geographic locations, ownership types, ecosystems and land uses, management goals, and project sizes.

The Workbook consists of 5 basic steps:

1. Define goals and objectives
2. Assess climate impacts and vulnerabilities
3. Evaluate objectives considering climate impacts
4. Identify adaptation approaches and tactics for implementation
5. Monitor effectiveness of implemented actions

3d: Apply decision support tools to set priorities for adaptation activities

The Forest Service manages 193 million acres of Federal land. Managing such a large land base requires managers to focus on actions where most needed; in some cases, the best course of action may be no action at all. The Forest Service has already developed numerous decision support tools that help managers identify if, when, where, and how to apply adaptation strategies. These tools, along with new resources, will enable managers to prioritize their actions and manage the land most effectively.

3e: Advance research on climate-adaptive ecosystem management

The Forest Service conducts long-term inventory, monitoring, and analysis using remote sensing technologies, field studies, and a network of experimental forests and ranges on Federal land. The Forest Service also partners with Federal, Tribal, State, and university partners on numerous long-term research studies in urban and rural areas. The agency also integrates biophysical expertise with climate projections to help land managers understand chronic climate change impacts under a range of scenarios.

3d SUPPORTING ACTIVITIES

- Develop geospatial tools for identifying high-priority areas for helping ecosystems adapt to climate change.
- Encourage interagency analysis, climate data sharing, and the application of combined expertise, where appropriate, for selecting high-priority landscapes for treatment and assessing risks from disturbances to further costeward landscapes across agencies.
- Encourage the use of adaptation planning tools to select appropriate adaptation actions, such as the Adaptation Workbook, Adaptation Library, and the Tribal Adaptation Menu.

3e SUPPORTING ACTIVITIES

- Conduct research and develop integrated assessments to improve understanding of the risk associated with chronic effects of climate change, recognizing the value of biodiversity, climate refugia, old growth forests, and species migration corridors.
- Develop an understanding of climate-habitat relationships at the species and population level to support assisted migration and scenario modeling.
- Support scenario planning to provide information on chronic effects of climate change under different management scenarios.
- Develop and test science-based management practices, frameworks, tools, and genetic information to support adaptation to chronic effects of climate change.

A full-page photograph of a man in bright orange shorts jumping into a river. He is in mid-air with his arms raised. In the background, two other people are swimming in the water. The river is surrounded by a dense forest on a hillside.

DISRUPTIONS IN THE DELIVERY OF ECOSYSTEM PRODUCTS AND SERVICES

Climate change will affect the ability of the Nation's forests and grasslands to furnish important services to the public, including clean water and air, carbon storage and uptake, timber and nontimber forest products, productive grazing land, and recreation opportunities. These benefits may be lost or altered due to changes in wildfire, extreme events, and chronic stresses on watersheds and ecosystems. These impacts of climate change will interact with changes in demands for products and services resulting from shifts in population and economic growth.

Luis Reyes jumps into the Ocoee River with other kids at Mac Point in the Cherokee National Forest, TN.
USDA Forest Service photo by Cecilio Ricardo.

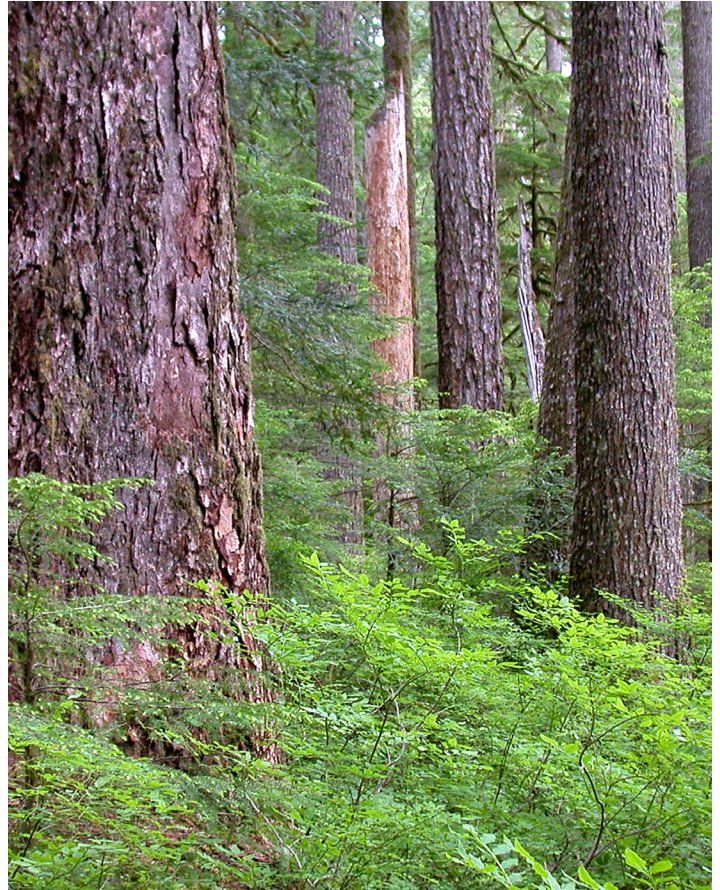
Threats to Water Supply

The national forests and grasslands supply drinking water to over [60 million Americans](#). Catastrophic losses from wildfire, coupled with the effects of other disturbances and long-term changes in water supply, will affect the ability of the National Forest System to continue to provide the quality and quantity of water that cities, rural communities, and Indigenous peoples have depended upon for generations. This puts urban and rural communities at risk of water shortages and could create tension over scarce water supplies. Disadvantaged communities may suffer disproportionate negative impacts when safe drinking water is scarce.

Changes in Carbon Uptake and Storage

Forests in the United States currently take up more carbon than they release to the atmosphere on an annual basis, making them a carbon sink. In addition, harvested wood products store carbon, displacing fossil-fuel-intensive products like steel and concrete. In urban areas, trees planted near homes can help reduce

carbon emissions from heating and cooling energy use in addition to storing carbon directly. Forest mortality and reduced productivity due to climate-related disturbances and stressors may reduce the ability of the Nation's forests and grasslands to store carbon and continue to serve as carbon sinks.



Old-growth forest. USDA Forest Service photo.

CARBON STEWARDSHIP

America's forests provide multiple benefits, such as clean air and water, biodiversity, recreation, wildlife habitat, and timber and nontimber forest products. In this era of climate change, carbon uptake and storage are also critical benefits from healthy forests. Nearly 13 percent of U.S. carbon emissions are taken up and stored in America's forests, including old-growth and other wildland, urban, and working forests.

Unfortunately, many forests are increasingly vulnerable to climate-amplified impacts and stressors. If a forest is vulnerable, so is its carbon. Thoughtful carbon stewardship does not seek to maximize carbon at the expense of forest health but rather to optimize carbon within the context of ecosystem integrity and climate adaptation. Some forests, such as those at risk for high severity wildfire, might require hazardous fuels treatments and other forest health interventions that reduce carbon storage in the short term even as they stabilize carbon in the long term. These ideas are at the core of the USDA climate-smart strategy, which supports the Forest Service goals of protecting communities and watersheds and creating long-term, nature-based climate solutions.

Threats to Timber and Nontimber Forest Products

Wood is a renewable, sustainable resource the Nation needs to reduce greenhouse gas accumulations in the atmosphere and avoid catastrophic climate change.

Wood-based products can substitute for other materials with a larger carbon footprint. In addition, the timber industry, supplied from both Federal and non-Federal lands, supports millions of jobs across the United States and is an integral part of the economy. Climate change presents an additional challenge to an industry that has already been affected by outside forces, such as changes in usage trends and demand for building materials. High volumes of salvage timber from fire, storms, and other disturbances can saturate local harvesting capacity and markets for salvage logs. In addition, long-term changes in timber supply due to shifts in forest composition and productivity may

result in challenges.

Climate change may also affect the availability of nontimber forest products, such as fuelwood, medicinal plants, nuts and fruits, maple syrup, Christmas trees, and arts and crafts materials that are important for regional and local economies. These products include subsistence foods that have cultural, nutritional, and economic benefits for Indigenous peoples and rural communities. Maple syrup production, for example, depends on a narrow range of temperatures just below freezing at night and just above freezing during the day. Climatic shifts may alter sap production as well as threaten the overall health and productivity of sugar maples, which are central to the land and part of the cultural identity and economy for many Indigenous peoples and rural communities in the Midwest and Northeast.



Forest Service Fire Management Officer and a Forest Service Public Affairs Officer look at cold wood at a timber sale on the North Mills Area, Pisgah Ranger District, Pisgah National Forest, NC. USDA Forest Service photo by Cecilio Ricardo.

Stress to Rangelands and Forage Production

Increased drought and disturbances can harm forage production. More frequent and severe wildfires are likely to damage fences, water systems, and other range improvements. Invasive plants reduce rangeland health, forage quality, and the potential for carbon sequestration in soil. Increasing stress from drought on rangeland vegetation and riparian areas can make them more susceptible to damage from grazing. Drought conditions often lead to restricted grazing to protect rangeland health. Many national forests have high-elevation pastures that permittees use in summer, and range managers may see more pressure for expanded grazing in spring and fall as temperatures warm and snowpack decreases.

Effects on Recreation Opportunities and Infrastructure

Outdoor recreation, important to the American economy and culture, will be affected by a changing climate. Rising water temperature, changes in streamflow, and altered growing seasons may alter or reduce opportunities for hunting and fishing. Decreased snow cover may reduce opportunities for winter activities, such as alpine skiing or snowmobiling, creating unpredictability for local communities that depend on winter recreation. The summer recreation season may lengthen in some areas as the shoulder seasons become more hospitable, and summer high temperatures and changes in air quality may increase health risks for visitors in some places. Visitors will also face more safety risks from heavy rain, flash flooding, and wildfire. Extreme events may also damage campgrounds, trailheads, roads, and other key infrastructure. Higher recreational demand during some seasons and increased risk to visitors may also place burdens on staffing.

Forest Service personnel use snowmobiles to pull the heavy trail grooming device over fresh snow to compact and flatten the snow trail for cross-country skiers to use on the George Washington Pines ski trail in the Superior National Forest region in Minnesota. USDA Forest Service photo by Lance Cheung.



ACTION 4

SUPPORT THE DELIVERY OF ECOSYSTEM PRODUCTS AND SERVICES IN A CHANGING CLIMATE

People will continue to need multiple benefits from the national forests and grasslands even as climate change affects both the supply of—and demand for—traditional and nontraditional uses and services. The Multiple-Use Sustained-Yield Act requires the Forest Service to provide a variety of services from the National Forest System without degrading the

productivity of the land. The agency will adapt to changing demand, support the development of innovative products and markets, and manage recreation and tourism opportunities under changing conditions to serve people while maintaining healthy, productive ecosystems.

4a: Help ensure the continued delivery of ecosystem services

A major goal for the Forest Service in helping ecosystems adapt to a changing climate will be the ongoing delivery of ecosystem services from the National Forest System, including clean drinking water and carbon uptake and storage. Protecting water quantity and quality for downstream users will require working with water providers and utilities to adapt natural and built infrastructure to climate change. The Forest Service will also likely face increased demands to manage ecosystems for carbon storage and sequestration. In response, the agency will find ways to balance carbon stewardship and the delivery of other goods and services with climate change adaptation.



Tourists take photos in Wade Lake in the Beaverhead-Deerlodge National Forests. USDA Photo by Preston Keres.

4a SUPPORTING ACTIVITIES

- Target watersheds vulnerable to climate change for watershed restoration projects that improve the natural storage of water for municipal and agricultural uses.
- Work with water providers and downstream communities to help them understand the risks from wildfire and declining snowpack, take steps to reduce risks to water systems, and effectively respond following disturbances.
- Develop projects that provide both adaptation and greenhouse gas mitigation benefits, such as agroforestry; reforestation and other natural climate solutions; methane capture; biomass removal and sequestration via biochar; and avoiding wildfire emissions.
- Develop public-private partnerships to support the delivery of critical ecosystem services in the face of climate change.

4b: Support new and existing forest product markets that align with adaptation

A changing climate and the management response will create shifts in market supply and demand. Loss of productivity and increased disturbances may reduce the viability of some traditional markets, and new markets may emerge for forest products. Adaptation activities, including hazardous fuels reduction and forest health treatments, may yield byproducts that are not viable on existing wood markets. Encouraging the development of additional markets for such byproducts would help offset costs associated with these activities and help support local economies as they deal with ongoing disruptions in traditional timber markets. Increasing the use of wood to meet industrial and consumer needs will also help reduce greenhouse gas emissions from nonrenewable and unsustainable products. The Forest Service will help smooth the way for economic shifts by developing partnerships, tools, and technologies to support new and emerging products and markets and furnishing sustainable supplies of new resources to support vibrant and diverse economies.

4b SUPPORTING ACTIVITIES

- Work with industry and Tribal enterprises to support economically viable markets for wood products from salvage harvests and fuels reduction activities, including small-diameter timber and nontimber forest products through programs such as the Financial Assistance to Mills Program in the Bipartisan Infrastructure Law.
- Develop new products from unused woody material and other biomass and new markets for high-value products such as cross-laminated timber, biochar, and nanocellulose.
- Manage ecosystems to support the long-term sustainability of culturally and economically important nontimber forest products.
- Identify and reduce vulnerabilities in forest product supply chains.

ADAPTA

The Caribbean Climate Hub for Tropical Agriculture and Forestry has the task of identifying and documenting sustainable management practices that farmers, ranchers, producers, and managers of agricultural and forestry lands can adopt to increase their resilience to climate change. ADAPTA (<https://www.climatehubs.usda.gov/hubs/caribbean/project/adapta-climate-adaptation-project>) provides climate services and provides educational resources for professionals in the agricultural sector in Puerto Rico and the U.S. Virgin Islands through videos, factsheets, and training workshops.



In the aftermath of the hurricanes, El Yunque closed for repairs and restoration work. USDA Forest Service photo.

4c: Adapt recreation facilities and opportunities to sustain the recreation economy

The Forest Service will anticipate recreation opportunities under changing landscape conditions and help recreationists adjust their expectations while keeping visitors safe from wildfire, extreme heat, flooding, and storms. As it adjusts to the impacts of climate change, the Forest Service will also help ensure that recreational opportunities are distributed equitably and that they continue to support local economies.

4c SUPPORTING ACTIVITIES

- Support planning and actions to reduce the risks from climate change to trails, buildings, campsites, and other recreation infrastructure such as through the BIL Ecosystem Restoration recreation funding.
- Develop new ways of communicating risks and opportunities to the recreating public.
- Develop adaptation actions that increase recreation accessibility and availability to disadvantaged communities.
- Work with partners and communities to find innovative ways of sustaining local recreation economies as they deal with climate-change-related shifts in recreation demand and opportunities.

4d: Take flexible approaches to manage grazing

The impacts of climate change on forage productivity and quality include the rising severity of drought and wildfire, as well as the spread of invasive species. The Forest Service will adjust its grazing management and its systems for administering grazing permits accordingly. Adjustments will also account for the increased vulnerability of ecosystems and watersheds to adverse impacts from grazing.

4d SUPPORTING ACTIVITIES

- Increase flexibility in grazing management to allow for changes in the timing and intensity of livestock grazing.
- Work with permittees to make range improvements (in fencing, water systems, and so forth) that enhance ecosystem adaptation to climate change.
- Restore and maintain native rangeland vegetation, where appropriate, especially species adapted to climate change.
- Provide decision support on agroforestry practices that support grazing.

4e: Support research on ecosystem products, services, and markets

Delivering products and services in a changing climate requires an understanding of how climate change will affect demand for them. It also requires research on developing new markets, including markets for small-diameter wood and other byproducts from adaptation activities. The Forest Service's and its partners' expertise in forest product development, natural resource management, and forest economics can help meet these needs.



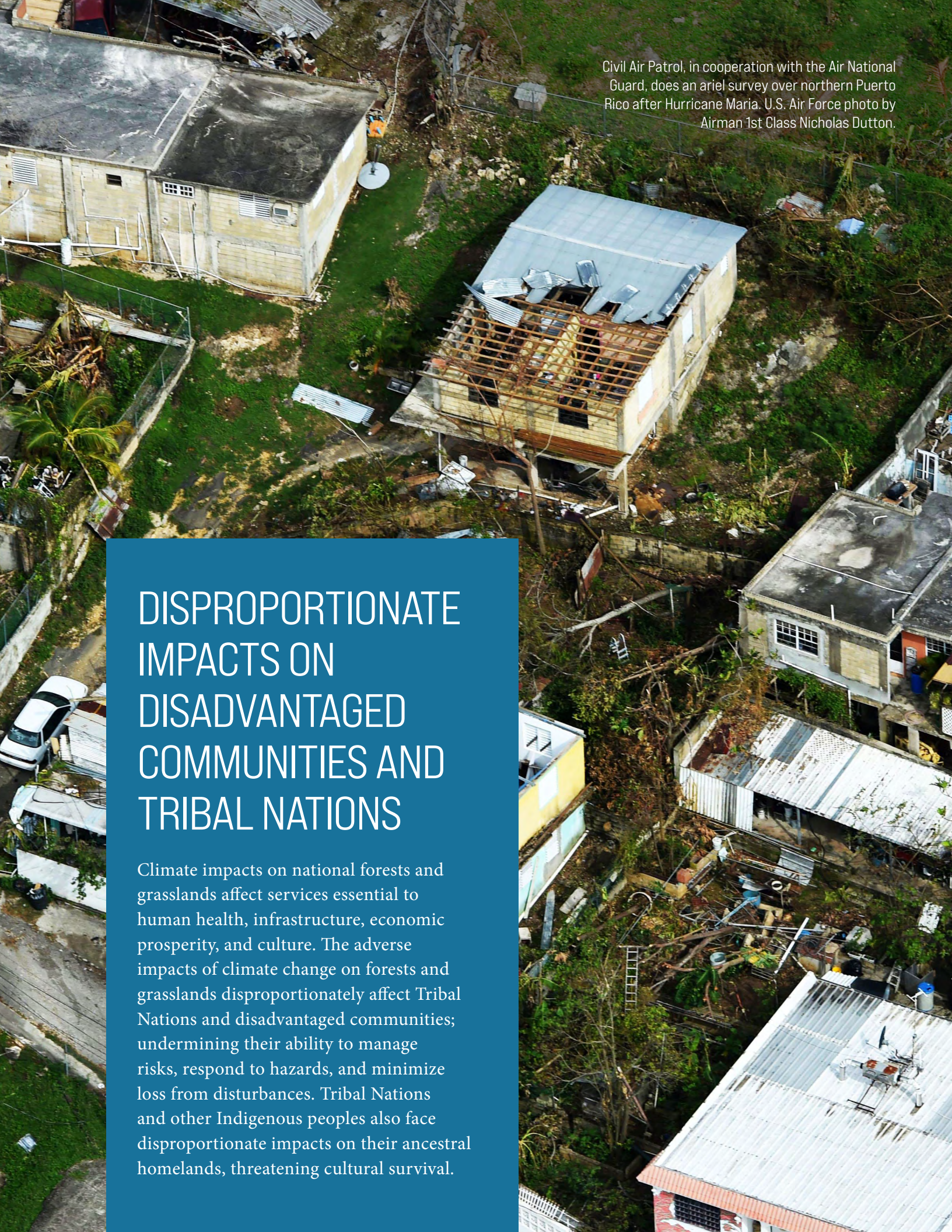
Adaptive Silviculture for Climate Change Transition Site at the Cutfoot Experimental Forest. USDA Forest Service photo by Leslie A. Brandt.

4e SUPPORTING ACTIVITIES

- Conduct research to anticipate changes in recreational demand, including from disadvantaged communities and to identify emerging opportunities for increased use and new recreational activities.
- Develop tools and information to help land managers understand climate change effects on ecosystem services and markets, including carbon sequestration and their management implications and vulnerability.
- Provide decision support tools and models for anticipating and responding to climate-related changes in social, economic, and political factors that influence the supply of and demand for ecosystem services.
- Assess the availability of resources and manufacturing potential for traditional and new forest products, conduct economic feasibility studies, and determine the supply chain infrastructure needed to promote the use of forest products.

ADAPTIVE SILVICULTURE FOR CLIMATE CHANGE

The [Adaptive Silviculture for Climate Change \(ASCC\)](#) network is addressing a critical need from forest managers to understand and implement climate-adaptive forest management strategies across different forest types in the United States and Canada. The network has engaged Forest Service climate change thought leaders from across the United States; built a robust experimental and science delivery framework to develop, evaluate, and demonstrate adaptation strategies; and engages a wide variety of partners and teams of scientists from across the United States and Canada.

An aerial photograph showing the aftermath of Hurricane Maria in northern Puerto Rico. The image captures several buildings that have suffered significant structural damage. One prominent building in the center has a roof that is mostly missing, exposing its wooden frame. To its left, another building has a dark, possibly collapsed or heavily damaged roof. The surrounding area is a mix of green vegetation and debris, with some trees appearing uprooted or stripped of leaves. In the bottom left, a white car is parked on a street. The overall scene conveys the extent of the destruction caused by the hurricane.

Civil Air Patrol, in cooperation with the Air National Guard, does an ariel survey over northern Puerto Rico after Hurricane Maria. U.S. Air Force photo by Airman 1st Class Nicholas Dutton.

DISPROPORTIONATE IMPACTS ON DISADVANTAGED COMMUNITIES AND TRIBAL NATIONS

Climate impacts on national forests and grasslands affect services essential to human health, infrastructure, economic prosperity, and culture. The adverse impacts of climate change on forests and grasslands disproportionately affect Tribal Nations and disadvantaged communities; undermining their ability to manage risks, respond to hazards, and minimize loss from disturbances. Tribal Nations and other Indigenous peoples also face disproportionate impacts on their ancestral homelands, threatening cultural survival.

Impacts on Indigenous peoples

Climate change threatens the cultures of Indigenous peoples and their ways of life. Warming temperatures and changing weather patterns will limit the availability of clean drinking water, fish, game, and wild and cultivated crops that play important roles in traditional culture, healthcare, and local economies. Tribal Nations depend on landscapes and ecosystems with cultural keystone species for subsistence, food sovereignty, and cultural identity, all of which are at risk from climate change. For example, rising stream temperatures are causing declines in salmon populations along the West Coast; salmon, a culturally significant food for the region's Indigenous peoples, is also important to the regional economy. In addition to serving as a traditional source of nourishment for Indigenous peoples, salmon are integral to the art of the Pacific Northwest. In parts of California, changing climate conditions are causing oak trees to produce fewer acorns, a traditional food source. Paper birch, a culturally important resource for Indigenous peoples in the Midwest and Northeast, is declining in part from warming temperatures. Working closely with Indigenous peoples and through government-to-government consultation with Tribal Nations will enable the Forest Service to better understand climate-related impacts and collaborate on approaches to climate change adaptation that incorporate Indigenous Traditional Ecological Knowledge.

Human Health Impacts

Wildfires and extreme events can directly affect human health, especially for people living in disadvantaged communities. Large severe wildfires can reduce air quality for weeks or months at a time in regions across the United States. People whose livelihoods necessitate sustained exposure to hazardous air quality produced by wildfire smoke may endure much greater health risks than the general population. Climate change impacts on watersheds on the national forests and grasslands can affect access to clean drinking water if

water is not appropriately treated. For disadvantaged communities, paying higher fees for water delivery and buying bottled drinking water are additional burdens.

Forests generally benefit human health. For example, trees in urban areas can help lower local temperatures, reducing heat-related risks to people, especially those without air conditioning or in poor health. However, the urban tree canopy is often lowest in areas of high poverty, and urban trees may be vulnerable to the impacts of climate change. People can enjoy health benefits, both physical and mental, from visiting their national forests, which offer respite to urban populations during hot summers. However, disadvantaged communities may face barriers to access exacerbated by climate-driven disturbances.



The Forest Service is planning and carrying out an urban silviculture project at Stillmeadow Community PeacePark with community residents. USDA Forest Service photo.

Threats to Natural and Built Infrastructure

Climate-driven disturbances can affect both natural and built infrastructure, with far-reaching effects on communities. Forests and other ecosystems constitute natural infrastructure that supplies abundant water in streams, absorbs stormwater, and filters pollutants from drinking water for downstream communities. In urban areas, trees and other vegetation play an important role in managing stormwater, which will become even more important as the frequency and intensity of heavy rain events increase. More effort may be required to maintain both natural and built infrastructure in the future. In some cases, costly technological alternatives may be needed to replace ecosystem services, such as water delivery, that are essential to human health and prosperity.

Fires and post-fire flooding and debris flows can damage roads, reservoirs, electrical transmission systems, and other built infrastructure essential to thriving economies. Disruptions to electrical grids caused by uncharacteristically severe wildfires and downed trees can affect water treatment, transportation services, public health, and day-to-day life in communities near national forests. Disadvantaged communities face higher risks due to chronic underinvestment in infrastructure, making them more vulnerable to power outages, poor water quality and quantity, and even loss of their homes. Residents of disadvantaged communities may lack the financial resources to compensate for the loss of ecosystem services and disruptions to services provided through built infrastructure, as well as the means to evacuate in the event of a disaster.

Damage to Cultural Resources and Threats to Cultural Survival

Climate change poses a variety of challenges to the social and cultural fabric of communities. People have cultural and spiritual connections to landscapes that can be fundamentally changed by uncharacteristically severe wildfire or another disaster related to climate change. Many plant and wildlife species of cultural importance to Indigenous peoples may lose suitable habitats. Historic properties and archaeological sites are also at risk from climate change impacts. Burial sites along flood plains, for example, are vulnerable to floods that are becoming more prolonged and severe. The Tribal Forest Protection Act, designed specifically to protect tribal lands and communities from threats on the National Forest System or originating from it, is a key tool to address such impacts.

Many communities, especially in rural areas, have cultural identities tied to uses and resources associated with national forests and grasslands. As climate change affects these uses, it can weaken traditional ties to the land. For example, ranching communities may find it difficult to maintain their way of life if climate change impacts on the national forests and grasslands reduce rangeland productivity and affect grazing opportunities. Likewise, rural communities with a long history of winter sports, such as skiing or snowmobiling, may face challenges as winters become shorter, with reduced snowpacks.



Yellow birch leaves and white trunks. USDA Forest Service photo.

ACTION 5

DELIVER ENVIRONMENTAL JUSTICE THROUGH ADAPTATION ACTIONS

The Forest Service will support climate adaptation actions that help disadvantaged communities prepare for climate effects. While pursuing climate adaptation actions, and through our work in support of the Justice40 Initiative, the Forest Service will advance environmental justice and strive for equitable environmental outcomes in urban and rural

communities. The Forest Service will strengthen relationships with Tribal Nations through government-to-government consultation to cocreate management activities and programs that reduce the adverse impacts of climate change on all beings. The Forest Service will also build relationships with new and existing partners to deliver environmental justice.

5a: Identify and engage disadvantaged communities

During the past half-century, the Forest Service has received public input and engagement in its decision-making from populations that tend to be mostly white and of higher income. People of color, Indigenous peoples, and lower income populations have often been unrepresented and underserved. Through sustained engagement, the agency will better understand how disadvantaged communities rely on National Forest System lands and Forest Service programs.



Green Corps members with trash bags of invasive spotted knapweed they collected near Round Island Lighthouse on Lake Huron. Photo courtesy of The Greening of Detroit.

5a SUPPORTING ACTIVITIES

- Analyze population characteristics to prioritize climate adaptation projects that engage and benefit disadvantaged communities.
- Use analyses of population characteristics to reach disadvantaged communities in public engagement and outreach processes for climate adaptation projects, such as reducing hazardous fuels on National Forest System lands and awarding Cooperative Forestry grants to increase tree canopy in urban areas in alignment with Justice40 Initiative goals.
- Offer disadvantaged communities more opportunities to join in public engagement processes by distributing public meeting notices to them in accessible languages and holding meetings at times and in places that are convenient for them.
- Develop capacity for facilitating engagement with underserved communities.

5b: Consult with Tribal Nations and establish strategic partnerships with disadvantaged communities

Fostering meaningful relationships with Tribal Nations through government-to-government consultation and building trusting partnerships with disadvantaged communities is the basis for successful climate adaptation. By honoring treaty rights and establishing strategic partnerships with organizations dedicated to diversity, equity, inclusion, and access, the Forest Service will improve the delivery of information and technology to Tribal Nations and disadvantaged communities.



Each year the San Juan National Forest consults with interested Tribes about planned projects for the year. USDA Forest Service photo.

5c: Improve communication of climate risks and opportunities for adaptation

As climate change and climate-related hazards become more prevalent, the Forest Service will communicate the related risks to visitors, local communities, and disadvantaged communities. The Forest Service will also increase access to the national forests and grasslands for disadvantaged communities in alignment with the Equity Action Plan.

5b SUPPORTING ACTIVITIES

- Consult with Tribal Nations and partner with Tribal organizations and disadvantaged communities to prepare for climate-related disruptions to electrical power, water systems, transportation, and communication networks as well as to improve access to emergency services and healthcare.
- Through technology transfer partnerships, provide environmental justice tools to disadvantaged communities, enabling them to join in creating approaches to managing climate-related risks.
- Codevelop adaptation strategies in consultation with Tribal Nations and National Tribal Organizations and in partnership with organizations representing disadvantaged communities.

5c SUPPORTING ACTIVITIES

- Create an environmental justice communication strategy for climate adaptation with tools to help agency employees build more effective working relationships with new and existing partners, especially those representing disadvantaged communities.
- Strengthen government-to-government consultation with Tribes by providing Forest Service staff with more opportunities to build cultural competency and more opportunities to learn about climate change issues faced by Tribal communities.
- Develop practices for agency employees to overcome language barriers for communicating about climate change adaptation, in alignment with limited English proficiency programs in the Equity Action Plan.
- Work with new and existing partners representing disadvantaged communities to expand recreation opportunities and access to national forests and grasslands.

5d: Help communities become fire-adapted as they prepare for climate change

The Forest Service plays an important role in mitigating risks to urban and rural communities from natural hazards exacerbated by climate change. By reducing risks, Forest Service climate adaptation actions are critical to disadvantaged communities because they are more at risk from wildfire and other disasters than high-income communities. As described in our Equity Action Plan and Justice40 Implementation Plans, the Forest Service will help communities, especially disadvantaged communities, prepare for increased smoke from more frequent and severe wildfires. The agency will also take actions aligned with the Forest Service's Justice40 Initiative and Equity Action Plan.

The Firewise Communities Mobile Education Unit offers countless consumer-friendly safety tips on a wide range of timely and important topics—everything you need to know to keep you, your family, and your neighbors safe from fire and related hazards. USDA Forest Service photo.

5d SUPPORTING ACTIVITIES

- Provide technical expertise, research, and funding to support fuels treatments and wildfire preparedness planning and to help residents create defensible space around homes and communities.
- Partner with local organizations and utilities to increase the resilience of natural and built infrastructure for water, electricity, and transportation for disadvantaged communities.
- Improve access to tools such as the Smoke-Ready Toolbox to help people learn about fire-related health risks like smoke exposure and how to manage them.
- Support community wildfire preparedness by providing scientific and financial resources to local communities, including community wildfire protection planning, grant programs, and access to organizations such as the Fire-Adapted Communities Learning Network.



5e. Expand urban forestry benefits to disadvantaged communities

The Forest Service's Urban and Community Forestry program supports nature-based solutions by propagating a resilient and equitable urban tree canopy. Expanding community engagement in the Urban and Community Forestry Program is a priority under the Agency's Justice40 Initiative. By expanding tree planting programs in disadvantaged urban areas, the Forest Service will help reduce urban heat island effects on human health and well-being in the face of climate change.



Forest Service climate specialist leads discussion on climate impacts with managers. USDA Forest Service photo by Leslie A. Brandt.

5f. Support social science research and to help address environmental justice

The Forest Service's social science research explores the cultural and economic dimensions of climate change effects to help land managers make climate-informed decisions. Climate adaptation strategies will build on the unique strengths of social science research to reduce inequities in resource management.

5e SUPPORTING ACTIVITIES

- Support tree planting programs for people in low-income and historically marginalized urban neighborhoods who suffer disproportionately from pollution and warmer temperatures related to climate change.
- Work with community organizations to provide training in tree care and urban forestry to support the long-term survival of planted trees and provide job training opportunities.
- Encourage funding proposals from applicants from disadvantaged urban communities through Forest Service's Urban and Community Forestry Program in alignment with Justice40 Initiative goals.

5f SUPPORTING ACTIVITIES

- Assess risks climate-related related to climate change to human communities and cultural resources.
- Increase support for social science on barriers to adaptive actions with examples of success in overcoming them, such as the Tribal Adaptation Menu.
- Support urban forestry research and monitoring to understand climate effects on urban forests and identify opportunities to increase the climate resilience of urban communities.
- Provide research that supports sustainability and restoration of culturally important species, ecosystems, and landscapes, with special concern for Tribal treaty resources, and that improves understanding and appropriate use of Indigenous Traditional Ecological Knowledge.

Santa Fe National Forest Forester measures the circumference of a tree. USDA Forest Service photo by Andy McMillan.

THREATS TO THE FOREST SERVICE'S MISSION, INFRASTRUCTURE, AND OPERATIONS

The impacts of climate change affect the ability of the Forest Service to fulfill its mission, sometimes generating direct threats to its workforce and operations. Climate change may create new challenges for public engagement as well as place additional stress on an understaffed workforce. Extreme events may damage or destroy critical infrastructure, disrupting operations and elevating health and safety risks to the workforce. Preparing for and responding to these changes will require clear performance and accountability measures that prioritize climate action.



Challenges to Public Engagement

Climate change has implications for the agency's relationships and communication with States, partners, and the public as well as for government-to-government consultation with Tribal Nations and the honoring of treaty and other reserved rights. Rising stress on natural resources from climate change may create tensions when making decisions where values conflict. For example, the Forest Service may need to relocate recreation sites beloved by visitors to areas less at risk. Agency leaders will have to balance the need for rapid decision-making to reduce environmental risk with the need for comprehensive public engagement that ensures that all concerns and needs are heard. Competing risks may need to be balanced. For example, minimizing risks to people and ecosystems may lead to short-term reductions in carbon storage, which constitutes a tradeoff against the need to increase long-term carbon storage to reduce climate change. The complexity of climate change will require the agency to develop adept communication approaches that connect adaptation to the agency's mission while recognizing the uncertainty and challenges inherent in climate change.

Disruptions to Operations and Vulnerable Infrastructure

Climate change will have direct and indirect effects on the Forest Service's day-to-day operations. Wildfire, floods, and severe storms will continue to damage the agency's transportation infrastructure as well as water, electrical, and communications systems. Infrastructure damage can affect the ability of employees to do their work and disrupt access for visitors and local communities to public lands. Longer and more intense fire years shift financial and personnel resources into fire suppression at the expense of longer term work needed to reduce wildfire risks and adapt to climate change. Climate change may alter visitation patterns, including increasing use during shoulder seasons, stretching the Forest Service's ability to provide recreational opportunities at times when staff and concessionaires are not available and when roads

may be closed. Longer recreation seasons may also place additional stress on infrastructure, reducing its effective lifespan.

Workforce and Employee Climate Resilience

The declining size of the Forest Service workforce has reduced the capacity of the agency to adapt to climate change. Forty percent of positions in the agency are currently unfilled, leaving the remaining workforce overstretched and unable to fully address or prepare for all the challenges created by climate change. As the fire year becomes longer and more severe, and is projected to increase more in the future, more workforce time is spent away from home on fire assignments. Longer fire seasons driven in part by climate change thus can lead to more work-related stress for both employees on assignments who must spend more time away from home and those who remain at the home office saddled with additional workloads. Employees have less time to attend needed training on climate change vulnerability assessments and adaptation and to incorporate climate change concepts into planning and actions. Climate change also has a direct effect on employee safety. Hotter conditions and low air quality from smoke can increase the risk of heat-related and respiratory illnesses, and fire and other natural disasters can put workers at risk of injury or even death.

Climate change may affect the ability of the Forest Service to recruit and retain employees. Fewer workers may be interested in field-based positions with rising risks to their health and safety. Climate-induced regional population shifts may also affect recruitment and retention, especially in areas where government housing is not available. Some employees may be forced to relocate due to rising sea levels, wildfire, extreme storms, and other climate-related factors. In 2020 and 2021, many employees lost their homes to wildfires, and hundreds of employees were displaced from their communities for multiple weeks. Similar



Boston Urban Connections Coordinator shares information about the Forest Service during Boston's GreenFest. USDA Forest Service photo.

displacements are likely to increase. Some employees may no longer consider local communities desirable places to live because of fire-related risks or extreme heat. Other communities may become so popular as an escape from poor climate conditions that housing costs become unaffordable for agency employees. These and other factors may lead to lower morale and workforce retention.

unprepared for difficult conversations with the public about climate vulnerabilities and the need to reduce the corresponding risks.

Climate Change Performance and Accountability Measures

The Forest Service's performance and accountability metrics focus on near-term targets assuming historical climate regimes. This reduces the agency's ability to mainstream climate adaptation into day-to-day operations, leaving it vulnerable as the climate continues to change. The Forest Service may not be prepared for the challenges associated with impacts on ecosystems, changes in workforce needs, and shifts in public safety and perceptions. Employees perceive that climate change adaptation, except in connection with wildfire risk reduction, is not an agency priority. Few employees have jobs that require them to focus on climate change, so few take the time to incorporate climate change into their work or factor it into their decisions. Failure to fully tap the creativity and experience of the workforce in responding to climate change leaves the agency



A fire engine crew conducts digging fireline training. USDA Forest Service photo by Brandon Everett.

ACTION 6

INCREASE AGENCY CAPACITY TO RESPOND TO CLIMATE CHANGE

The Forest Service will increase its capacity for climate preparation and response across all four deputy areas and the USDA Climate Hubs. Partnerships between researchers and managers offer opportunities to identify adaptation actions that are both grounded in science and feasible in practice. Shared Stewardship agreements will help the Forest Service work across boundaries and build on the capacity of Tribal Nations,

State agencies, and external partners. Expanding capacity will require continued innovations in hiring and other human resources activities to help ensure that the agency has the workforce it needs to take on the challenge of climate change. The agency will build a representative workforce in alignment with the goals of the Equity Action Plan, integrating environmental justice into Forest Service operations.

6a: Expand climate change workforce capacity

The Forest Service will develop a climate-focused workforce of sufficient size and with the specialized training and experience needed to directly support adaptation work in the short term, while also working across Deputy Areas to increase Agency capacity and climate literacy to help mainstream adaptation work throughout Forest Service operations and activities. This may include expanding the scope of work in existing positions to include specific duties and performance measures related to climate change. It may also include expanding the workforce to include more employees specifically focused on climate change, sustainability, and environmental justice. As it recruits new employees to tackle the climate crisis, the agency will build on ongoing innovation in hiring, training, and developing other human resources activities.

6a SUPPORTING ACTIVITIES

- Prepare the Civilian Climate Corps to conduct activities described in this adaptation plan.
- Recruit, train, and build a pipeline for talented employees to fill key needs in climate, sustainability, and environmental justice while increasing diversity and inclusion in the workforce.
- Recruit highly trained professionals in research, decision support, and management with expertise in climate change, sustainability, and environmental justice.
- Build a diverse workforce using a variety of tools to reach out to diverse candidate pools, such as university networks, Tribal Nations, social media, and professional societies.

6b: Support employees as they tackle climate change

The Forest Service workforce is highly trained and dedicated, with a wealth of skills and institutional knowledge needed to tackle climate change. The Forest Service will support employees both personally and professionally as they take on climate change challenges and as climate change affects them.

6b SUPPORTING ACTIVITIES

- Provide flexibility in the timing and location of work to reduce climate-related risks and account for climate-induced displacement and disruptions.
- Support employee health, wellness, and safety programs to increase personal resilience to climate change and its impacts on mental and physical health.
- Support employees facing challenges from housing displacement due to climate-intensified disturbances, increased housing costs, and population shifts.
- Incentivize and reward work on climate change research and adaptation, environmental justice, and sustainability.

6c: Establish agencywide employee education programs on climate change and environmental justice

Climate literacy is the foundation of success in responding to climate change. Forest Service employees will acquire a common understanding of climate change concepts, terms, and tools so they can apply them consistently across the agency in making management decisions. Through the Justice40 Initiative, we will increase our climate-related trainings offered through career development programs. Work on climate change will be grounded in environmental justice, so employees will also acquire a common understanding of the corresponding concepts and best practices.

6c SUPPORTING ACTIVITIES

- Include basic climate change training in new employee orientation.
- Give all employees regular educational opportunities on climate, sustainability, and environmental justice in natural resource management.
- Create targeted training for specialists and agency leaders on how to effectively integrate climate change considerations into their programs and decisions.

6d: Reduce risks and improve capacity in agency operations and infrastructure

To operate effectively in the face of climate-related disasters, the Forest Service will reduce risks to its physical and information technology infrastructures. The agency will also invest in the data and information needed to identify risks and track progress on taking the adaptation actions needed for continuity of operations in delivering benefits to the public. Improvements to facilities and infrastructure will also help the agency reduce greenhouse gas emissions associated with its operations. These mitigation measures will model best practices for the public and help the agency attract and retain a talented workforce.

6d SUPPORTING ACTIVITIES

- Fully integrate corporate databases to track climate-related actions and impacts.
- Assess risks to agency infrastructure using vulnerability assessments and geospatial tools and reduce the risks through repair, replacement, or relocation.
- Adjust agency operations to increase safety and resource protection during extreme events, wildfires, and other disturbances.
- Reduce climate impacts from agency operations, including from facilities and fleet, while minimizing associated costs and advancing sustainable operations.

SUSTAINABLE OPERATIONS

Improving the environmental sustainability of Forest Service operations is key to mitigating the agency's environmental footprint and aligning with its mission, as well as supporting climate adaptation. The Forest Service continues to encourage and track early adopter work in six identified environmental footprint areas: energy conservation, water conservation, fleet and transportation, sustainable procurement, waste prevention and recycling, and sustainable leadership. Reducing impacts in these areas aligns with the agency's values of conservation and interdependence. It also results in lower greenhouse gas emissions (GHG) and lower lifecycle costs of facilities, fleet, and other equipment. Moreover, it is a form of adaptation to changes in regulatory and business drivers stemming from climate change and can improve operational resilience. An example is the Off-Grid Energy Savings Performance Contract Project completed in 2019 at five remote, mission-critical sites in the Pacific Southwest Region. This project reduced GHG emissions via photovoltaic solar panels and batteries (in some cases mounted on trailers) and improved resilience by reducing reliance on existing generators, which were breakdown-prone and expensive to fuel.

IMPLEMENTATION

The Forest Service is already a leader in climate change research, decision support, and adaptation actions on the ground. Data collected through the agency's Climate Change Performance Scorecard and Sustainability Scorecard over the past decade shows that all national forests and grasslands already have locally specific vulnerability information and that many are integrating climate change into their planning and management. Ongoing integration of climate change considerations into agency programs will help in carrying out the Forest Service Climate Adaptation Plan.

These entities focus specifically on climate change impacts and adaptation, but all Forest Service programs across the four deputy areas will play a role in carrying out the adaptation plan. Line officers across the agency will play a pivotal role in implementing this plan by using their decision-making authority and providing support of the plan's goals. The Forest Service will work with the USDA, Natural Resources Conservation Service to coordinate adaptation actions across boundaries. In addition, the Forest Service will coordinate with other USDA agencies, other Federal agencies, Tribal Nations, States, international partners, and other partners in refining projects and carrying out actions. Coordination with partners from organizations focused on environmental justice and equity will help ensure that the actions are distributed equitably and do not lead to unintended consequences.

FOREST SERVICE CLIMATE ADAPTATION PROGRAMS AND INITIATIVES

Forest Service programs and initiatives that focus on climate change adaptation include:

- The Office of Sustainability and Climate, which provides guidance, tools, information, and technical assistance on climate change across the agency.
- The Northern Institute of Applied Climate Science and Adaptation Partners, which provide vulnerability assessments and support adaptation planning for national forests and grasslands, other Federal agencies, Tribal Nations, States, and private and municipal entities.
- The Eastern Forest Environmental Threat Assessment Center and the Western Wildland Environmental Threat Assessment Center, which develop science and assessments on environmental threats, including climate change, for agency managers and their partners.
- Forest Service Research and Development, which conducts basic and applied research on climate change impacts and adaptation and delivers tools and information to managers across five research stations, two threat centers, and the Forest Products Laboratory.
- A network of regional and national forest and grassland climate change coordinators and research station science advisors who deliver climate change information to all programs throughout the Forest Service.
- Communities of practice focused on climate adaptation, climate data and tools, and environmental justice, which share lessons learned and the latest tools across deputy areas.
- USDA Climate Hubs through which climate science, information, and technology are shared among diverse audiences.

Evaluating Progress

The Forest Service will track progress on adaptation actions, in addition to actions related to sustainable operations and carbon stewardship, using the Climate Action Tracker (CAT, Figure 2). The Forest Service's Office of Sustainability and Climate will prepare annual reports on these activities for Forest Service and Departmental leadership. The agency developed the CAT with broad input from across the Forest Service and using an agile learning approach to help ensure it evolves with changing needs, information availability, and sophistication. Ultimately, the Forest Service will populate the CAT via standardized work streams and databases used in day-to-day operations. Initially, the agency will use staff surveys and database queries to inform the CAT while identifying gaps and opportunities for database development and integration. Release of the first version of the CAT is expected shortly after the release of the "USDA Forest Service Climate Adaptation Plan." The Forest Service organized the CAT to support agency goals across the agency's deputy areas with four top-level dimensions: serving people, natural resource management, infrastructure and operations, and organizational capacity (appendix 3). Adaptation is a component of all four dimensions. Each dimension is served by multiple strategic objectives that are measured through a targeted staff survey and database reporting. The metrics for a given objective will vary by deputy area, since different parts of the Forest Service engage in different activities. This structure also allows for easier identification and coordination of Forest Service programs and initiatives across deputy areas that contribute to the same objectives and metrics.

In addition to the CAT, the agency can track adaptation outcomes in landscape, social, and economic conditions using programs that support long-term monitoring, including the Forest Inventory and Analysis program, Forest Health Monitoring, and long-term studies on the experimental forests and rangelands. The Forest Service has also developed

new techniques for remote sensing and near-term tracking of impacts from climate-driven disturbances. Integrating these tools into management decision-making will help ensure continued progress.

Barriers To Implementation

The agencywide survey conducted for this plan indicates lack of staff, insufficient financial resources, lack of leadership support, and conflicts with other priorities were the top four barriers to adaptation actions by the Forest Service. Climate change may heighten all four barriers as more resources are needed to respond to climate-related wildfires and extreme events, leaving fewer resources for long-term planning and management in response to climate change. Survey respondents perceived a lack of guidance and policy direction as barriers: employees do not always believe that they have the authority or direction to take the needed steps to assess climate-related risks and develop adaptation actions. The adaptation plan outlines actions to address such barriers, including increased staffing and updated guidance. However, success will partly depend on appropriation levels and enabling legislation, which are outside of the agency's control.



Figure 2. Dimensions and strategic objectives in the Climate Action Tracker.

FOUNDATIONS FOR ADAPTATION

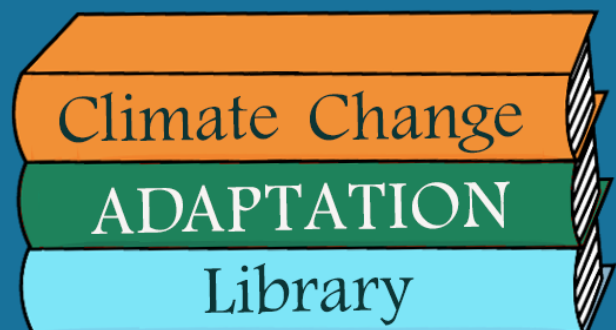
Tribal engagement, environmental justice, workforce climate literacy, and the USDA Climate Hubs are foundations for successful and widespread adaptation. Solidifying and building upon these foundations will yield the greatest benefits from multiple knowledge systems, community perspectives and needs, workforce creativity and professionalism, and dedicated focus. The Forest Service can meet our obligations as a Federal agency to honor the intent of Joint Secretarial Order 3403, while benefiting from millennia of Indigenous Traditional Ecological Knowledge to adapt landscapes to climate change. The agency can work to secure environmental justice by ensuring that adaptation actions are distributed equitably and in a way that accounts for the disproportionate impacts of climate change on disadvantaged communities. By extending workforce climate literacy agencywide, the Forest Service will prepare employees to manage risks, develop appropriate adaptation actions, and communicate both risks and actions effectively in engaging with the public. The USDA Climate Hubs are well-positioned to deliver science, synthesis products, and other support for adaptation actions at landscape scales.

Cedar Fire in Sugarloaf Mountain Park near the Forest Service Sequoia National Forest, Posey, CA. USDA photo by Lance Cheung.



ADAPTATION LIBRARY

The [Climate Change Adaptation Library for the Western United States](#) compiles information derived from climate change vulnerability assessments conducted by adaptation partners and collaborators as members of science-management partnerships. The library allows users to identify adaptation actions based on region, resource area, climate change effects, and specific topic areas (e.g., aquatic, conifers, trails, transportation).



Tribal Engagement

Government-to-government consultation, honoring treaty and reserved rights and developing strong collaborations with Tribes and other Indigenous peoples, is a foundation for the agency's ability to adapt to climate change. The Forest Service will learn from successful examples of Tribal climate adaptation across the country, recognizing that each Tribal Nation faces its unique challenges and provides its unique perspectives. Resources are already available that can be used to facilitate the integration of Tribal perspectives and knowledge in adaptation. For example, the Institute for Tribal Environmental Professionals Tribes and Climate Change Program provides training, webinars, and workshops for Tribal natural resource professionals and their partners on climate impacts and adaptation. Many Tribal Nations and organizations are developing natural resource vulnerability assessments and adaptation plans that provide excellent examples of blending western science and Indigenous Traditional Ecological Knowledge, such as the Karuk Climate Adaptation Plan and the Climate Change Vulnerability Assessment and Adaptation Plan for the 1854 Ceded Territory. Another example is the award-winning climate adaptation model developed by the Northern Institute of Applied Climate Science and Tribal partners, [Dibaginijgaadeg Anishinaabe Ezhitwaad – A Tribal Climate Adaptation Menu](#), a tool created to strengthen the connection between Indigenous values and climate adaptation planning. By learning from these examples and strengthening relationships with Tribal Nations and Indigenous peoples, the Forest Service will be better able to understand and prepare for the effects of climate change.

Environmental Justice

The principles of environmental justice—fair treatment and meaningful involvement—will guide the Forest Service in engaging disadvantaged communities in cocreating inclusive adaptation actions in response to the disproportionate impacts of climate change. Adaptation actions to redress environmental injustices will remove barriers to meaningful involvement by Indigenous peoples, communities of color, and other disadvantaged communities in project planning and development and the coproduction of knowledge. Adaptation actions will include delivering information and capacity to disadvantaged communities and helping them prepare for increasing climate-related disasters. Incorporating environmental justice and equity into Forest Service programs is critical: the number of people directly impacted by climate change and climate-related disasters increases annually. Tribal Nations and low-income, minority, and disadvantaged communities suffer disproportionate and cumulative negative impacts. Engaging populations from diverse backgrounds will expose land managers to new ideas and perspectives and help ensure that adaptation actions do not lead to unintended consequences for people or the environment.



This Tribal Climate Adaptation Menu, developed by collaborators representing Tribal, academic, intertribal, and government entities in the Great Lakes, provides a framework to integrate indigenous and traditional knowledge, culture, language, and history into the climate adaptation planning process. Artwork by Ziigwanikwe Katy Bresette.

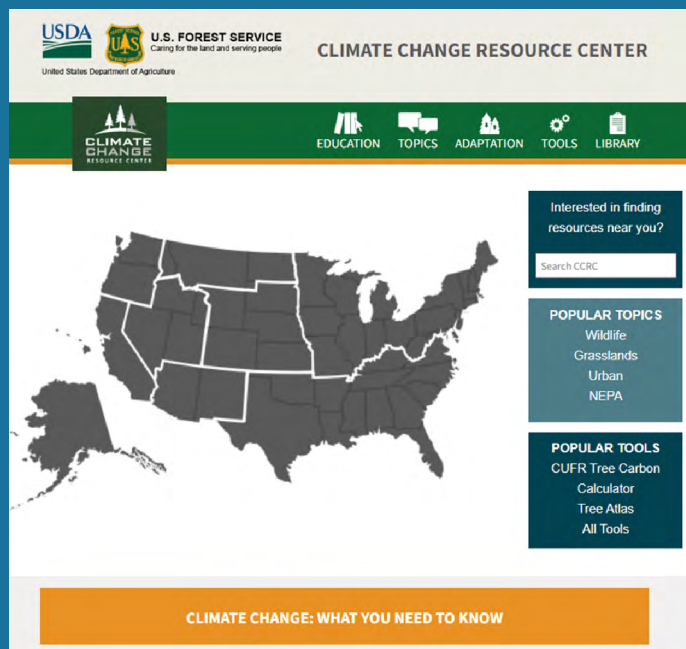
Workforce Climate Literacy

The Forest Service needs a workforce that has the knowledge and skills to conceive and fully implement effective adaptation actions. All employees need a basic understanding of the implications of climate change for the agency's mission and operations and a foundational understanding of how adaptation can help reduce its impacts. Natural resource specialists and other technical staff require specialized knowledge about the impacts of climate change on the resources they manage, along with knowledge of specific adaptation tools and strategies. Employees in public engagement, planning, or leadership roles need training in how to effectively communicate with the public about climate change impacts and agency adaptation actions.

The Forest Service can build on ongoing activities and resources to develop workforce climate literacy. The agency hosts a monthly First Friday All Climate Change Talks webinar series that is open to all employees. The Office of Sustainability and Climate hosts regular webinars for all employees on climate change impacts, adaptation, and environmental justice. The Forest Service's Climate Change Resource Center provides introductory modules on climate change science, impacts, and adaptation that are open to employees and the public. In addition, programs throughout the agency host training for specialists on integrating climate change into their programs and projects. More coordination is needed to meet climate literacy needs, especially ones regarding environmental justice.

CLIMATE CHANGE RESOURCE CENTER

The [Forest Service Climate Change Resource Center](#) is a web-based, national platform that connects land managers and decision-makers with usable, high-quality science to address climate change in natural resources planning and management. The Climate Change Resource Center (CCRC) provides expert-reviewed information about climate change impacts on forests and other ecosystems and approaches to adaptation and mitigation in forests and grasslands. The CCRC includes educational resources, climate change and carbon tools, video presentations, literature, and briefings on management-relevant topics, ranging from basic climate change information to details on specific management responses. The CCRC also curates a compendium of more than 500 climate adaptation approaches, developed by Adaptation Partners and the Northern Institute of Applied Climate Science.



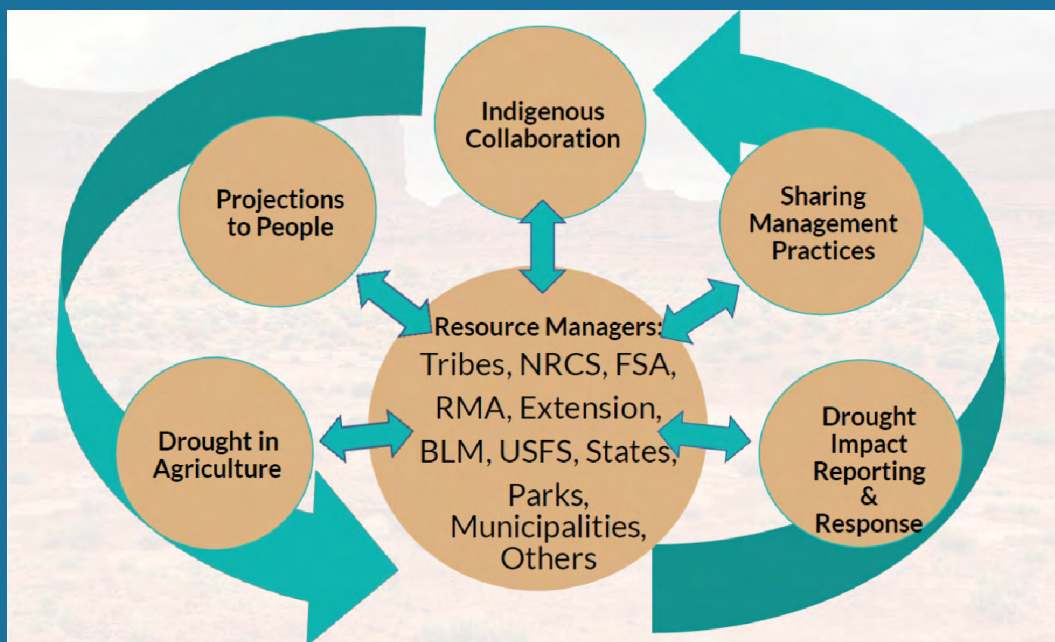
USDA Climate Hubs

USDA agencies, including the Forest Service, are providing increased support for the USDA Climate Hubs, which are unique in their work across agency boundaries at the intersection of agricultural systems, forests and rangelands, and climate change. In addition to delivering science, the USDA Climate Hubs play a key role in convening partners and assessing needs for climate science to support adaptation in forests, rangelands, and agricultural systems. The USDA Climate Hubs can collaborate across USDA to convene partners, determine needs, and coproduce science in support of adaptation. The broader USDA Climate

Hubs collaborative network includes land-grant universities and cooperative extension, State natural resource agencies, nongovernmental partners, and international organizations. The USDA Climate Hubs can work with these partners to assist national forest and grassland managers and State and Private Forestry staff in applying climate science and adaptation actions to local landscapes. The USDA Climate Hubs will support the adaptation plan by coordinating with the Office of Sustainability and Climate, the network of climate change coordinators, and other Forest Service programs to identify and implement high-priority actions at national, regional, and local scales.

SOUTHWEST DROUGHT LEARNING NETWORK

The Drought Learning Network (DLN) is a peer-to-peer knowledge exchange between climate service providers and resource managers. The main goal of the DLN is to gather and share lessons learned from drought events to improve responses to future droughts. The DLN was conceptualized as a framework for stakeholders to share experiences in preparing for, responding to, and recovering from drought to inform current and future response and mitigation actions.



INTENDED OUTCOMES

Through the six adaptation actions, the Forest Service will support long-term outcomes to further its mission. These intended outcomes include:

- Reduced wildfire risk.
- Reduced risk of extreme weather and disturbance.
- Productive, diverse ecosystems and watersheds.
- Multiple benefits provided to the public.
- Enhanced social resilience to climate impacts and environmental justice.
- Agency workforce and operations are prepared for multiple climate impacts.

The Forest Service will track actions and outputs supporting these outcomes annually through the Climate Action Tracker. These actions will be facilitated by the four foundations of Tribal engagement, environmental justice, workforce climate literacy, and the USDA Climate Hubs. By working toward these outcomes, the Forest Service will help sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations.

HURRICANE PREPARATION AND RECOVERY GUIDES FOR LAND MANAGERS

These guides, developed by the Southeast Climate Hub, include considerations for building a resilient operation, long-term operation maintenance, short-term preparedness actions, and post-hurricane recovery. All of the guides include a wealth of online resources for state- or commodity-specific information from Federal, State, university, and other organizations.



GLOSSARY

Adaptation: Adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects ([U.S. Global Change Research Program](#)). Climate change adaptation includes initiatives and measures to reduce the vulnerability of natural and human systems to actual or expected climate change effects. Adaptation strategies include (1) building resistance to climate-related stressors; (2) increasing ecosystem resilience by minimizing the severity of climate change impacts, reducing vulnerabilities, and/or increasing the adaptive capacity of ecosystem elements; and (3) facilitating ecological transitions in response to changing environmental conditions ([FSH 1909.12 zero code](#)).

Assisted migration: The intentional movement of plants or animals into areas assumed to be their future habitats ([U.S. Global Change Research Program](#)). This can include the human-assisted movement of seed sources or populations (genotypes) to new locations within the historical established range of a species (assisted population migration); moving seed sources or populations from their current range to suitable areas just beyond the historical species range; facilitating or mimicking natural dispersal (assisted range expansion); and moving seed sources or populations to a location far outside the historical species range, beyond locations accessible by natural dispersal (assisted species migration) (see [Climate Change Resource Center](#)).

Disturbance: Any relatively discrete event in time that disrupts ecosystem, watershed, community, or species population structure and/or function and changes resources, substrate availability, or the physical environment ([36 CFR 219.19](#)).

Ecological integrity: The quality or condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence ([36 CFR 219.19](#)).

Ecosystem services: The benefits produced by ecosystems on which people depend, for example, fisheries, drinking water, fertile soils for growing crops, climate regulation, and aesthetic and cultural values ([U.S. Global Change Research Program](#)).

Environmental justice: The fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice means that everyone enjoys the same degree of protection from environmental and health hazards and has equal access to the decision-making process for ensuring that people have a healthy environment in which to live, learn, and work ([EO 12898](#), [U.S. EPA](#)).

Equity: The consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, Indigenous and American Indian persons, Asian Americans, and Pacific Islanders, and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality ([EO 13985](#)).

Evapotranspiration: Evaporation of water from soil and plant leaves ([U.S. Global Change Research Program](#)).

Extreme event: A weather event that is rare at a particular place and time of year, including, heatwaves, cold waves, heavy rains, periods of drought and flooding, and severe storms ([U.S. Global Change Research Program](#)).

Indigenous Traditional Ecological Knowledge: A body of observations, oral and written knowledge, practices, and beliefs that promotes environmental sustainability and the responsible stewardship of natural resources through relationships between humans and environmental systems. It is applied to phenomena across biological, physical, cultural, and spiritual systems ([November 15, 2021, Memorandum on Indigenous Traditional Ecological Knowledge and Federal Decision Making](#)).

Refugia: Areas that remain relatively buffered from contemporary climate change over time and enable the persistence of valued physical, ecological, and sociocultural resources ([Climate Change Resource Center](#)).

Resilience: The capability to anticipate, prepare for, respond to, and recover from significant multihazard threats with minimum damage to social well-being, the economy, and the environment. In the context of ecosystems, the Forest Service defines resilience as the ability of an ecosystem and its component parts to absorb or recover from the effects of disturbances through preservation, restoration, or improvement of its essential structures and functions and redundancy of ecological patterns across the landscape ([U.S. Global Change Research Program](#)).

Stressors: Factors that may directly or indirectly degrade or impair ecosystem composition, structure, or ecological processes in a manner that may impair the ecological integrity of an ecosystem. Such factors include invasive species, loss of connectivity, and the disruption of a natural disturbance regime ([36 CFR 219.19](#)).

Vulnerability: The degree to which physical, biological, and socioeconomic systems are susceptible to and unable to cope with the adverse impacts of climate change ([U.S. Global Change Research Program](#)).

APPENDIX 1: RELATED AGENCY INITIATIVES

Administration Priorities and Executive Orders

EO 14008: Tackling the Climate Crisis at Home and Abroad

Executive Order 14008 established a governmentwide approach to tackling climate change and directed departments and agencies to develop climate adaptation plans. Delivering environmental justice is a central theme that runs through Executive Order 14008. It also resulted in two other strategic documents that will shape the Forest Service's actions on climate change. [The Climate-Smart Agriculture and Forestry Strategy: 90-Day Progress Report](#) summarizes recommendations, based on outreach with external organizations, to USDA and its agencies as they develop strategies for adapting to climate change. The "USDA Forest Service Climate Adaptation Plan" builds on these recommendations by identifying specific impacts and adaptation actions that align with concepts in the report. Also in response to EO 14008, an interagency team released the [Conserving and Restoring America the Beautiful report](#), which outlines principles and priorities for a campaign to conserve and restore at least 30 percent of the Nation's lands and waters by 2030. These principles emphasize collaboration, local leadership, and Tribal sovereignty. Activities outlined in this "USDA Forest Service Climate Adaptation Plan" will help the agency restore and adapt the lands it manages to climate change in line with the goals of the "American the Beautiful" campaign.

EO 14057: Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability

Executive Order 14057 and the accompanying [Federal Sustainability Plan](#) set out a range of sustainability goals for Federal agencies. Although Executive Order 14057 focuses primarily on sustainable operations and reducing greenhouse gas emissions, several components also relate to adaptation and resilience. Initiatives associated with Executive Order 14057 relevant to the "USDA Forest Service Climate Adaptation Plan" include developing climate-resilient infrastructure and operations, developing a climate and sustainability-focused workforce, and advancing environmental justice and equity.

EO 14072: Strengthening the Nation's Forests, Communities, and Local Economies

[Executive Order 14072](#) expands governmentwide efforts to tackle the climate crisis by (1) safeguarding mature and old-growth forests on federal lands, as part of a science-based approach to reduce wildfire risk; (2) Strengthening reforestation partnerships across the country to support local economies and ensure we retain forest ecosystems and sustainable supplies of forest products for years to come; (3) Combating global deforestation to deliver on key COP26 commitments; and (4) Enlisting nature to address the climate crisis with comprehensive efforts to deploy nature-based solutions that reduce emissions and build resilience.

USDA Climate Hubs 5-Year Strategic Plan

The mission of the USDA Climate Hubs is to develop and deliver science-based, region-specific information and technologies for agricultural, forest, and natural resource managers and communities that enable climate-informed decision-making and to assist in implementing those decisions. The Climate Hubs Strategic Plan 2020-2025 outlines three goals to support mission delivery:

- Enhance working lands resilience and productivity.
- Build climate awareness.
- Continually improve program effectiveness.

The USDA Climate Hubs will advance these goals by working collaboratively with agencies and partners to provide science and data synthesis; tool and technology development; and outreach, convening, and training to better serve communities and underrepresented groups and grow partnerships. The program continually evaluates and refines program metrics and procedures to improve effectiveness and communicate success.

Forest Service Climate Change Initiatives

This plan aligns with a series of past and ongoing efforts in the Forest Service to respond to climate change through research and land management activities.

Forest Service Strategic Framework for Responding to Climate Change

[The Strategic Framework for Responding to Climate Change](#) was released in 2008 and outlines seven goals to address climate change:

- **SCIENCE**—Advance our understanding of the environmental, economic, and social implications of climate change and related adaptation and mitigation activities on forests and grasslands.
- **ADAPTATION**—Enhance the capacity of forests and grasslands to adapt to the environmental stresses of climate change and maintain ecosystem services.
- **MITIGATION**—Promote the management of forests and grasslands to reduce the buildup of greenhouse gases, while sustaining the multiple benefits and services of these ecosystems.
- **POLICY**—Integrate climate change, as appropriate, into Forest Service policies, program guidance, and communications and put in place effective mechanisms to coordinate across and within deputy areas.

- **SUSTAINABLE OPERATIONS**—Reduce the environmental footprint of Forest Service operations and be a leading example of a green organization.
- **EDUCATION**—Advance awareness and understanding regarding principles and methods for sustaining forests and grasslands, and sustainable resource consumption, in a changing climate.
- **ALLIANCES**—Establish, enhance, and retain strong alliances and partnerships with Federal agencies, State and local governments, Tribes, private landowners, nongovernmental organizations, and international partners to provide sustainable forests and grasslands for present and future generations.

These goals continue to guide the Forest Service's climate response and align with many of the adaptation actions described in this plan.

Forest Service National Roadmap for Responding to Climate Change.

The [Roadmap](#), released in 2010, builds on the strategic framework and lays out three types of actions for the Forest Service to employ in a continuous cycle of adaptive management based on monitoring and evaluation. The roadmap remains relevant today: the strategic framework involving assessment, engagement, and management underlies the process used to develop this plan.

Climate scorecards

The Forest Service has been tracking progress on climate change actions since 2011 using an annual scorecard. From 2011 to 2016, the Forest Service used the Climate Change Performance Scorecard to measure initial progress in building agency capacity to address climate change. In 2019 and 2020, the Forest Service transitioned to its Sustainability Scorecard, which was built on the previous iteration but provided more structure for units to measure their progress. The agency is currently developing the third iteration of a scorecard, the Climate Action Tracker (CAT),

which will align with USDA and Forest Service climate change and strategic plans. The CAT, which will include new measures for environmental justice, will launch in fall 2022 and continue annually thereafter, with reporting at the national, regional, and forest levels. It will be a tool for evaluating progress on actions outlined in this adaptation plan.

Forest Service Strategic Plan, 2015-2020

The Forest Service's strategic plan, in the section "Sustain Our Nation's Forests and Grasslands," includes the strategic objectives of fostering resilient, adaptive ecosystems to mitigate climate change and mitigating wildfire risk. Adaptation actions discussed in this plan support these strategic objectives.

Forest Service Global Change Research Strategy, 2009-2019

[The Forest Service Global Change Research Strategy](#) outlines research across a range of management, science, and science delivery actions aimed at developing adaptation and mitigation approaches to sustain healthy ecosystems, including:

- Research to enhance ecosystem sustainability.
- Research to increase carbon sequestration.
- Research to provide decision support.

Shared research needs: infrastructure, scientific collaboration, and science delivery.

Forest Service research and science delivery is an essential component of the adaptation plan, providing the foundation for understanding climate change impacts and the consequences of potential adaptation actions and developing tools and management systems to facilitate ecosystem, landscape, and community adaptation.

International Initiatives

Forest Service international engagement supports administration priorities, including the President's Emergency Plan for Adaptation and Resilience (PREPARE) and the Plan to Conserve Global Forests, both announced at UNFCCC COP26 in Glasgow in December 2021. PREPARE supports developing countries and communities in vulnerable situations around the world in adapting to and managing the impacts of climate change. The Plan to Conserve Global Forests promotes the conservation and restoration of critical ecosystems that serve as global carbon sinks.

Related Forest Service Policies and Initiatives

In addition to building on Forest Service initiatives that focus on climate change, the "USDA Forest Service Climate Adaptation Plan" aligns with policies and initiatives that address related topics, including wildfire, ecological restoration and reforestation, and planning.

Confronting the Wildfire Crisis: A Strategy for Protecting Communities and Improving Resilience in America's Forests

Under the [10-Year Wildfire Crisis Strategy](#), the Forest Service will work with partners to treat up to an additional 20 million acres on National Forest System lands; treat up to an additional 30 million acres on other Federal, Tribal, State, and private lands; and develop a plan for long-term maintenance beyond the 10 years. The "USDA Forest Service Climate Adaptation Plan" includes sections on the impacts of climate change on wildfire and adaptation actions related to wildfire, which expand on the Wildfire Crisis Strategy.

Equity Action Plan

The Equity Action Plan includes actions with the potential for creating systemic change that benefits employees, Tribal Nations, partners, and the public. The Equity Action Plan commits the Forest Service to assess barriers and identifying equity outcomes for underserved communities. Actions in the adaptation plan align with actions in the Equity Action Plan.

USDA Forest Service National Tribal Relations Action Plan

The National Tribal Relations Action Plan for fiscal years 2022 to 2024 outlines steps for the agency to take to meet its Federal trust responsibility, honor treaty obligations, and support Tribal self-determination. Guided by this plan, the Forest Service will meet its obligations through consultation, collaboration, and coordination with Tribal Nations and Alaska Native corporations.

Ecological Restoration and Resilience Directive (FSM 2020)

The primary objective of this foundational policy for sustainable management of National Forest System lands is to restore and maintain resilient ecosystems with the capacity to withstand stressors and recover from disturbances, especially those under changing and uncertain environmental conditions, including climate change and extreme events.

Shared Stewardship Strategy

The [Shared Stewardship](#) strategy fosters cooperation, comanagement, and collaborative priority setting for forests, including fuels and forest health treatments, involving the Forest Service and other Federal, Tribal, State, and local government agencies, along with private organizations and landowners. This strategy promotes efficiencies in project planning at a landscape scale to help ensure that treatments target the areas at highest risk.

2012 Planning Rule

The [Planning Rule](#) gives guidelines for land and resource management plan development and revision by the national forests and grasslands under the National Forest Management Act. The rule requires consideration of climate change in land management planning and includes requirements related to sustainability and ecological integrity to facilitate the restoration and maintenance of resilient ecosystems on the national forests and grasslands. Revised land management plans developed under this rule offer opportunities to reduce vulnerabilities and take adaptation actions.

Watershed Condition Framework and Terrestrial Condition Assessment

The [Watershed Condition Framework](#) (WCF) establishes a process for evaluating and improving the health of watersheds on national forests and grasslands. Watershed restoration under the WCF offers a key opportunity for reducing climate change vulnerabilities and taking adaptation actions. The [Terrestrial Condition Assessment](#) (TCA), a complement to the WCF, assesses the ecological integrity of terrestrial systems. The TCA identified potential restoration opportunities on 9 million acres of National Forest System lands that burned at uncharacteristically high severities, 80 million acres with high to very high wildfire hazard potential, 23 million acres with tree mortality due to insect and disease outbreaks, and an additional 25 million acres at risk for tree mortality due to insect and disease infestations.

National Strategy for a Sustainable Trail System

Released in 2017, the [National Strategy for a Sustainable Trail System](#) outlines challenges and goals for managing the National Forest System's nearly 160,000 miles of motorized and nonmotorized trails. Climate-informed trail stewardship would support many goals outlined in the strategy.

APPENDIX 2: PLAN DEVELOPMENT PROCESS

Cross-Deputy Team

Representatives from National Forest System, State and Private Forestry, Research and Development, and the USDA Climate Hubs formed a cross-mission-area team to guide the development of the adaptation plan, with input from across the agency.

The core team included representation from the following offices: Office of Sustainability and Climate (NFS), Western Wildlands Environmental Threat Assessment Center (R&D), Sustainable Forest Management Research (R&D), Forest Health Protection (S&PF), Pacific Northwest Regional Office (NFS), Northern Forests Climate Hub (R&D), Northwest Climate Hub (R&D), and Office of the Deputy Chief (NFS).

Plan Input and Creation

The core team engaged with all deputy areas from the Washington Office and with and to solicit feedback and provide information about plan design and creation. The core team collected targeted input into the plan at multiple levels:

- Forest Service employees were invited to provide input via a web-based survey on climate change risks, climate adaptation, and environmental justice from November 4 to November 30, 2021. The agency received 648 responses that helped frame the key risks and adaptation actions that went into the adaptation plan.

- Four cross-deputy area workshops were held in January 2021: Fire (January 11); Eastern Friendly Time Zone (January 18); Western Friendly Time Zone (January 20); and Environmental Justice (January 25). A total of about 250 employees with expertise in climate change, environmental justice, and related topics participated, providing knowledge of climate change risks and critical adaptation actions.
- Three externally focused roundtables were held with the following groups: Tribal Nations and Tribal organizations (December 17); forest industry and nongovernmental organizations (January 26); and State forestry representatives (January 27). Approximately 100 representatives attended these sessions, identifying key climate-related risks and adaptation actions of interest to organizations that work closely with the agency.
- The core team engaged with agency subject matter experts for review and specific input, including from environmental justice staff and USDA Climate Hubs to ensure that USDA guidance was adequately addressed.
- The writing team evaluated complementary Federal, departmental, and agency climate impact assessments and plans for alignment with this plan.
- The core team designed the adaptation plan in parallel with the Climate Action Tracker for monitoring progress and effectiveness.
- The core team led the writing of the plan, building content from the above feedback and coordinating additional subject matter expert input and review.

Climate Adaptation Plan Survey

In November 2021, the Forest Service Climate Adaptation Plan Core Team developed a web-based survey to inform the adaptation plan, following guidance developed by the USDA Office of the Chief Economist. The survey was distributed broadly to Forest Service employees and the USDA Climate Hubs. This survey included questions on climate change risks, adaptation actions, environmental justice, and

related topics. A total of 648 Forest Service employees responded to this survey across all deputy areas. Respondents were well-distributed geographically, with respondents in 40 States plus Washington, DC, and Puerto Rico, and substantial numbers of respondents from each region. The text results were summarized and used to inform the adaptation plan, as well as the virtual workshops and roundtables.

Informational Resources

The survey asked employees, “What informational resources do you use to address climate change issues?” Of the 12 options provided, the most frequent source was peer-reviewed publications, followed by Forest Service Research and Development and Forest Inventory and Analysis data and models, climate change vulnerability assessments, and the Office of Sustainability and Climate. They also had an opportunity to list other information sources; common responses included Forest Service regional offices, other agencies, and organizations, as well as universities, nonprofit organizations, and other partners focused on climate change adaptation, such as the USDA.

Climate Change Impacts

The survey asked respondents to rate a series of current or projected climate impacts affecting their program or office’s ability to carry out the agency’s mission. The list of impacts was based on climate science from the National Climate Assessment and represented common threats anticipated across the United States (Figure 3).

Adaptation Actions

The survey asked respondents, “What are some actions that your local program/office has taken to identify and reduce climate-related risks in the past five years?” and “What additional actions could your program/office or the Forest Service be taking to reduce climate-related risks to our agency?” There were 487 and 480 responses to each question, respectively. Common responses included adaptation actions related to changes in prescribed burning and fuels

management; assisted migration; habitat protection; riparian restoration; improved planning, funding, and monitoring; data and tools; greater collaboration; improved infrastructure; more sustainable operations; improved training, education, and leadership; and measures to improve employee safety and well-being, among other measures.

Challenges

The survey asked respondents what their top three challenges were in implementing adaptation actions. The most common categories selected were lack of staff, lack of financial resources, and conflicts with other priorities (Figure 4). Seventy-six respondents also provided additional challenges in the “Other” category. Their responses included issues related to burnout, culture, leadership, messaging, permitting and regulatory requirements, data, and technical needs.

USDA Climate Hubs

The survey asked, “What additional assistance could the USDA Climate Hubs provide (through technical assistance, science delivery, etc.) to help you in assessing vulnerability and developing potential adaptation actions?” There were 144 responses to this question. Some employees were not aware of the USDA Climate Hubs or their role in providing climate information. Many offered suggestions related to education and outreach, staffing, funding, guidance, data, tools, and case studies.

Environmental Justice

The survey asked a series of questions on environmental justice issues. It provided a brief description of environmental justice, then asked, “Does your program/office currently serve Indigenous, low-income, and minority populations (EJ populations)? If yes, please describe.” Approximately 69 percent of respondents said yes, 11 percent said no, and 20 percent said they didn’t know; 397 provided additional information, including examples of projects conducted in their forests or offices.

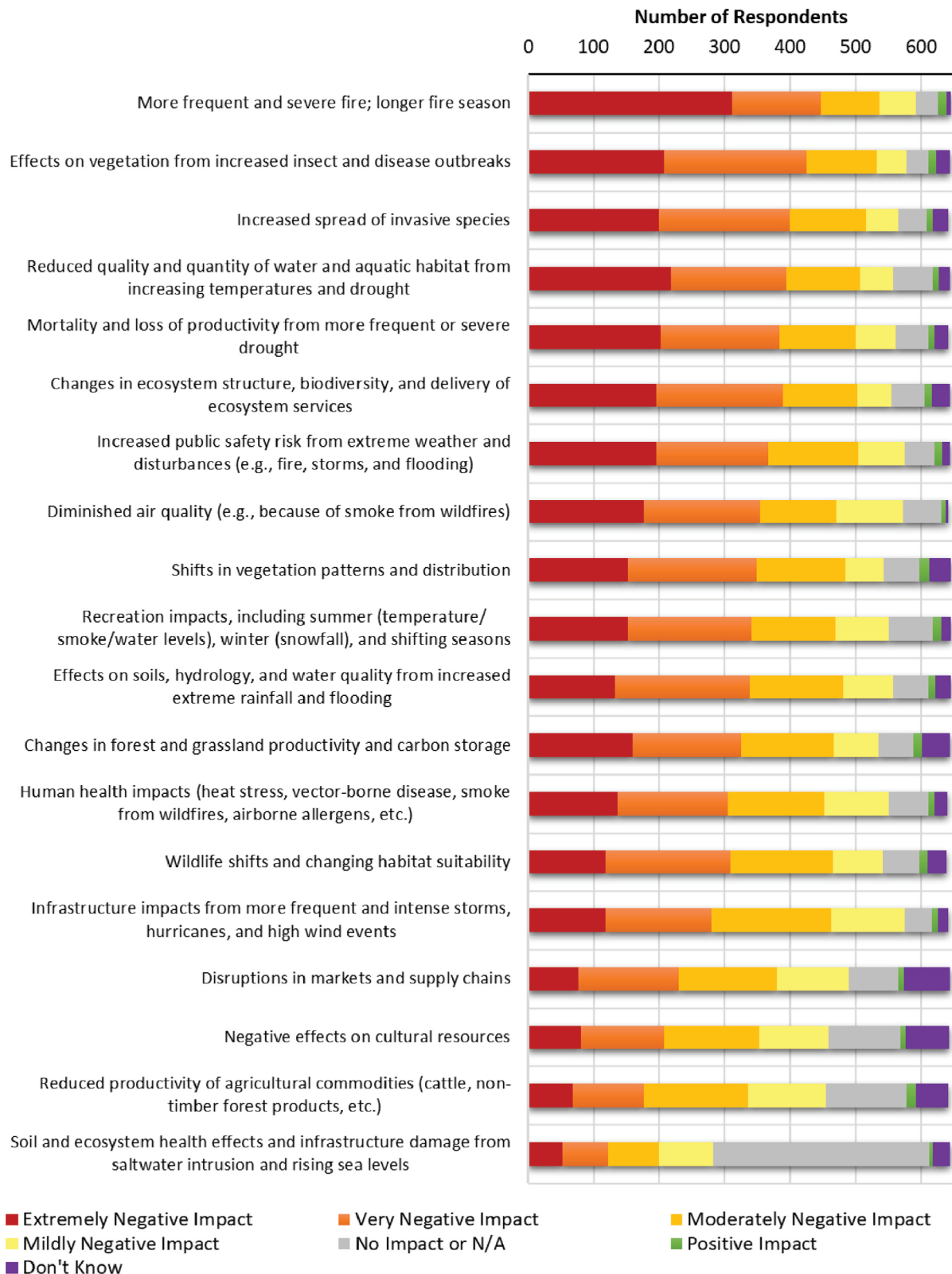


Figure 3. Responses to the question “Below is a list of climate change impacts from the National Climate Assessment that are either already occurring or projected to occur in the United States and that have the potential to affect our mission. Rate which impacts listed below you think will have the largest effect on your program/office’s ability to carry out the agency’s mission.” In addition to the predefined impact categories, respondents could also provide feedback on other climate impacts affecting their work or likely to affect it in the future. Respondents described issues related to habitat and ecosystems; rare and endangered species; invasive species, pathogens, and pests; drought and water quality and quantity; changes to soils; fire effects; infrastructure damage from flooding; communities, recreation, subsistence, cultural use, and livestock; environmental justice issues; and effects on employee recruitment, retention, safety, and well-being, among other themes.

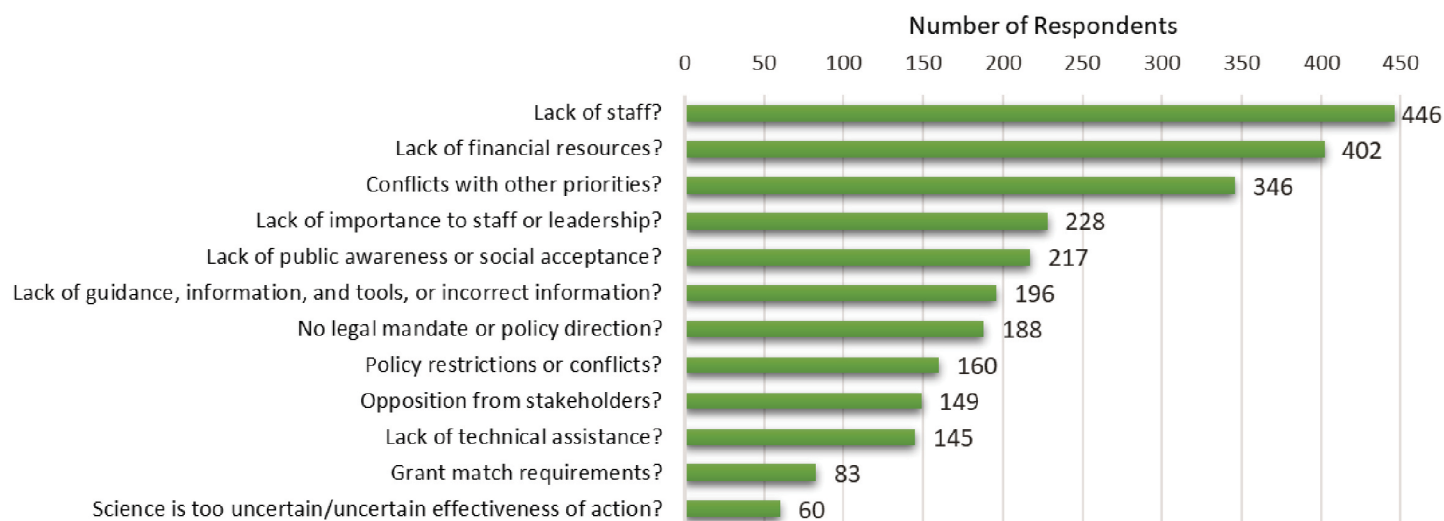


Figure 4. What challenges do you foresee in implementing these actions? (Select the top three).

The survey then asked, “Do you have an adequate understanding of climate justice and strategies for mitigating the threats to EJ populations associated with climate change?”. Approximately 20 percent of respondents said they had little to no understanding, 51 percent said they had some understanding, another 20 percent said they had a good understanding, and 8 percent of respondents said they had a very good understanding. These results indicate a need for more education, training, and outreach on these issues.

The survey asked respondents, “Does your program/office face barriers to assisting EJ communities in preparing for the risks associated with climate change?”. If yes, please describe.” About 50 percent of respondents said they didn’t know, with another 37 percent saying yes, and 13 percent saying no. Among the responses, 222 provided additional information on these barriers, including issues related to staff, capacity, and funding; leadership; training and outreach; lack of relationships and language barriers; lack of data and expertise; and challenges in getting grant opportunities to these communities, among others.

Finally, the survey asked, “What would help your program/office have a more positive impact on EJ communities?”, to which 380 responded with ideas for addressing each of the challenges described above. This included more funding and staff, better leadership

support and coordination, more training and outreach, better translation services and better community connections, more flexible funding, better data and mapping, case studies, guidance, and tools.

Throughout the environmental justice questions, many respondents indicated confusion about terminology (what is environmental justice, and what does this include?), potentially creating an opportunity for employee education and outreach on environmental justice, how the Forest Service is currently addressing this issue, and why it matters for the agency’s work.

Climate Adaptation Plan Roundtables

In December 2021 and January 2022, the Forest Service Office of Sustainability and Climate hosted three virtual roundtable discussions to gather input and feedback from Tribes and external partners on the Climate Adaptation Plan. The first, a roundtable for Tribes and Tribal organizations, was on December 17, 2021, with around 20 attendees. The second, a roundtable for nongovernmental organizations and industry groups, was on January 26, 2022, with around 65 attendees. The final roundtable for State foresters was on January 27, 2022, with around 25 attendees. The Office of Tribal Relations and State and Private Forestry assisted in determining invitees.

Each roundtable was 90 minutes long and began with brief opening remarks from both the Office of Sustainability and Climate acting director and deputy director, followed by a group listening session. Participants were given three questions as a prompt to guide the session. The first two questions were the same for all roundtables: (1) What climate change impacts are you most concerned about? and (2) What actions would you like to see the Forest Service take or not take to address climate change impacts? The third question was tailored to each roundtable as follows:

- How can we best work with Tribes in developing and implementing this Climate Adaptation Plan? (Tribal Roundtable)
- How would you like to see partnerships included in the Plan? (Nongovernmental Organization and Industry Roundtable)
- What needs to be done to scale up and address climate change? Are there barriers or challenges we could address? (State Foresters Roundtable)

Tribal Roundtable—December 17, 2021

Climate Change Impacts

Key themes discussed at the Tribal roundtable included impacts of climate change on ecosystem services, including biodiversity, water provisioning (quantity and quality), agriculture, and spiritual/cultural services; declining forest health; and risks to safety, infrastructure, and emergency management capacity posed by extreme events and disturbances, such as wildfire, flooding, and heavy winds. Participants also emphasized concern over disproportionate impacts on Indigenous, subsistence-practicing, and other vulnerable communities. They also stressed that climate change impacts on forestlands could also impact treaty rights.

Adaptation Actions

In general, responses emphasized landscape-scale and collaborative management actions and goals. Water was a key theme across several responses, emphasizing managing watershed health and maintaining access to water by people, other beings, and ecosystems. Participants mentioned managing watershed health (headwaters, downstream flows, storage capacity), improving water quantity and quality, increasing drought resilience, and preserving groundwater. Participants also emphasized a desire to see Tribal knowledge and perspectives incorporated into management actions, such as landscape-scale incorporation of Indigenous Traditional Ecological Knowledge and cultural burning practices. Participants also provided examples of successful Tribal landscape-scale collaborations, plans, and vulnerability assessments.

Working Together

Participants emphasized the need to recognize, incorporate, and learn from Tribal and Indigenous perspectives, world views, and knowledge. For example, Mother Earth and the interconnectedness of all beings, including natural and cultural resources, are central to many Tribal and Indigenous perspectives on climate adaptation. Additionally, participants stressed the need to prioritize formal engagement mechanisms like memorandums of understandings; to fully implement the Tribal Forest Protection Act; and encourage collaboration between States, the Federal Government, and Tribes.

Nongovernmental Organization and Industry Roundtable—January 26, 2022

Climate Change Impacts

Key themes discussed at the nongovernmental organization and industry roundtable included declining forest health (i.e., insect and disease outbreaks, invasive species); impacts on ecosystem services, including carbon uptake/storage and biodiversity; and risks posed by extreme events and disturbances, such as wildfire and drought. Participants were also concerned about Impacts on human health, including disproportionate exposure of vulnerable communities to fire and smoke and exposure of urban communities to extreme heat.

Adaptation Actions

A common theme was the need to take a holistic, multiple-benefit, and multiple-use perspective to the Climate Adaptation Plan that facilitates resilience. Examples of achieving this perspective include considering whole ecosystems, watersheds, or landscapes; addressing and managing forest health and resilience; and supporting biodiversity and wildlife (e.g., maintaining habitat connectivity, refugia, and old growth). Several participants also emphasized the need to consider both adaptation and mitigation in the adaptation plan, as the two concepts are related (e.g., declining forest health increases emissions from wildfire smoke; managing healthy forests and forest soils sequesters more carbon).

Some participants emphasized a need for a proactive approach to adaptation and management. In the context of wildfire, examples included more support for prescribed burns and thinning and the need to help communities cope with and adapt to fire (i.e., supporting “fire-adapted communities”). Another proactive approach mentioned was to support private owners in “keeping forests as forests” (e.g., by analyzing benefits from private forest lands and the wood products industry).

Participants mentioned prioritizing and investing in existing Forest Service resources and programs can better serve climate adaptation needs. Specific examples included existing genetic resources, the Experimental Forest and Range Network, Forest Products Laboratory, and the Resources Planning Act Assessment. Other recommendations included elevating outcomes-based performance measures and filling vacant positions needed to manage adaptation.

Working Together

Participants emphasized the benefits of partnerships, collaboratives, and networks for learning and adapting to climate change. These include gaining larger scale and cross-boundary perspectives, and access to new resources and knowledge. Participants also requested that the Forest Service make it clear how climate change is nested in other agency priorities and how different agencies integrate adaptation plans. In addition, participants discussed recognizing treaty rights and the need for more meaningful Tribal consultation and costewardship (facilitated by Tribal Forest Protection Act and Good Neighbor Authority).

State Foresters Roundtable—January 27, 2022

Climate Change Impacts

Key themes discussed at the State Foresters Roundtable included declining forest health and land area; impacts to ecosystem services, including carbon uptake/storage, biodiversity, and wildlife habitat; and risks posed by extreme events and disturbances, such as wildfire, drought, flooding, and extreme heat. In addition, participants cited concern over declines in the forest and fire management workforce and difficulty attracting, training, and retaining highly qualified workers. Lastly, participants mentioned changes to forest recreation, including overcrowding and an influx of new users, which can stress recreation infrastructure and increase the prevalence of risky behavior (e.g., fire risk).

Adaptation Actions

A key theme was supporting and incentivizing private landowners to keep forests as forests. Examples of how to do this include establishing longer term timber contracts (i.e., incentivizing investment in the infrastructure needed to produce wood products), helping develop markets for timber products and biomass, and supporting wood innovations. Participants also requested greater clarity around carbon credits (i.e., accounting procedures, how to achieve additionality) and increased support for reforestation, including increasing nursery capacity and available seed stock.

Participants also requested science delivery and education services. For example, additional training could help support both wildfire response and prescribed burn application. Participants would also appreciate concise, consistent, and up-to-date science-based talking points on forests and climate change so that messaging across the Forest Service and partners is clear. These talking points should include both the impacts of climate change and how well-managed forests can be a solution to the problem.

Working Together

Participants stressed that climate change requires both the Forest Service and its partners to be ready to engage and assist quickly and on-demand. Examples of how to do this include providing and funding the full suite of State and private forestry programs, having regional partnerships already established and ready to act and addressing indecision (i.e., predetermining who needs to act when a problem arises). Establishing a mechanism or program for recognizing early adopters and good land stewards was also mentioned, as these partners are critical to advancing climate adaptation on private lands.

Climate Adaptation Plan Workshops

In January 2022, the Forest Service Climate Adaptation Plan Core Team arranged a series of workshops to gather input on climate change impacts and adaptation measures. This consisted of a workshop on fire issues (January 11), two general workshops (January 18 and 20), and an environmental justice workshop (January 25). The core team sought representation from across geographies, deputy areas, and programs in the agency, including employees engaged in climate change adaptation and environmental justice as well as those in decision-making roles. Approximately 70 people participated in each workshop. For each session, the core team introduced the adaptation plan and the goals of the workshops, then divided participants into breakout groups to discuss a series of questions about climate change impacts and adaptation measures. This information helped to inform the writing of the Climate Adaptation Plan, including specific examples used throughout the plan.

Climate Change Impacts

The impacts discussion included questions on the consequences of each impact, specific examples, challenges, and opportunities related to this impact, science and information needs, and environmental justice considerations. Discussions were wide-ranging and considered a variety of issues around each impact. Below is a selection of some of the climate change impacts discussed in these workshops; this is not a comprehensive list of all the topics discussed.

- **Cultural resources:** Impacts on cultural sites and on plants and animals that are important for Indigenous and other cultural groups.

- **Drought:** Effects on tree mortality (including large trees such as sequoias), reforestation and seedling availability, conversion of forests to nonforest land, riparian and aquatic habitats and organisms, fisheries, agriculture, grazing, recreation (e.g., river and lake recreation opportunities), subsistence, water quality and quantity, water management issues, and social and economic effects on rural communities.
- **Heavy rainfall and flooding:** Urban flooding, water quality issues, changes to soils and hydrology, landslides, lost access to communities, post-fire erosion, damage to roads, bridges, culverts, facilities, and homes, and equity issues in responding to floods.
- **Invasive species:** The encroachment of pest species into new habitats, interactions with fire, increased tree mortality, increased hazard trees, aquatic invasives and effects on fisheries (e.g., nonnative trout), loss of native species, loss of native grasses, and side-effects of increased pesticide use.
- **Species distribution:** Loss of vulnerable species, vegetation type conversion (e.g., loss of forest, encroachment on alpine areas), creation of novel ecosystems, reduction in timber and carbon storage, impacts on wildflowers, and need for assisted migration programs.
- **Sea-level rise:** Impacts on Indigenous communities.
- **Snowfall:** Rain on snow events, earlier snowmelt, and loss of ski resorts.
- **Temperature change:** Urban heat islands, increased demand for recreation opportunities, and increased energy costs.
- **Wildfire:** Effects on ecosystem structure and productivity (e.g., conversion to grasslands), effects on soils and hydrology, effects on fish and wildlife, invasive species, lost biodiversity, loss of large trees, loss of timber and carbon, air quality, human health and safety (including to Forest Service employees), emergency management issues (e.g., challenges of communicating risk, especially to non-English speaking communities), shifting tourism and

recreational use patterns to avoid fire and smoke issues, effects on subsistence and cultural resources, effects on grazing, damage to infrastructure and homes, loss of access to communities, human migration, effects on water quality and quantity, economic effects, equity issues in rebuilding after wildfires, increased complexity of wildfire incidents, effects on staffing, resources, workload, and other priorities, and loss of public trust.

- **Wildlife:** Losses and changes to habitat (e.g., large tree habitat, loss of deep snow for denning, alpine species), species lost, effects of pests and diseases, effects on aquatic organisms and fisheries from stream temperature, species migration, and changes in movement patterns, effects of phenology changes, and conflicting priorities between different species and resources.

Adaptation Actions

In the adaptation breakout sessions, participants discussed ways to address the impacts they identified. These included possible adaptation actions, resources needed, potential collaborations, environmental justice collaborations, and information needs. Below is a summary of some of the topics discussed in these workshops. The core team considered and evaluated these suggestions for their feasibility, alignment with the agency mission and current policies, and relevance for addressing climate impacts.

- **Carbon:** Carbon analysis, management, and communication of carbon risks and benefits.
- **Data and Knowledge Sharing:** Integrated databases, external and internal climate communication, decision support, and sharing lessons learned.
- **Drought:** Proactive management, building flexibility and faster response times into management, adjusting the timing of forest and range operations, and partnering with other organizations to aid in response.

- **Environmental Justice:** Improving and increasing engagement with communities, including providing training and decision support services; strengthening partnerships with environmental justice organizations, improving coordination and integration of related Forest Service activities, research, and management actions; hiring locally; and making funding more accessible to underserved communities.
- **Fire:** Accelerating the pace and scale of prescribed burning, including during shoulder seasons; using wildland fire as a management tool when appropriate; long-term wildfire planning and risk analysis that incorporates climate change and pre- and post-fire considerations; working with partners to build trust.
- **Heavy Rainfall and Flooding:** Developing flood early warning systems, producing, and sharing research on flood and heavy rainfall risks, and managing ecosystems to accommodate increases in flooding (e.g., reconnect floodplains, restore riparian and instream habitat).
- **Infrastructure:** Systematically making infrastructure more resilient to climate change impacts, including updated design, and decommissioning at-risk infrastructure.
- **Monitoring:** Monitoring to understand wildfire, fuel treatment, and timber management effects on multiple resources and ecological processes (e.g., plants, insects/pests, wildlife, recreation, cultural services); prioritizing monitoring in adaptive management; standardized approaches for consistency in datasets; and early detection of invasive species and pests.
- **Organizational Adaptation:** Focusing on adaptation outcomes, facilitating engagements between decision-makers and stakeholders, and providing funding for pilot projects and other approaches that promote innovation.
- **Outreach:** Connecting and engaging with communities and partners to facilitate transboundary management; creating community liaison roles to better engage environmental justice and urban communities; working with communities to increase awareness of adaptation to wildfire smoke (“smoke-adapted communities”), and creating consistent, tailored messaging about climate-related issues (including wildfire and prescribed burning).
- **Planning and National Environmental Policy Act (NEPA):** Processes to incorporate climate change information (e.g., vulnerability assessments) into planning and NEPA; cross-boundary, landscape-scale collaborative planning; including Indigenous Traditional Ecological Knowledge in planning; incorporating adaptation into plan amendments; building relationships between research and planning; and modernizing and streamlining the NEPA process to account for climate change.
- **Recreation:** Accommodating changes in climate and visitor use patterns by shifting the timing of activities, promoting shoulder season and nonwinter activities, and anticipating high-use times; identifying areas where recreation can persist (“recreation refugia”); and evaluating visitor experiences considering climate-related concerns like wildfire, drought, and heat.
- **Research:** Applying long-term and cross-boundary modeling, tailoring research to local needs, developing, and using tools to optimize treatments based on objectives and values at risk, mapping climate effects on geological hazard risks, and mapping stewardship networks to indicate pathways for community involvement.

- **Species Distribution:** Re-evaluating ecological zones, seed zones, and species distributions to incorporate climate change; developing official guidance on assisted migration that includes both biophysical and cultural considerations; strengthening plant breeding and genetics program, including nurseries; mapping habitats to identify fragmentation, connectivity needs, potential climate refugia, and species in need of ex-situ conservation.
- **Timber Program:** Developing and implementing climate-informed reforestation, restoration, and silvicultural practices; increasing the pace and scale of reforestation and restoration; integrating fuels, timber, markets, and outreach work via coordination across Forest Service programs and partnerships; using models to identify areas that can provide multiple benefits or the greatest return on investment, and developing markets for underutilized and innovative wood products to reduce wildfire risk and benefit rural economies.
- **Training:** Training to build climate literacy across the agency, including leadership; including Indigenous Traditional Ecological Knowledge in climate change training; and promoting knowledge exchange via partnerships and inclusion in existing training programs.
- **Vegetation Management:** Selecting species and genotypes that are resilient to climate change and disturbance; using disturbance as a management tool, including leveraging benefits of low-and moderate-severity fire; placing mechanical treatments in high priority areas; supporting year-round fire management and permanent adaptation, and implementing cross-boundary fuels treatments by leveraging partnerships.
- **Workforce:** Developing performance measures associated with climate change adaptation; integrating climate change work across Deputy Areas, including designating leaders and science delivery specialists; prioritizing workforce diversity; and quickly hiring and training new staff in climate-focused positions, including proactive fire management and response.

APPENDIX 3: CLIMATE ACTION TRACKER

The Forest Service will use the Climate Action Tracker (CAT) to evaluate progress on climate response, including adaptation actions described in this plan. The CAT builds on previous agency climate scorecards and aims to track agency progress across four dimensions: Natural Resource Stewardship, Operations

and Infrastructure, Organizational Capacity, and Serving People. The agency will measure progress on strategic objectives within each dimension through outcome-based metrics tied to each deputy area and level within the agency (Table 1). The Forest Service will track metrics using existing agencywide databases where possible. It will obtain additional information through an annual survey of agency staff responsible for coordinating climate and sustainable operations work. The Climate Action Tracker is an adaptive tool that the Forest Service will modify and expand as new climate-related initiatives unfold and new tools and information become available.



Table 1. Climate Action Tracker dimensions, strategic objectives, and corresponding adaptation plan focus areas

CAT Dimension	CAT Strategic Objective	CAT Strategic Objective (full)	Adaptation Plan Focus Areas ¹
Natural Resources Stewardship	Carbon and Climate Research	Deliver and support world-class research on the effects of climate change on ecosystems and communities, adaptation strategies, and carbon cycling and stewardship.	1e, 2e, 3e, 4e, 5f
	Natural Resources Adaptation	Integrate climate change science and information into management actions to prepare for and respond to changing climate conditions.	1a, 1d, 2a-d, 3a, c-d, 4c-d, 6d
	Carbon Stewardship²	Understand and integrate carbon science and climate adaptation into long-term stewardship of carbon resources, recognizing carbon as one of many benefits forests and grasslands provide.	4a-b
Operations and Infrastructure	Climate-Ready Infrastructure	Design facilities and infrastructure to adapt to the effects of climate change while minimizing their environmental footprint.	2b, 4c, 6d
	Sustainable Operations²	Take tangible steps to integrate the six Environmental Footprint Areas (Energy, Water, Fleet & Transportation, Waste Prevention & Recycling, Sustainable Acquisition, and Sustainability Leadership) across program functions and organizational levels to reduce resource consumption, operational costs, and related greenhouse gas emissions.	6d
Organizational Capacity	Employee Training	Increase employee understanding of climate change science, effects on cultural, economic, and natural resources and human communities, and potential adaptation actions and responses; increase ability of specialists and agency leaders to incorporate and communicate relevant climate information and environmental justice into their programs of work.	6c
	Financial Investment	Make sound investments by assessing climate risks and considering vulnerable communities and ecosystems; leverage funding through partnerships to integrate climate change science and response into all our programs and activities.	3a, 5e
	Workforce	Build and foster an inclusive, diverse, adaptable, and effective workforce that will lead and implement climate change adaptation, sustainable operations, carbon stewardship, and environmental justice efforts.	1b, 6a-b
Serving People	Environmental Justice	Engage with disadvantaged communities to understand the effects of climate change and develop strategies to reduce the disproportionate impacts on these communities, helping to ensure the benefits of climate change activities are distributed equitably.	5a-f
	Outreach	Exchange information, research, tools, education, and training with external audiences on the effects of climate change on our forests, grasslands, and communities and communicate science on how to effectively adapt to and mitigate these changes.	5c
	Partnerships	Collaborate with the public and international, Federal, State, local government, non-governmental, and industry partners and organizations to understand and respond to the effects of climate change on forests, grasslands, and communities.	3b, 5b
	Tribal Engagement	Consult, coordinate, and collaborate with Tribal Nations and engage with Indigenous peoples to better understand and address Tribal and Indigenous needs and apply community-driven responses to the effects of climate change.	5b-c

¹The focus areas listed here are not a comprehensive list of all actions aligned with this strategic objective. Additional focus areas and actions related to climate change and sustainability through other departmental and agency initiatives may also relate to this objective.

²These strategic objectives are complementary to but not the primary focus of the adaptation plan.





After a wildfire, experts need to assess the potential for debris flow, the geological phenomena in which water-laden masses of soil and fragmented rock rush down mountainsides, funnel into stream channels, and form thick, muddy deposits on valley floors. USDA Forest Service photo.

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Climate Change Adaptation Planning Document

July 2022



How ARS is addressing climate change in its research programs and integrating climate adaptation into its operations to ensure it can fulfill its mission.

USDA Agricultural Research Service Climate Change Adaptation Planning Document July 2022

ARS has prepared this Climate Change Adaptation Plan in accordance with Departmental Regulation (DR) 1070-001, which provides guidance on the establishment and periodic revision of the USDA Climate Change Adaptation Plan and is consistent with implementation of Executive Order (E.O.) 14008, Executive Order on Tackling the Climate Crisis at Home and Abroad, issued on January 27, 2021. This plan describes how ARS addresses climate change in its research programs and is integrating climate adaptation into its operations to ensure it can fulfill its mission.

I. ARS Mission in relation to Climate Change Adaptation

ARS is the USDA's chief in-house research agency and is one of four agencies in the USDA Research, Education, and Economics (REE) mission area. ARS has about 6,000 employees, including 2,000 scientists and post docs representing a range of disciplines. ARS has 660 research projects at 90+ locations, including overseas labs, and has an annual budget of \$1.5 billion.

The ARS Mission is to deliver scientific solutions to national and global agricultural challenges for American farmers, producers, industry, and communities to support the nourishment and well-being of all people; sustain our nation's agroecosystems and natural resources; and ensure the economic competitiveness and excellence of our agriculture.

To achieve its mission, ARS identifies problems affecting American agriculture and plans and executes strategies needed to address these problems by mobilizing human, financial, and physical resources. ARS research is organized into four Science Areas: Nutrition, Food Safety, and Quality; Natural Resources and Sustainable Agricultural Systems; Crop Production and Protection; and Animal Production and Protection. These four Areas are in turn organized into 15 National Programs that ensure the most important research is conducted with minimal redundancy.

ARS Science Area	ARS National Program (Program number)
Nutrition, Food Safety and Quality	Human Nutrition (NP 107)
	Food Safety (NP 108)
	Product Quality and New Uses (NP 306)
Natural Resources and Sustainable Agricultural Systems	Water Availability and Watershed Management (NP 211)
	Soil and Air (NP 212)
	Grass, Forage, and Rangeland Agroecosystems (NP 215)
	Sustainable Agricultural Systems (NP 216)
Crop Production and Protection	Plant Genetic Resources, Genomics, and Genetic Improvement (NP 301)
	Plant Diseases (NP 303)
	Crop Protection and Quarantine (NP 304)
	Crop Production (NP 305)

Animal Production and Protection	Food Animal Production (NP 101)
	Animal Health (NP 103)
	Veterinary, Medical, and Urban Entomology (NP 104)
	Aquaculture (NP 106)

ARS does not have a climate change research program *per se*. Instead, research conducted in all ARS National Programs targets how agricultural systems can adapt to climate change and the potential for those systems to mitigate climate change. Adaptation research investigates how crop and animal systems might respond to predicted climate changes and how to make these systems more resilient, so they are less vulnerable to impacts on productivity and they conserve essential soil, air, and water resources. Mitigation research develops management practices and technologies that reduce fossil fuel use and greenhouse gas emissions (GHG), sequester carbon, and generate feedstocks or energy that offsets fossil fuel use. ARS scientists also study how climate and climate adaptation and mitigation affect food quality, safety, and security. ARS coordinates with other federal agencies through programs such as the USDA Climate Hubs to provide the science that informs policy, and partners with stakeholders to provide the practices, technologies, and decision tools needed for sustainable, profitable enterprises.

From a facilities and operations perspective, climate adaptation involves energy efficiency, water conservation, and sustainability efforts. ARS follows the REE Energy, Water, and Sustainability policy, P&P 134.2, which states: *Consistent with REE’s mission and without compromising health and safety, it is REE policy to give energy and water conservation as well as sustainability, prime consideration in the acquisition, use, and disposal of all property and in the performance of all functions. This action will reduce the impact of our activities on the environment and help conserve resources. Efficiency and conservation shall be integrated into the core activities of the Agency. It shall be every employee’s responsibility to ensure that every reasonable effort is made to reduce operating costs and conserve energy, water, and resources.*

II. ARS Vulnerabilities to Impacts of Climate Change

1. Vulnerabilities of ARS Research Resources

ARS research activities happen in many places, but they can be broadly grouped into indoor facilities and outdoor areas. Both are vulnerable to the impacts of climate change.

ARS indoor facilities include labs, workshops, greenhouses, and barns that have several vulnerabilities to increasingly intense and frequent severe weather. Whenever facilities are damaged, in addition to repair and replacement costs, there is significant impact on ARS research capacity through interruption or loss of ongoing experiments, delays in planned research, and obstacles related to placing people and resources in temporary space. ARS encourages its research locations and programs to have a Continuity of Operations Plan (COOP) to continue critical operations during severe weather impacts. Considerations are detailed in the next section on Vulnerabilities of ARS facilities.

ARS outdoor research is also diverse, occurring in many climates and places, and at different scales, from small scale field plots over a few years to large scale landscape or watershed research over decades. Outdoor research is also diverse and broadly includes crop production, animal production, and environmental monitoring of air, soil, and water, and often animal (e.g., insects) resources. Research is often designed to incorporate climate change adaptation, such as the impact of increasing atmospheric CO₂ on crops and weeds, and what crops and animals are best adapted to drought and heat stress. However, there is extensive non-climate research where drought or extreme weather can negatively impact or cause complete loss of experiments. ARS research Project Plans intentionally include a section where scientists document vulnerabilities of their research and contingencies for how they will adapt research, including climate considerations.

ARS is committed to the humane treatment of its research animals, especially as it relates to climate, such as heat stress or changing pest and disease management. Vulnerability to utility interruption is a concern for animal facilities. Space conditioning, air change rates, and availability of drinking water cannot be allowed to be compromised. Exposure to extreme weather and other climate conditions can threaten animals with physical harm, dangerous heat or cold, flooding, emotional stress, and difficulty getting food, water, or other necessities of life. Maintaining animal facilities is a critical priority. Both facility and research planning account for weather impacts, and any impacts of weather are addressed and remedied immediately.

2. Vulnerabilities of ARS Facilities, Fleet, and Personnel

Facilities: ARS has 3,170 buildings in 94 domestic locations and one foreign location, the National Agricultural Library, and 86 worksites. Severe weather and storms are happening with increased intensity and frequency and can impose significant cost for facility and resource replacement.

ARS is evaluating and upgrading building design and planning for extreme weather considerations, such as severe drought and risk of fire. Storm and sanitary sewer capacity needs, security, biocontainment, and contamination risks can also result from extreme weather events. For example, loss or contamination of research can result from physical damage or utility interruption. Refrigeration of research and germplasm repositories require reliable power and backup generators. Security of pathogens and agents can be threatened after storms and power outages. Chemicals and spills can create dangerous situations and occupant exposure risks when ventilation systems lose power.

The sections below describe facility vulnerabilities posed by climate change and the actions ARS is taking to address those vulnerabilities.

- **Energy Security** is critical to ARS mission continuity. The ability to purchase, produce, and store energy provides the resilience needed for survival and recovery, or the orderly shutdown and transfer of operations because of a weather event.

Energy Sustainability in ARS follows the December 2020 Guiding Principles for Sustainable Federal Buildings and receiving certification from a 3rd party such as LEED or Green

Globes. The Energy Independence and Security Act of 2007 (EISA) requires that large new construction or modernization projects follow the methodology of LEED or Green Globes to measure sustainability, and a minimum of 5% of new construction projects must be submitted for certification. If a building is submitted for certification, it must also comply with the guiding principles to be sustainable. ARS policy is to meet LEED Silver to two Green Globes to be sustainable, plus comply with the guiding principles.

Building electrification is a strategy ARS is considering for energy efficiency. EISA Section 433 requires Agencies to design buildings after 2020 to reduce fossil fuel energy use 80%, and 100% by 2030. For example, ARS is leveraging technologies such as heat pumps to heat and cool spaces and heat water without fossil fuels.

Energy Redundancy is using standby technology, duplicate equipment, or secondary fuels to maintain service. ARS is positioning facilities to have energy redundancy as:

- Secondary fuels with the lowest greenhouse gas emissions.
- Duplicate equipment to operate individually when one fails, together during high demand, or rigged for alternating service.
- Backup power like emergency generators, uninterruptible power supplies (UPS), surge protectors, and batteries are commonly used on ARS facilities that need constant electricity.

Renewable Energy includes photovoltaic (PV), solar thermal, geothermal, wind, biomass, hydroelectric, and renewable alternative fuels. Federal Agencies are statutorily required to purchase or produce 7.5% of their electricity consumption in renewables, by EPCA 2005 section 203. ARS purchases Renewable Energy Certificates (RECs) to fulfill this requirement.

ARS surveys its facilities for renewable energy opportunities, and efforts to increase use of renewable energy include:

- 7 locations with photovoltaic arrays, two of which are net zero electric facilities. ARS has developed a proven RFP for photovoltaic projects that won a Federal Energy and Water Management Award in 2019.
 - 2 solar thermal projects that produce 42 million BTUs of energy annually.
 - 1 open loop geothermal system that uses a plate and frame heat exchanger to precool chiller water. ARS explored geothermal systems at two locations when the boilers were being replaced. Neither of them were viable.
 - ARS facility in Beltsville, MD, won a Closing the Circle award in 2008 for using B20 Biodiesel in its diesel farm equipment. The program was discontinued several years later for economic reasons.
- **Water Security:** Human non-potable water is used by ARS for agricultural purposes, such as irrigation, animal watering, and aquaculture. ARS continues to improve its agricultural irrigation systems to optimize both the amount of water used and the energy used to move that water in pumping. One ARS location, the Western Human Nutrition Research Center at Davis CA, uses greywater provided by the university; and another at Riverside, CA, uses

- water that has been used for research and is ready for discharge. Greywater is untreated or partially treated but not fit for human consumption.
- **Threats to property:** ARS owns miles of overhead and buried power wiring, transformers, electric substations, underground steam pipes, underground natural gas pipes, and underground domestic water and sewer lines, all of which are vulnerable to severe weather and need periodic maintenance to improve and maintain reliability, functionality, and resiliency. ARS performs regular and preventive maintenance to keep buildings and equipment in optimal condition to resist and survive severe weather. The risk of storm damage is addressed by incorporating proper structural design criteria into ARS' Design Manual P&P 242.1.
 - **Climate Related Resources:** The following is a list of strategies ARS uses to address its energy, water, and building resource use and security related to climate change.
 - Using Biobased (or BioPreferredSM) products (<http://www.biopreferred.gov/>).
 - Incorporating products with recycled content into projects to reduce the embodied energy and divert waste.
 - Selecting Energy Star products.
 - Leveraging the WaterSense[®] program, a national voluntary partnership program administered by EPA that offers a simple way to identify water-efficient products and practitioners.
 - Applying the Safer Choice EPA Pollution Prevention (P2) program to reduce, eliminate, or prevent pollution at its source.
 - Implementing the SmartWay EPA program to help the freight transportation sector improve supply chain efficiency.
 - Re-commissioning to ensure optimum performance of a facility, in accordance with design or current operating needs, over the useful life of the facility, while meeting building occupancy requirements.
 - Conducting energy audits to identify energy and water conservation measures and capital improvements that will save energy and water.
 - Leasing sustainable buildings that use LEED, Green Globes, or Energy Star Portfolio Manager.
 - Using Performance Contracting to take advantage of private sector capital to fund energy and water saving equipment and renewable energy systems at Federal facilities.

Personnel, Fleet, and Travel: There are many weather- and climate-related impacts on personnel, including heat stress, severe cold, flooding, wind, and accidents associated with loss of control of equipment or hazardous chemicals. A striking example is the impact of Hurricane Katrina on the ARS personnel at the Southern Regional Research Center in New Orleans, LA. Major damage and flooding rendered the Center completely unusable. A total of 178 employees, along with their families, had to be relocated to 22 temporary duty stations in 12 states to maintain research projects. Personnel-related costs totaled more than \$4 million over 3 fiscal years. ARS continues to implement and refine Health and Safety alerts and

communications applications to keep personnel informed and safe during extreme weather events.

ARS promotes energy efficiency in personnel transportation, including use of telework, and use of lower emission commuting, public transportation, and ridesharing. ARS is also optimizing business travel by leveraging virtual meetings and using travel methods with the optimal GHG impact considering time, cost, and availability.

ARS has 2,700 vehicles and replaces about 250 vehicles per year. ARS is optimizing purchasing and using fleet vehicles and equipment to make progress towards zero emissions, including using renewable alternative fuels such as in E-85 vehicles, EV, and Plug-in Hybrid Electric Vehicles (PHEV). ARS has one Level 2 EV Charging Station in Las Cruces, NM, and looks to expand GOV charging stations for fleet vehicles as well as for guests visits.

III. ARS Actions Related to Adapting to Climate Vulnerabilities

1. Facilities

The previous section includes discussion of actions ARS is taking to ensure that facilities and operations are adapting to climate vulnerabilities. Other specific examples include:

- Applying COOP plans to continue critical operations at ARS locations under a range of circumstances, including weather impacts.
- Implementing renewable energy and microgrids. ARS has one net-zero electricity facility, and another just completed construction. Other photovoltaic energy projects are in procurement and under development. Geothermal energy is used at one location, and its use has been studied at two other locations. Two facilities have solar thermal hot water.
- Investing in personnel trained and qualified to administer renewable energy projects, interconnection agreements, and utility contracts, such as engineers, contracting officers, and attorneys.
- Improving condition and resilience of electrical, steam, natural gas, and water infrastructure. Leak test all domestic and irrigation water systems that show inconsistent consumption or lack of integrity. Perform preventive maintenance and promptly make cost effective and technically feasible repairs.
- Switching fuels, using dual fuel equipment, and reducing carbon footprint. Convert heating plants burning fuel oil to natural gas or propane with high efficiency boilers. ARS has converted four locations away from fuel oil; one more location and several small buildings that still use fuel oil should be converted. Convert steam systems to hot water. Reduce the carbon footprint of small buildings by converting heating and hot water equipment from fossil fuels to electric systems, especially where they can be powered by solar panels. Install solar thermal systems. Convert to use of dual fuel boilers where the secondary fuel has low greenhouse gas emission (e.g., propane). Convert emergency generators to natural gas or tier 4 final Diesel fuel.
- Leveraging the Fixing America's Surface Transportation (FAST) Act to install EV charging stations at ARS locations for government and private vehicles.

2. Research

ARS recognizes the need to constantly pursue cutting edge research as well as interdisciplinary research that tackles agriculture's "wicked problems" like climate adaptation. Examples of administratively supported programs to do this are:

- *ARSx*: a high-risk, high-reward research funding competition that encourages ARS scientists to put forward their breakthrough ideas for a transformative solution to a serious agricultural problem. Two themes addressed so far in 2020 and 2021 include "Harvest for a Healthier Future" and "Disruptive Pests and Pathogens", both of which considered climate change in their evaluation criteria.
- *Grand Challenge Synergies* supports projects for greater impact than conventional ARS projects by facilitating and incentivizing synergistic interactions between scientists across locations, National Programs, and research systems. Synergistic projects harness the energy of diverse scientific teams to address complex problems of high national importance that may not be solved within the boundaries of a single discipline. Current Grand Challenge projects include climate related topics like pest and disease pressure on crops, the impact on dairy forage feed quality in different climates on milk nutritional properties, and beef cattle adaptation to different environments throughout the Northern and Southern Plains.

Beyond its conventional research planning process described in Section IV.2 below, ARS recognizes that research needed to support the agricultural industry in response to climate change must be transformative. Scientists representing all aspects of the agricultural supply chain must work more effectively with not only each other but also non-science partners in large, integrated teams. Examples of how ARS is responding to this new research paradigm include:

- *Long Term Agroecosystems Research* (LTAR, <https://ltar.ars.usda.gov/>): Network of 18 research locations combining strategic research projects with common measurements on multiple agroecosystems (croplands, rangelands, and pasturelands) and developing new technologies to address local and national challenges, with a focus on climate change adaptation and mitigation.
- *GRACEnet* (Greenhouse gas Reduction through Agricultural Carbon Enhancement): Network of 34 research locations whose coordinated research goals are to better quantify GHG emissions from cropped and grazed soils under current management practices and to identify and develop improved management practices that will enhance carbon sequestration in soils, decrease GHG emissions, promote sustainability, and provide a scientific basis for carbon credits and GHG trading programs.
- *Conservation Effects Assessment Project (CEAP) Watershed Assessment Study (WAS)*: Working in 14 benchmark watersheds at 12 ARS locations to provide scientific basis for the CEAP National Assessment being led by NRCS to provide a better understanding of how agricultural conservation practices and programs impact the nation's environmental objectives for clean air and water, healthy soils, and functioning habitat for wildlife.
- *Resilient Economic Agricultural Practices (REAP)*: Multi-location team that formed to identify biomass feedstock harvest rates and management that would sustain soil

resources. Current focus is soil health and resilience as a focal point to sustainably intensify the provision of food, feed, fiber and fuel; increased soil carbon; efficient nutrient cycling; improved water quality; and economically sustainable agricultural opportunities.

- ***Breeding Insights Platform***: Coordinated team of specialists in information technology, genomics, and breeding process that partners with ARS plant and animal breeding research groups to leverage recent improvements in genomics and open-source informatics components so they can harness powerful digital tools to accelerate their genetic gains towards climate adaptation.

ARS is also committed to broadening access to and availability of its climate-related research data at regional and local scales for USDA Mission Areas, producers, land managers, and other stakeholders. A primary example is the ***ARS Partnerships for Data Innovations (PDI)***. Established in 2019, PDI intends to seize the potential of data-driven technologies to build a culture of data stewardship. PDI is integrating customer-partners in developing and implementing state-of-the-art digital tools, leveraging off-the-shelf technologies when advantageous. In its short life, PDI has transformed more than 100 projects, from projects catalyzing collaborative efforts and underpinning information management to those salvaging end-of-life data repositories. Empowered by this active inclusive partnership and through sharing digital solutions on a “Digital Research Workbench” within the ARS Agricultural Collaborative Research Outcomes System infrastructure, PDI hopes to accelerate agricultural research through data standardization, automation, and integration.

IV. Sustaining and Evaluating Adaptation Progress

1. Facilities

ARS is taking steps to document facility progress toward climate adaption. Examples include:

- ***Reports and records***
 - ARS prepares and submits an annual energy report each year that benchmarks consumption and cost of electricity, renewable energy, fuel oil, natural gas, propane, purchased steam, purchased chilled water, bulk fuels, and potable water as well as documents building efficiency, performance contracts, and training.
 - The Compliance Tracking System reports energy audits and projects to implement them.
 - Corporate Property Automated Information System (CPAIS) tracks sustainable buildings.
 - The annual Waste and Recycling report tracks waste and waste diversion by facility.
- ***Environmental Management System (EMS)***: ARS implements an EMS at each location in accordance with the ISO 14001 standard. An EMS provides a framework for a continual cycle of planning, implementing, reviewing, and improving to allow an organization to consistently address the effects its operations may have on the environment and support continual improvement. Through the EMS, each location can track environmental compliance requirements and energy, transportation, and

other conservation efforts, collectively called “sustainability” requirements, by identifying specific aspects and their impacts, and establishing goals, objectives, and targets and monitor progress towards achievement of goals. ISO 14001, 14090, and 50001 are standardized approaches to EMS. ARS demonstrates conformity with ISO 14001 through self-determination and/or self-declaration, and in some cases, by seeking confirmation of its self-declaration by a party external to the organization (usually reserved for some of the larger centers or facilities).

- 3rd party sustainability certification. ARS is leveraging LEED, Green Globes, and Energy Star methods to measure sustainability and benchmark utilities.

2. Research

ARS uses a robust and transparent planning and implementation process to integrate climate change research priorities into its programs, and to sustain and evaluate progress toward achieving those objectives. On 5-year cycles, each ARS National Program develops a research action plan that is informed by extensive stakeholder and partner input and considers the program’s human and fiscal resources. This stakeholder information is gathered through surveys, listening sessions, and research location meetings. An action plan is developed to set the program research priorities and anticipated products. Scientists in the program in turn develop their research project plans to align with the action plan. These project plans detail specific research activities for the 5-year cycle. This process ensures that research is aligned from the individual scientist all the way through to the ARS Strategic Plan, thereby ensuring continuity with the USDA, REE, and ARS visions for agricultural research.

Each year, all locations and National Programs develop annual reports to document their progress toward achieving their objectives. The location reports in particular offer an opportunity to document and communicate challenges that locations face in completing research and adaptation they are implementing, including those to deal with climate change issues. At the National Program level, towards the end of a 5-year cycle, a program conducts a retrospective analysis to see how well the priorities and products of its action plan were achieved and to help inform the program about potential for improvement and adaptation.

ARS will continue to use this research planning processes to integrate climate change into its research programs and will continuously adapt research objectives as customer and partner needs for climate research shift. For example, where ARS does certain research may change in response to climate. If crops or production systems becomes less viable in certain regions, or producers change what they grow, ARS can adapt its research focus in those regions accordingly. This process also offers an opportunity to address new issues that may be priorities in other federal agencies, such as use of agrivoltaics in production systems.

V. Special Topics

1. Environmental Justice

ARS is continuously exploring research opportunities to enhance outreach to disadvantaged communities (as defined by USDA 2501 guidelines), and is using the following examples to ensure its activities include underserved populations:

- Increase participation of faculty in minority-serving institutions in professional training related to clean energy, and climate change adaptation and mitigation through the ARS 1890 Faculty Research program. The 1890 Faculty Research Sabbatical Program (FRSP) allows faculty at 1890 land-grant universities to participate in a residency at an ARS lab to conduct research of mutual interest.
- Measure participation in the ARS Student Outreach Database in the following categories: HACU Students, Wallace Carver Interns, 1890 National Scholars, 1994 National Scholars, and CAPAL Interns.
- During its research planning process described in section IV.2, ARS seeks input from a diverse set of stakeholders, including from disadvantaged communities, to develop its research priorities and collaborations.
- ARS is working closely with other REE agencies to identify new ways to track agricultural research benefits for disadvantaged communities as part of the Justice 40 initiative.

2. Workforce Climate Literacy

Facilities: The following are examples of how ARS is integrating climate literacy into its facility planning and operation

- Following Design Manual 242.1 and P&P 134.2 for Energy, Water, and Sustainability. P&P 160 also includes topics of Environmental compliance and Pollution Prevention.
- The Facilities Division (FD) Safety, Health, and Environmental Management Branch (SHEMB) holds several monthly calls and has committees to exchange information among staff. Biosafety, Safety Awareness Month during February helps train personnel and share information. Training is recorded and published to the ARS intranet site.
- FD also observes Earth Day every year with an email blast to all of ARS about a subject such as Climate Hubs in 2021 and live demonstrations at various locations.
- Sponsoring staff to attend Energy Exchange, Federal Utilities Partnership Working Group (FUPWG), and International Institute for Sustainable Laboratories (I2SL) training on climate change and related subjects.
- Monthly Energy Awareness Conference Calls with informational presentations on a product, process, or requirement for the facilities or research community.
- Incorporating climate change related topics and priorities into performance plans.
- Publishing case studies of Biobased Success Stories and Energy Patriots, who are employees that accomplished a noteworthy energy, water, or sustainability action. One recognition example is Polly Goldman, who was selected for a FEDS Spotlight Recognition Award and recognized at the 2021 virtual Energy Exchange. The nomination read: *“Polly Goldman is a Biological Sciences Research Technician who studies plant pathogens and replacements for ozone-depleting Methyl Bromide fumigation in strawberry cultivation in Salinas, CA. She was active in the design process of the new LEED Certified Agricultural Research Technology*

Center. Polly is championing the 1.1-megawatt Salinas Solar ARS ESPC Energy Sales Agreement photovoltaic project. She seeks out energy- and water-efficient alternatives to high-impact equipment and processes such as ultra-low freezers, growth chambers, and irrigation and finds ways to encourage adoption at the Salinas lab."

Research: ARS scientists are considered experts on the impact of climate change on agricultural production and how agriculture can adapt to climate change to maintain productivity. Therefore, ARS scientists are often invited by federal agencies, professional societies, and non-governmental groups to present their research and knowledge about climate related science. In this way, ARS contributes extensively to workforce climate literacy across the USDA. Specific examples of ARS involvement in workforce climate literacy include:

- Participating in planning, providing speakers for, and providing ARS employee access to the 2022 USDA-wide Climate, Agriculture, and Forestry Seminar Series designed to increase climate literacy across the USDA and Cooperative Extension workforce. The series focuses on the scientific foundation of climate change and its relationship to working lands.
- ARS locations are regularly conducting internal science update seminars for their staff and partners, including topics on climate science. One example is the US Dairy Forage Research Center's monthly Webinar Series (<https://www.ars.usda.gov/midwest-area/madison-wi/us-dairy-forage-research-center/upcoming-events/upcoming-events/>)
- ARS Office of Communications mission is to inform the nation of the nature and progress of ARS research through a coordinated, multi-media approach. The Office has an Internal Communications Branch that is responsible for amplifying the role, missions, and successes of ARS to its current and alumni workforce through the delivery of information via internal communication platforms. <https://www.ars.usda.gov/oc/>.

3. ARS partnership with the USDA Climate Hubs

Along with US Forest Service and USDA Natural Resources Conservation Service, ARS helps to lead and host the USDA Climate Hubs. The Hubs are thus critical partners that enhance ARS capacity to enable climate-smart agriculture by making ARS research more regionally relevant, helping ARS respond regionally to USDA and interagency priorities, investing in priorities and outcomes through regional engagement of underrepresented groups, and training the next generation of climate-informed scientists.

The ARS Climate Hubs and ARS research units frequently and purposefully engage each other and seek opportunities to leverage resources to further enable collaboration. Recently, the ARS Climate Hubs were formally integrated into the ARS project portfolio to facilitate Hub engagement between the Hubs and ARS National Programs. ARS also participates regularly in Hub information dissemination, such as the Northeast Climate Hub Webinar [Series](#).

A key activity of the Climate Hubs is to identify regional climate vulnerabilities and risks. Through the Hubs partnership, ARS is using this Hubs information to develop the locally specific tools and resources that stakeholders need to help build climate change adaptation capacity. These resources are then disseminated through the Hubs. One example is the Grass-Cast model (<https://grasscast.unl.edu/>) that is featured by the Hubs and provides forecasts of rangeland

forage productivity in the Plains and Southwest to help producers adapt their cattle management to climate-driven conditions.

Table 1. Adaptation actions to address climate change effects and vulnerabilities

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Timeframe	Coordination	Progress Metrics	Accomplishments to Date
Impacts to research resources	Research locations and programs have a Continuity of Operations Plan (COOP) to continue critical operations during severe weather impacts.	Ongoing	5 ARS regional Area Offices	2022 and continuous	Internal to ARS	Plans developed and Action Items are tracked	
Impacts to research resources	Animal research facilities plan for animal welfare during extreme weather	Ongoing	Individual locations coordinated by Area Offices	2022 and continuous	Internal to ARS	Individual locations track their plans	
Impacts to research resources	All location Project Plans include a contingency plan for how experiments will be adapted in the event of extreme weather or climate	Ongoing	Individual locations coordinated by Area Offices and Office of National Programs	2022 and continuous	Internal to ARS	Individual locations track their plans	See individual location existing Project Plans
Impacts to Facilities	Continuity of Operations (COOP) plans to continue critical operations at ARS locations under a range of circumstances, including weather impacts	Ongoing	Individual locations coordinated by Area Offices	2022 and continuous	Internal to ARS	Individual locations track their plans	
Impacts to Facilities	Energy Sustainability follows 2020 Guiding Principles for Sustainable Federal Buildings and receiving certification from a 3rd party such as LEED or Green Globes.	Ongoing	Facilities Division	2022 and continuous	Internal to ARS		

Impacts to Facilities	Position facilities to have energy redundancy	Ongoing	Facilities Division	2022 and continuous	Internal to ARS	Compliance Tracking System	
Impacts to Facilities	Purchase or produce 7.5% of electricity consumption in renewables	Ongoing	Facilities Division	2022 and continuous	Internal to ARS	Compliance Tracking System	7 locations with photovoltaic arrays. Developed RFP for photovoltaic projects that won a Federal Energy and Water Management Award in 2019. 2 solar thermal projects that produce 42 million BTUs of energy annually. 1 open loop geothermal system that uses a plate and frame heat exchanger to precool chiller water.
Impacts to Facilities	Energy Storage	Ongoing	Facilities Division	2022 and continuous	Internal to ARS	Environmental Management System (EMS) plans	ARS has one net-zero electricity facility, and another just completed construction. Other photovoltaic energy projects are in procurement and under development. Geothermal energy is used at one location, and its use has been studied at two other locations. Two facilities have solar thermal hot water.
Threats to Property	Performs regular and preventive maintenance to keep buildings and equipment in optimal condition to resist and survive severe weather.	Ongoing	Facilities Division	2022 and continuous	Internal to ARS	Environmental Management System (EMS) plans	Incorporating proper structural design criteria into ARS' Design Manual P&P 242.1.

Threats to personnel	Implement and refine Health and Safety alerts and communications applications to keep personnel informed and safe during extreme weather events.	Ongoing	Individual locations coordinated by Area Offices	2022 and continuous	Internal to ARS	Individual locations track their plans	
Threats to Research Mission	Implement programs to ensure research is current with stakeholders needs for climate adaptation	Ongoing	Office of National Programs	2022 and continuous	Internal to ARS	Program Action Plans, Retrospective Review Reports, Location annual project reports	
Threats to Research Mission	Implement programs to promote collaborative research for climate adaptation	Ongoing	Office of National Programs	2022 and continuous	ARS, NRCS, University Partners	Project visioning documents and annual reports	Established the LTAR, GRACEnet, CEAP, REAP, Breeding Insights Platform research initiatives
Threats to Research Mission	Implement programs to promote innovative research for climate adaptation	Ongoing	Office of National Programs	2022 and continuous	Internal to ARS	Project Annual Reports	Established the ARSx, PDI, Grand Challenge Synergies programs
Workforce Climate Literacy	Integrate climate literacy into planning and operations	Ongoing	Location offices and Facilities Division	2022 and continuous	Internal to ARS		Safety, Health, and Environmental Management Branch (SHEMB) monthly calls. Biosafety, Safety Awareness Month
Workforce Climate Literacy	Integrate climate literacy into research mission	Ongoing	Location offices, Office of National Programs, Office Communications	2022 and continuous	internal and in coordination with USDA agencies as appropriate	Location and Office Planning	Locations hold regular research webinars. Numerous outreach products by Office of Communications.



National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE



NIFA CLIMATE ADAPTATION & RESILIENCE PLAN

MAY 04, 2022

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NIFA CLIMATE ADAPTATION & RESILIENCE PLAN TEAM

The NIFA Climate Adaptation Plan was created through an inclusive and iterative process across NIFA's institutes and departments. The teams below provided instrumental support through the ideation and drafting of the plan.

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NIFA CLIMATE ADAPTATION & RESILIENCE PLAN

In December 2021, NIFA carried out an agency-wide survey to gather input about how NIFA's mission is impacted by climate change and what actions could be marshalled to address identified vulnerabilities. The internal survey was followed by small group and individual interviews with NIFA staff. Additionally, NIFA conducted a stakeholder listening session and received written comments on this topic in January 2022. The key vulnerabilities identified center around water, agroecosystem sustainability, food and nutrition security, resilience to extreme weather, and continuity of operations. The actions that emerged involve: Programs & RFAs, Strategic Planning, Organizational Effectiveness, and Stakeholder Outreach.

1. NIFA'S GOALS & OBJECTIVES

The United States Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA) was established by the Food Conservation and Energy Act of 2008 (P.L. 110-236, also known as the 2008 Farm Bill) to find innovative solutions to issues related to agriculture, food, the environment, and communities. NIFA's mission is to invest in and advance agricultural research, education, and Extension to solve societal challenges. NIFA's essential functions of research, education, and Extension are referred to throughout this document as "science."

NIFA's goals include advancement and application of science and technology to:

- Achieve global food security and fight hunger
- Mitigate climate change impacts on agricultural, forest and rangeland systems
- Improve and increase the production of goods and services from working lands while protecting the nation's natural resource base and environment
- Contribute to the nation's energy independence through sustainable production of bioenergy and bio-based industrial products
- Ensure the availability of affordable, nutritious, and safe food, and provide individuals and families science-based nutritional guidance
- Ensure the development of human capital, communities, and a diverse workforce

NIFA is USDA's primary extramural science funding agency. The Land-Grant University system is NIFA's base partner and consists of 112 research institutions across each state and territory, including 19 Historically Black Land-Grant Universities and 36 Tribal Land-Grant Colleges and Universities. The system includes a network of State Agricultural Experiment Stations (AES) and multiple substations in geographically significant areas of each state, staffed by over 16,400 faculty and professionals. In 2021, the State AESs conducted nearly 75% of US public agricultural research and development, up from 61.4% in 1950.ⁱ The Land-Grant System's Cooperative Extension Service supports each of the 3,243 U.S. counties or county equivalents with over 32,000 staff to deliver real-time applied science, science-based recommendations, and education for agricultural producers,

businesses, and families, based on NIFA-sponsored research. The Extension system provides uniquely effective non-formal education to youth through the 6 million members of 4-H.

Additionally, NIFA partners with non-Land-Grant Universities and Colleges, other Federal agencies within and beyond USDA, tribal communities, organizations, and nations, nonprofit organizations, professional science societies, commodity groups and grower associations, small businesses, citizen groups, foundations, regional centers, the military, and other groups. This unmatched partner base enables NIFA to be a leader in climate science research, development and application for impactful change that serves the public.

2. KEY CLIMATE CHANGE VULNERABILITIES

Climate change will impact NIFA's ability to carry out its mission along a variety of pathways and threatens to exacerbate the disparities and challenges faced by historically underserved communities. NIFA's key climate vulnerabilities and the impacts of climate change on historically underserved communities are described below.

2.1 Water Quality & Quantity

Climate change threatens water resources through drought, flooding, alteration of snowmelt and precipitation, soil erosion, and coastal inundation. Water resource limitations can cause conflicts between urban and agricultural systems, and the human dimensions of water use and technology adoption can further compound management challenges.

- **Water Quantity.** Communities across the country face changes in precipitation, including variations in the seasonality, quantity, intensity, and spatial distribution of precipitation events. Increased temperatures and shifts in seasonality also impact the quantity and timing of annual snowpack and melt, further affecting downstream water supply. Changes in precipitation can manifest in different geographic regions as persistent drought and/or catastrophic flooding, both of which threaten agricultural food systems and community well-being.
- **Water Quality.** Runoff and soil erosion caused by extreme precipitation events and flooding can reduce water quality through contamination by pollutants, excess nutrients, and sediments. Accelerated evaporation rates from higher temperatures, variable timing of precipitation and persistent drought can cause increased concentrations of contaminants and decreased water quality. Both scenarios can lead to eutrophication and hypoxia. Decreased water quality threatens agricultural production, aquaculture systems, groundwater, and downstream riparian and aquatic ecosystems.
- **Groundwater.** Increased groundwater extraction in combination with reduced groundwater recharge in areas experiencing altered precipitation and drought can compound stress on agricultural systems. Similarly, groundwater systems can become contaminated as surface water quality declines. Saltwater intrusion caused by sea level rise and groundwater extraction further threatens groundwater resources and crop productivity.
- **Riparian and Aquatic Ecosystems.** The impacts of climate change on water have repercussions for other connected, dependent systems, including riparian and aquatic systems and their related ecosystem services. These ecosystems are important habitats for beneficial species that aid in the maintenance and resilience of adjacent agroecosystems. Changes in water quantity and quality associated with climate change will further threaten these already imperiled ecosystems.

- **Historically Underserved Communities.** Historically underserved communities are particularly vulnerable to climate change-induced issues of water quantity and quality because of the long history of displacement to marginal lands and persistent environmental pollution. Additionally, many tribal communities reside in drought-prone regions of the western U.S. that will face heightened water stress in coming decades. All too often, these communities also lack investment in public infrastructure for delivery of clean water.

2.2 Agroecosystem Productivity & Sustainability

Monoculture agroecosystems are vulnerable to an increasingly variable and extreme climate. Climate change is accelerating risks from biotic stressors, including pests (e.g., rodents and arthropods), weeds and pathogens, and abiotic stressors, such as soil erosion caused by wind and water. Successful climate adaptation will require prioritized attention to multiple components of agroecosystem productivity and sustainability.

- **Pests, Invasive Species, and Disease.** As climate change impacts seasonality, resulting in milder winters, pests, weeds, and pathogens are likely to expand their geographic ranges. Both the number and diversity of invasive species are projected to increase with climate change because of higher temperatures, more frequent and intense habitat disturbances, and stress on crops and native species.
- **Pollinator Health.** Pollinators, which are critical to agricultural production, are particularly vulnerable to extreme weather events and shifting weather patterns. The resulting altered seasonality can cause mismatched timing of flowering and pollination. Native pollinators are impacted by biodiversity loss of both forage and host plants, and are increasingly threatened by pests, pathogens, and invasive species, as described above.
- **Soil Health.** Higher temperatures and drought increase evapotranspiration rates and reduce soil water availability, which can have cascading effects on soil health and agricultural productivity. More frequent and intense precipitation and wind events will likely increase soil erosion.
- **Forest Health.** The impacts of climate change on water availability, pests, disease, and invasive species have important repercussions for forest health. Long term drought and higher temperatures create conditions for catastrophic wildfire. In response to increasing temperatures and shifting seasonality, many tree species are also exhibiting poleward migration beyond their traditional ranges. Forests are a crucial resource for carbon sequestration; therefore, declining forest health will exacerbate climate change mitigation challenges.
- **Livestock Productivity.** Heat and water stress and extreme weather pose threats to livestock productivity. These impacts are further compounded by the increased prevalence of parasites and pathogens, which can affect livestock quality and health.
- **Coastal Agroecosystems.** In addition to facing more extreme and variable weather, coastal agroecosystems will experience ocean acidification and coastal inundation caused by sea level rise. Not only will productive agricultural land be lost due to inundation or periodic coastal flooding, saltwater intrusion of groundwater will also decrease water and soil quality and quantity for coastal farm operations. Coastal inundation and more extreme and variable weather along the coasts, as well as ocean acidification, may also create challenges for marine and estuarine aquaculture productivity.

- **Ecosystem Services.** Shifting seasonality, increased temperatures, extended ranges of pests, increased disease prevalence, reduced pollinator health, and lessened water quantity and quality will decrease the ecosystem services that sustain agroecosystems. Addressing this vulnerability will require systems-level approaches to sustainable productivity.
- **Markets and Livelihoods.** Altered climate patterns and extreme and variable weather events will cause geographic and temporal shifts in crop production. Such shifts will add significant production risks and threaten the stability of agricultural livelihoods. Additionally, extreme, and variable weather events will disrupt agricultural production and associated supply chains, leading to market instability.
- **Historically Underserved Communities.** Historically underserved communities are particularly vulnerable to the impacts of climate change on agroecosystem productivity. For historically underserved communities on marginal lands, the agroecosystems they steward are likely already experiencing impacts of climate variability and extreme events. This enhanced vulnerability may lead to more drastic losses in productivity. Additionally, the long-term economic disenfranchisement of historically underserved communities often leads to less resilience when faced with environmental and economic shocks, in part stemming from a lack of investment capital for climate adaptation and disaster recovery strategies.

2.3 Food & Nutrition Security

Evidence indicates that increased temperature, drought, rainfall variability, extreme weather and ocean acidification associated with climate change is related to reduced food production, altered nutrient content, inequitable access to healthy foods and beverages, and high rates of food insecurity. Climate change poses a threat to both food security for communities as well as nutrition security. Nutrition security builds on food security by connecting how the quality of what we eat can help reduce diet-related diseases. It also emphasizes equity and tackling long-standing health disparities. Climate change and its varied effects, including extreme weather events and longer-term degradation and loss of resources, can create new insecurities and exacerbate existing inequities. Black, Hispanic, and Native Americans, as well as people living in rural and lower-income communities, experience the greatest disparities related to food insecurity, nutrition security, and associated diet-related chronic diseases.

- **Food Systems.** Local, regional, and global food systems are weakened because of emerging climate change impacts on agricultural productivity. At the local level, climate change threatens Indigenous food systems and the production of and access to traditional food.
- **Food Safety.** Food safety and processing is impacted by availability of water and extreme weather events. Water stress will impact water costs and, therefore, the costs of properly cleaning food products. Extreme weather can cause disruptions to food processing and distribution and may expose food to unsafe temperatures. Such disruptions can directly affect food preservation and safety, which has serious consequences for health.
- **Food Access.** Transportation, storage, preservation, and access points (grocery stores, markets, food banks) to nutritious, safe food will be impacted both by rising temperatures and severe weather events that interrupt supply chain infrastructure. Limited food access has direct implications for community health, particularly within historically underserved communities.

- **Food Loss and Waste.** Food loss during processing and distribution is likely to increase because of rising temperatures, leading to increased waste as food moves from market to consumer. If food reaching consumers is not at peak freshness, food waste at the consumer level will likely rise. An increase in food waste has repercussions for food access, community health, and agroecosystem sustainability.
- **Nutritional Quality.** The impacts of climate change on the nutritive quality of food are not yet fully established; however, several correlations, some nonlinear, have been observed. Food is threatened by climate change impacts on soil, water quality and availability, and rising temperatures, all of which may have complex effects on the nutritive quality of a given product.
- **Historically Underserved Communities.** Food and nutrition access and safety are particularly insecure in and among historically underserved communities. The impacts of climate change will exacerbate existing inequities. The cascading effects of the loss of assets, morbidity, and displacement caused by climate change can further compound access to safe, nutritious, and culturally appropriate food for these communities. Nutrition security means *all* Americans have consistent access to the safe, healthy, affordable foods essential for optimal health and well-being.

2.4 Resilience to Extreme & Variable Weather Events

Climate change will lead to greater frequency and intensity of extreme weather-related disasters caused by naturally occurring hazards (e.g., extreme temperatures, wildfires, tornados, floods, hurricanes, tropical storms, windstorms, and blizzards), which directly impact agricultural, rangeland, forestry, aquaculture production and dependent systems, and can lead to infrastructure damage and land degradation. Extreme, unpredictable, or variable weather can erode the capacity of systems to withstand and recover.

- **Supply Chains.** Supply chains are often adversely impacted by extreme weather and disasters at the production, processing, distribution, and consumption stages. This can lead to agricultural productivity losses and shocks to commodity pricing. Supply chain disruptions can also have negative effects on innovation and research due to exorbitant costs or delays in manufacturing and distribution of supplies.
- **Livestock Welfare.** Extreme weather poses unique challenges for animal welfare. Flooding, hurricanes, tornados, wildfire, and blizzards can cause mass mortality events of livestock. Evacuation of large livestock populations requires advanced planning and warning systems, which are not always feasible.
- **Historically Underserved Communities.** Extreme weather disproportionately affects historically underserved communities who often live on marginal lands that are vulnerable to extreme weather events. These communities often have limited capital or infrastructural capacity to prepare for or respond to disasters. Additionally, communities that rely on agriculture and forests for income and employment face critical setbacks when extreme and variable weather disrupts these systems.

2.5 Education Pipeline

NIFA is responsible for investing in formal and informal education to ensure the development of human capital, communities, and a diverse workforce. Climate change presents a new challenge for ensuring equitable participation and updating curricula at all stages of NIFA's educational pipeline, including 4-H programming for

youth and community, four-year colleges and universities, M.S.- and Ph.D.-granting institutions, and Cooperative Extension for adult community members. By systematically incorporating climate change science into the educational pipeline, stakeholders will be empowered to anticipate climate change impacts on their communities and adapt accordingly.

- **Land Managers & Producers.** Changing and variable weather creates new challenges for land managers and producers to remain profitable. Climate change impacts production and leads to less predictable input and market prices. This is especially true for small- and mid-size producers who lack additional income from outside their production operations to buffer them financially.
- **Public & Non-Profit Sectors.** NIFA supports the educational pipeline that supplies K-12 agricultural teachers; college of agriculture faculty; Extension educators; local, state, and federal government employees of USDA and related agencies; and the nonprofit sector that supports the agricultural, forestry, aquaculture, and community nutrition and health sectors of the US economy. While climate change indiscriminately threatens these sectors, climate change knowledge and adaptation capacity are unevenly distributed across the country. Climate change education is crucial to the development of policies, programs, incentives, and safety nets to facilitate climate change adaptation.
- **Private Sector.** Companies that support the agricultural, forestry and aquaculture sectors with business strategies — such as developing new machinery, plant and animal varieties and nutrient and pest protection technologies; managing supply chains; and investing in commodities — will all face challenges in their business operations related to climate change. Nevertheless, new business opportunities will arise for the development of technologies that can assist customers, and companies will need to draw upon climate change science, knowledge, skills, and experience in order to be nimble and adapt.
- **Historically Underserved Communities.** Historical inequities in funding and support contributed to disparities in agricultural education and among producers today. NIFA can build resilience in the agricultural workforce by continuing and bolstering its efforts to develop a more equitable agriculture, forestry, aquaculture and community services workforce pipeline; an effort that is imperative to anticipate the needs of a diverse citizenry facing climate change challenges.

2.6 Continuity of Operations

Climate change may affect NIFA's ability to carry out its mission and objectives. For example, extreme weather events may lead to operational stoppages, such as delays in funding transfers due to internet outages. Extreme weather events may damage field-based projects and even science infrastructure. Thus, climate change poses a dual threat to the continuity of essential research, education, and Extension by disrupting NIFA's capacity to support its stakeholders and by impeding grantees from fulfilling funded objectives.

- **Infrastructure.** Extreme weather events pose risks to NIFA's office in Kansas City, Missouri, and stakeholders' facilities throughout the country. While most NIFA staff have entered telework or remote

work agreements, senior leadership are still required to report to the Kansas City office. Climate may also impact the technological infrastructure in Kansas City where information systems are housed and require a temperature- and humidity-controlled environment. This also applies to NIFA's backup systems located outside of Kansas City.

- **Personnel.** Extreme weather can impede NIFA staff from completing job tasks in the event of internet outages, power outages and the inability to safely commute. Disruption to remote and teleworking personnel's infrastructure may negatively impact daily operations and may affect the overall grantmaking process, from panel reviews to awarding as well as database and records management.
- **Stakeholder Operations.** Immediately following extreme weather events, urgency associated with cleanup and restoration efforts dominate community priorities, shifting the focus away from ongoing NIFA-funded research, Extension, and education projects in the short term. Climate related events may impact the ability of grantees to carry out the full scope of their work, due to increasingly frequent, severe, and longer-term weather-related disasters. Additionally, severe climate events may affect grantees' abilities to carry out Extension activities that provide essential, on-the-ground services to agricultural communities. The displacement of communities resulting from climate change effects, such as rising sea levels or extreme weather events, will also present extenuating challenges to grantees and Land-grant Universities.
- **Historically Underserved Communities.** Many of NIFA's stakeholders and grantees live in historically underserved communities, including Minority-Serving Institutions and Tribal Colleges and Universities. Often, these institutions lack resources and are already strained by the requirements and policies of grant makers. NIFA will need to examine policies and procedures related to historically underserved communities to better anticipate the disproportionate climate change effects they face.

3. CLIMATE ADAPTATION ACTIONS

The proposed climate adaptation actions cluster around four themes: Programs and Requests for Applications (RFAs), Strategic Planning, Organizational Effectiveness, and Stakeholder Outreach. We further examine how proposed actions relate to cross-cutting themes including environmental justice, workforce development, and USDA Climate Hubs. The proposed actions are envisioned as applicable to multiple vulnerabilities, further contributing to an adaptive, resilient NIFA.

3.1 New NIFA Programming

- a. Develop **new opportunities** to address climate change vulnerabilities, contingent on available funding.
 - i. New AFRI Priorities. Depending on future funding availability, NIFA will create new opportunities within the Agriculture and Food Research Initiative (AFRI) to address climate-smart agriculture and forestry practices and mitigation of agriculture greenhouse gases (GHG). These new emphases will lead to scientific advances that address NIFA's climate change vulnerabilities, which will be disseminated through education and Extension programs to empower students and communities to adapt to climate change.

- ii. Cooperative Extension. NIFA will support the national Cooperative Extension System in assisting agriculture, forestry, and rural communities to adapt to the challenges of climate change and develop resilient rural economies. Reaching every county throughout the U.S., Cooperative Extension is in the unique position to foster grassroots trust for climate change science and help communities adapt to climate change at the local level.
 - iii. Traditional Ecological Knowledge (TEK). TEK is an important resource for management of natural resources and mitigation of risks from extreme weather events. TEK also forms potential repositories for climate records that stretch back for millennia. The intentional and respectful incorporation of TEK(s) as science can further inform climate-smart agriculture and forestry practices, management, and adaptation. NIFA will support work to better understand TEK through investments in research, Extension, and education.
 - iv. Climate Hubs Partnerships. **[CROSS-CUTTING ACTION]** Through continued support of the Extension, Education & USDA Climate Hubs Partnership Program (A1721), NIFA encourages Extension partners, such as Cooperative Extension, to collaborate with USDA Climate Hubs to develop and deliver culturally appropriate, nonformal educational outreach materials about climate change. These partnerships can efficiently translate basic climate change science generated by USDA's Agricultural Research Service (ARS) and universities into tools and outreach materials that help producers, USDA field staff and other stakeholders adapt to climate change.
 - v. Positive Youth Development. Climate change is a multigenerational concern, and the education and empowerment of youth can have positive impacts across generations. Invigorating NIFA's positive youth development through Extension and the 4-H program with updated curricula will help ensure that climate science and environmental justice are foundational knowledge for the next generation's workforce.
 - vi. Integration. NIFA will evaluate opportunities to include language about climate change throughout future RFAs and priorities. This integration will ensure that climate change science is embedded across NIFA's funding portfolio and connected to many areas of research, Extension, and education.
- b. Encourage stakeholders to adapt their science to climate change by **modifying RFA application instructions**, where applicable.
- i. RFA Purposes & Priorities. NIFA will review its authority to include standardized language that emphasizes the importance of climate change into the "Purpose and Priorities" section of RFAs. This language will provide NIFA stakeholders with clear and consistent messaging about the importance of climate science to agriculture, forestry, and rural communities.
 - ii. Broader Impacts. NIFA will review its current authority to include a new section called "Broader Impacts" within AFRI RFAs. This section would request that applicants articulate (among other things) how their proposals will affect climate change adaptation, mitigation, and resilience.
 - iii. Pitfalls. Instructions for the "Pitfalls" section of AFRI RFAs will be amended to include instructions for applicants to describe project-specific vulnerabilities to climate events, such as droughts, floods,

fires, and other extreme weather. The instructions will help ensure that applicants consider climate change in their project designs and that NIFA is prepared to support grantees when climate change adversely impacts their capacity to complete project objectives.

- c. Take an **integrated systems approach to climate change programming** to translate research to adoption of practices and behavior changes.
- i. Climate Change Priority Team. **[CROSS-CUTTING ACTION]** NIFA's Climate Change Priority Team will continue to recruit participation from throughout the agency. Participation from across NIFA will promote climate literacy within NIFA, lead to new cross-cutting initiatives that are broadly relevant, and enable synergies across the traditional NIFA program areas.
 - ii. NIFA Staffing. NIFA will strengthen and expand internal climate change expertise by ensuring biological and social science staff with climate science expertise are present in each NIFA science institute. Linking climate change expertise with the breadth of topics covered by NIFA programs will strengthen our ability to serve stakeholders who must respond to climate change impacts on farms, across food systems, and within communities.
 - iii. Climate Science Communications. NIFA will invest in improving accessibility of climate change communication for our stakeholders. Improved communications will help deliver culturally appropriate messaging and build trust in climate science and adaptation strategies throughout stakeholder communities.
 - iv. Integrated Investments. NIFA will aim to balance its climate change investment portfolio across research, education, and Extension through individually focused and integrated projects. This balance will ensure that climate research reaches those communities most affected by climate impacts.

3.2 Strategic Planning

- d. Integrate climate change into **agency-wide planning processes**.
- i. NIFA Strategic Plan. In line with the Government Performance and Results Act of 1993, NIFA will publish a new Strategic Plan that will consider climate adaptation in its mission, programs, and operations. Strategic planning will help ensure that climate adaptation initiatives and standards are set throughout the agency.
 - ii. Timeliness. NIFA will establish a team of subject matter experts to assist with setting timelines for RFA language and developing relevant grant policies. This strategy will put NIFA in a position to proactively plan for annual updates to climate adaptation programming.
 - iii. Agency Champion. NIFA has identified and will continue to identify a senior executive service (SES)-level lead for climate change science. This person will champion climate adaptation efforts, ensure coordination of efforts across the agency, and align climate initiatives with Departmental policies and strategies.

e. Increase interagency coordination for climate change science.

- i. FPAC. NIFA leadership will continue to meet and coordinate with USDA's Farm Production and Conservation (FPAC) leadership on climate science. This coordination effort will improve the delivery of information about USDA-wide climate adaptation funding opportunities. It will also link NIFA stakeholders with opportunities to inform FPAC programming (e.g., developing climate-relevant practice standards).
- ii. Science Funding Agencies. NIFA will work directly with agency funding partners — such as the National Science Foundation, the Department of Energy, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey and the National Aeronautics and Space Administration — and through the U.S. Global Change Research Program (USGCRP) to examine opportunities for collaborative climate adaptation funding programs. This collaborative effort will help fill gaps in climate adaptation funding and will create interdisciplinary approaches to climate change science that are relevant to USDA stakeholders.
- iii. EDAPT. NIFA is engaged in USDA's effort to create the Enterprise Data Analytics Platform & Toolset (EDAPT) and uniform standards for stakeholder access to spatially explicit USDA data. EDAPT will be an online repository that will improve stakeholder access to public data and facilitate analysis of NIFA climate science investments and impacts.
- iv. NASS. As a sibling agency within USDA's Research, Education and Economics (REE) mission area, NIFA will coordinate with the National Agricultural Statistics Service (NASS) to access and use data on climate-smart agriculture and forestry practices to analyze the impacts of NIFA climate adaptation funding.
- v. NIST. NIFA will review opportunities to work with the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) to use the iEdison portal and better assess inventions and valuable intellectual properties resulting from NIFA investments in climate adaptation.
- vi. NSF NCSES. **[CROSS-CUTTING ACTION]** NIFA will review opportunities to work with the National Science Foundation's (NSF) National Center for Science and Engineering Statistics (NCSES) to better understand the impacts of our climate adaptation investments on awarded degrees and employment outcomes, including those for women, minorities, and persons with disabilities. It is necessary to support a diverse pipeline of talent to tackle climate challenges of the future.
- vii. Treasury. NIFA will continue its participation and engagement in the Treasury's Financial Literacy and Education Commission, which will result in a Climate Change and Transition Report on building household financial well-being under climate change.
- viii. USGCRP. NIFA will continue its participation and engagement, as authors on NCA chapters, reviewers, and working group members, in the U.S. Global Change Research Program (USGCRP).

3.3 Organizational Effectiveness

- f. Adapt **NIFA granting procedures** to climate change.
 - i. No-Cost Extensions. NIFA will highlight existing authorities to allow no-cost extensions for climate-related project setbacks. Staff will be trained to make no-cost extensions efficient and to educate awardees about related policies. This process will allow NIFA's stakeholders greater flexibility to deliver meaningful research, education, and Extension in the face of disruptions posed by climate change.
 - ii. Adapted Objectives. In cases where climate change precludes completion of initial research objectives (e.g., extreme weather destroys field experiment), NIFA will support stakeholders by allowing amendments to project objectives. This support will allow for continuity of NIFA's mission and service to stakeholders through the challenges of climate change.
 - iii. Extended Application Deadlines. In the case of extreme weather events, NIFA will extend application deadlines when justified for applicants in affected areas to ensure all stakeholders can submit competitive proposals.
- g. Examine **reporting mechanisms** to track climate change expenditures and impacts.
 - i. Metrics. NIFA's Climate Change Priority Team will determine what impact metrics are both informative and feasible to collect from applicants. For select funding opportunities that support climate change science, NIFA will request that applicants propose and report metrics related to climate adaptation, GHG mitigation, and applicable co-benefits (e.g., resilience, workforce development, environmental justice, etc.). These data will help NIFA understand and predict the impacts of future climate-related funding.
 - ii. Tracking. NIFA will evaluate existing award tracking methods to improve identification of climate change projects and will train programmatic staff in climate change award tracking techniques. These actions will improve the accuracy of NIFA's climate change expenditure reporting to leadership and the Office of Management and Budget (OMB).
 - iii. Open Data. NIFA will work to develop advanced analytics (e.g., artificial intelligence) and visualization dashboards for climate change science projects. Associated data will be available internally and publicly via the EDAPT Open Data platform, which will improve NIFA and stakeholder capacity to assess climate change science investments.
 - iv. Impacts. NIFA will expand analyses of climate-related investments by jurisdiction and institution to determine how those expenditures impact climate adaptation in different communities. This expansion has the potential to move NIFA's climate science focus from inputs to impacts but will require significant new investments in personnel, reporting platforms, and analytics.

h. Improve NIFA's workforce flexibility to better adapt to climate change.

- i. NIFA Workforce. **[CROSS-CUTTING ACTION]** NIFA will encourage staff to become better educated and experienced with climate science and its intersections with environmental justice. Specific mechanisms to accomplish this include encouraging staff to add climate science literacy and leadership opportunities to their Individual Development Plans (IDPs); compiling and distributing to staff a list of climate training opportunities (including those available through AgLearn); internally advertising stakeholders' climate science webinars; and encouraging staff to attend USDA's climate science seminar series. This effort will increase NIFA's institutional knowledge about impacts of climate change on stakeholders and improve administration and evaluation of the agency's climate science portfolio.
- ii. Remote Work. NIFA has moved to a work model in which employees can choose their work duty locations. This flexibility will increase the ability for operations to continue unimpeded in the face of extreme climate events at the USDA-Washington, D.C. and NIFA-Kansas City headquarters. With a workforce that is now dispersed across the country, NIFA employees can be closer to the many stakeholders NIFA serves, increasing awareness of climate change impacts across the U.S.
- iii. Leave Policies. NIFA Human Resources staff will clarify and educate NIFA employees about how leave policies, such as the Family Medical Leave Act (FMLA) or Americans with Disabilities Act (ADA), could be invoked to care for family members or oneself whose health is adversely impacted by extreme weather. This training will help ensure a healthy and resilient workforce and long-term capacity to fulfill NIFA's mission.

3.4 Stakeholder Outreach & Education

i. Increase outreach to stakeholders about NIFA climate change activities, opportunities, and data.

- i. Climate Change Funding Webinars. NIFA will host public webinars about climate change funding opportunities. NIFA will intentionally work with its network of partners and stakeholders, especially historically underserved audiences, to increase the number and diversity of stakeholders applying to NIFA climate adaptation opportunities.
- ii. International Cooperation. NIFA's Center for International Programs will evaluate opportunities to encourage international partnerships that will help the U.S. advance climate adaptation domestically. Cooperation on research priorities — such as indoor agriculture, artificial intelligence, water conservation technologies, and carbon sequestration — can accelerate U.S. adaptation to climate change while supporting the international Agriculture Innovation Mission for Climate (AIM4C) initiative.
- iii. Minority-Serving Institutions and Tribal Colleges and Universities. **[CROSS-CUTTING ACTION]** NIFA will emphasize outreach to and support for Minority-Serving Institutions (MSIs) and Tribal Colleges and Universities (TCUs), including concerted efforts to reach stakeholders at 1890, 1994, and Hispanic-Serving Land-Grant institutions. NIFA will continue to support education and Extension around TEK and will explore new and creative opportunities for additional support for TCUs.

Outreach activities may include webinars, grant writing workshops, and other ways to build and strengthen relationships with and amongst these stakeholders. These efforts serve to increase the participation and success of MSIs and TCUs in NIFA's climate adaptation opportunities.

- iv. Liaisons. NIFA will develop communication tools, such as talking points and slide decks, about NIFA's climate adaptation funding opportunities to further support National Science Liaisons; regional, state, and multistate liaisons; and key stakeholder liaisons. This improvement will help ensure that NIFA opportunities and science-based climate information are consistent, accessible, and widely available to all stakeholders and partners.
- v. Universities & Extension. **[CROSS-CUTTING ACTION]** NIFA will work with key stakeholders to evaluate gaps in university and Cooperative Extension expertise related to climate change and will work with Extension partners to create a roadmap to close those gaps. This will improve the formal and informal education pipeline and ensure the future workforce is ready to adapt to climate change.

3.5 NIFA Climate Adaptation Cross-Cutting Actions

a. **Environmental Justice**

- i. Minority-Serving Institutions and Tribal Colleges and Universities. NIFA will emphasize greater engagement and outreach to, and support for, Minority-Serving Institutions (MSIs) and Tribal Colleges and Universities (TCUs), including concerted efforts to reach stakeholders at 1890, 1994, and Hispanic-Serving Land-Grant institutions. Outreach activities may include webinars, grant writing workshops, and other ways to build and strengthen relationships with and amongst these stakeholders. These efforts serve to increase the participation and success of MSIs and TCUs in NIFA's climate adaptation opportunities.
- ii. Inclusive RFA Language. As NIFA develops and revises funding opportunities to support research, education and Extension for climate-smart agriculture and forestry, there will be consideration for how projects improve inclusion of historically underserved communities and small-scale farmers. Funding opportunities will use language that elevates the importance of inclusion and promotes participation of and benefits to these communities.
- iii. Tracking Inclusion. NIFA will develop internal procedures to track investments in climate change research, education, and outreach at awardee institutions. Through internal tracking, NIFA can identify opportunities to reach stakeholders who have been historically underserved and support inclusive climate adaptation.
- iv. Environmental Justice Impacts. In collaboration with stakeholders and partners, NIFA will develop new approaches, including the respectful incorporation and dissemination of TEK, to document and measure benefits of climate adaptation investments for historically underserved communities facing disproportionate burdens from climate change. This effort will allow USDA to measure, report and align climate change science funding with equity goals more accurately.

b. Workforce Development

- i. NIFA Workforce. NIFA will encourage staff to become better educated and experienced with climate adaptation and intersections with environmental justice. Specific mechanisms to accomplish this include encouraging staff to add climate science literacy and leadership opportunities to their Individual Development Plans (IDPs), compiling and distributing to staff a list of climate training opportunities (including those available through AgLearn), internally advertising stakeholders' climate science webinars, and encouraging staff to attend USDA's climate science seminar series. These opportunities will improve climate knowledge among NIFA staff and better prepare the workforce to address climate change through programming and other avenues.
- ii. RFA for the Future Workforce. NIFA will examine opportunities to expand language in workforce development funding opportunities to include climate change education and Extension for diverse target audiences. Clear RFA language encouraging climate-focused workforce development will help prepare the agricultural workforce to adapt to climate change and support clean energy industries.
- iii. Universities & Extension. NIFA will work with key stakeholders to evaluate gaps in university and Cooperative Extension expertise related to climate change and will work with Extension partners to create a roadmap to close those gaps. This collaborative effort will improve the formal and informal education pipeline and ensure the future workforce is ready to adapt to climate change.
- iv. NSF NCSES. NIFA will review opportunities to work with the National Science Foundation's (NSF) National Center for Science and Engineering Statistics (NCSES) to better understand the impacts of our climate adaptation investments on awarded degrees and employment outcomes, including those for women, minorities, and persons with disabilities. It is necessary to support a diverse pipeline of talent to tackle climate challenges of the future.
- v. Climate Change Priority Team. **[CROSS-CUTTING ACTION]** NIFA's Climate Change Priority Team will continue to recruit participation from throughout the agency. Participation from across NIFA will promote climate literacy within NIFA, lead to new cross-cutting initiatives that are broadly relevant, and enable synergies across the traditional NIFA program areas.
- vi. Workforce Development Priority Team. NIFA's new workforce development priority area presents an opportunity to invest in climate change education, mentorship, and training for future generations through positive youth development programs and 4-H curricula. NIFA's Workforce Development Priority Team will continue to recruit participation across NIFA, creating a foundation for synergies between the climate change and workforce development priority areas.

c. Climate Hubs

- i. Climate Hubs Partnerships. Through continued support of the Extension, Education & USDA Climate Hubs Partnership Program (A1721), NIFA encourages Extension partners, such as Cooperative Extension, to collaborate with USDA Climate Hubs to develop and deliver culturally appropriate, nonformal educational outreach materials about climate change. These partnerships can efficiently translate basic climate change science generated by USDA's Agricultural Research Service (ARS) and

universities into tools and outreach materials that help producers, USDA field staff, and other stakeholders adapt to climate change.

- ii. Internships & Sabbaticals. Through the previously mentioned A1721 program and the Food and Agriculture Science Enhancement (FASE) grants, NIFA provides opportunities for students and scientists to complete internships and sabbaticals at USDA Climate Hubs. This program leverages USDA Climate Hub knowledge and expertise to accelerate climate adaptation throughout the U.S.

4. SUSTAINING AND EVALUATING ADAPTATION PROGRESS

NIFA anticipates that positive climate change adaptation impacts can be achieved by adopting an adaptive management framework (**Figure 1**). Through regular iteration of programmatic monitoring and evaluation and stakeholder engagement, NIFA can learn from outcomes; adjust climate adaptation actions to become increasingly effective and efficient; and course-correct when needed. NIFA's mission directly affects the nation's farming, ranching, forestry, fishery, and rural communities and indirectly affects every American. Implementing and updating this Climate Adaptation Plan can begin to tackle the existential challenges of climate change.

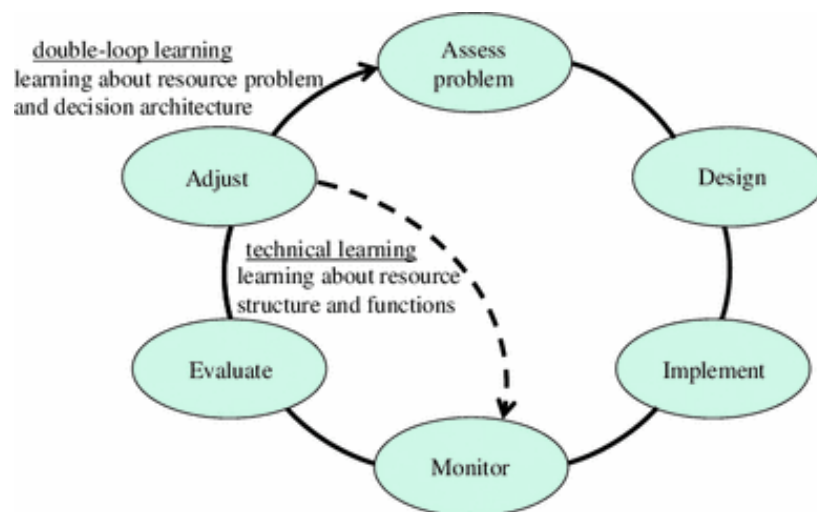


Figure 1. Diagram of the *adaptive management process*ⁱⁱ, which requires institutions to 1) assess the problem; 2) design solutions; 3) implement solutions; 4) monitor implementation; 5) evaluate success of solutions to address the problem; and 6) adjust solutions based on knowledge gained through the evaluation. Iterating both monitoring, evaluation, and assessment of the identified problem are important steps in the adaptive management framework, allowing for learning and flexibility.

To operationalize this plan, NIFA has organized a Climate Change Priority Team, headed by NIFA's Associate Director and Deputy Director of the Institute for Bioenergy, Climate, and Environment, with representation from all NIFA institutes and divisions. This team meets three times per month to coordinate climate change work

across the agency and will be responsible for overseeing and coordinating the implementation of proposed Climate Adaptation Plan actions. Twice annually, the team compiles accomplishments for USDA and NIFA review; progress towards implementing this Climate Adaptation Plan will become a regular part of accomplishments reporting.

Progress toward implementing proposed actions can be monitored by tracking data on output metrics that lead to desired outcomes and long-term impacts (**Table 1**). Some of the Climate Adaptation Plan Actions are “ongoing”, “planned”, or “proposed.” “Ongoing” refers to an action that is already being tackled; “planned” means the action has not yet been undertaken but can be accomplished by reallocating existing resources; and “proposed” refers to an action that it will require additional personnel and/or financial resources. Most of the climate adaptation actions described in this report are either ongoing or planned. The proposed actions, which are more challenging, center around hiring new personnel with climate change science expertise, developing new program area priorities for climate change science, and developing new methods to track the impacts of climate change science funding overall and on historically underserved communities.

Table 1. Anticipated outcomes and long-term impacts from implementing proposed climate adaptation actions with corresponding metrics of progress and feasibility.

Target Outcome (Corresponding Actions)	Action Description	NIFA Lead	Inter- & Intra- Agency Coordination	Timeframe	Status*	Progress Metrics	Accomplishments to Date
AFRI program aligned with identified climate vulnerabilities (a. i)	Identify existing opportunities and new areas for investments within AFRI to address climate vulnerabilities	Climate Lead, Climate National Science Liaison (NSL), AFRI Team, Deputy Directors	Climate Change Priority Team, All Institutes, Office of Grants & Financial Management (OGFM), Communications	2022 & continuous	Ongoing, Proposed	# AFRI program area priorities; \$ Investment value in AFRI program area priorities for climate change science	Evaluation of existing AFRI funding for climate change science is in progress <u>Proposed:</u> Accelerate action with increased funding to AFRI
Emphasis on Extension & positive youth development (a. ii, v)	Support opportunities to fund Cooperative Extension engagement to develop youth and community members' climate change knowledge and community's capacity to adapt to climate change	Climate Lead; Climate NSL; Institute of Youth, Family, & Community (IYFC); Institute of Bioenergy, Climate, & Environment (IBCE); Deputy Directors	Climate Change Priority Team, IYFC, IBCE, Communications	2022 & continuous	Ongoing, Proposed	# Programs; # Funded projects; \$ Value of funded projects	Created new funding opportunities in FY21 & FY22 for positive youth development & Cooperative Extension <u>Proposed:</u> Accelerate action with increased funding to AFRI
Traditional ecological knowledge (TEK)-informed climate adaptation (a. iii)	Support the respectful understanding, dissemination, and applications of TEK through research, education, and extension programming	Climate Lead, Climate NSL, Tribal Programs NPL, IYFC, IBCE	Climate Change Priority Team, All Institutes, Office of Grants & Financial Management (OGFM), Communications	2022 & continuous	Proposed	# Programs; # Funded projects; # of participating TCUs, and other tribal entities	Incorporated TEK language to the existing AFRI RFA <u>Proposed:</u> Work closely with TCUs to develop new programming opportunities around TEK
Climate change integrated into existing RFAs (a. vi)	Insert climate change-relevant language in existing RFAs, particularly in the Purpose and Priority sections, to support integration of climate science across disciplines	Climate Lead, Climate NSL, All Deputy Directors	Climate Change Priority Team, All Institutes, OGFM, Communications	2023 & continuous	Ongoing	# Modified program area priorities; # New climate change projects funded; \$ Invested in new climate change projects	Climate change language incorporated in RFAs, where appropriate, in FY22; Opportunities for inclusion will be reviewed annually during RFA revision cycles
Potential climate change impacts on proposed work identified by	Modify 'Pitfalls' instructions and create a new 'Broader Impacts' section in AFRI RFAs to ensure applicants consider climate	Climate Lead, Climate NSL, AFRI Team, Deputy Directors	Climate Change Priority Team, All Institutes, OGFM,	2023 & continuous	Proposed	AFRI RFA instructions are modified to include new guidance	<u>Proposed:</u> Plans in development to convene a working group to discuss proposed RFA modifications

Target Outcome (Corresponding Actions)	Action Description	NIFA Lead	Inter- & Intra- Agency Coordination	Timeframe	Status*	Progress Metrics	Accomplishments to Date
applicants in AFRI proposals (b. i, ii, iii)	change risks in their project designs and the impacts of their research in the context of climate change		Communications				
Climate change competency of NIFA workforce (c. i, ii)	Improve workforce climate change literacy through staff-led educational opportunities and task-oriented climate action through NIFA's cross-institute Climate Change Priority Team	Climate Lead, Climate NSL, Climate Change Priority Team	All Staff	2022 & continuous	Ongoing	# Members per NIFA institute in Climate Change Priority Team	NIFA Climate Change Priority Team created and open to all staff for voluntary participation
Interdisciplinary climate change expertise across NIFA (c. i, ii)	Instill climate expertise through recruitment of new social and biological science staff with expertise in climate science across all NIFA institutes	Climate Lead, Climate NSL, Deputy Directors, OGFM	Executive Council, Climate Change Priority Team, All Institutes, Human Resources	TBD	Proposed	# Natural and social scientist NPLs and supervisors with climate science expertise per institute	Discussions underway about staff expertise needs and proposed recruitment of new social and biological science staff
Improved climate change science communication with stakeholders (c. iii)	Emphasize social science and behavior change when developing programming related to climate change to encourage trust in climate science amongst diverse stakeholders	Climate Lead, Climate NSL, Communications	Climate Change Priority Team, All Institutes, USDA Extension Staff	2023 & continuous	Planned	# Projects with climate change science or adaptation behavior or communications	To be considered during the FY2023 RFA revision process and beyond
Integrated climate change science investments (c. iv)	Promote positive science impacts on communities by balancing climate investments across research, education and Extension with projects that focus on integrating across NIFA mission areas	Climate Lead, Climate NSL, Deputy Directors, OGFM	Executive Council, Climate Change Priority Core Team, All Institutes	2023 & continuous	Ongoing, Planned	Proportion of funding invested in climate science research, education, & Extension; # Integrated climate change research projects	Working group created and initiated a climate change funding portfolio analysis; NIFA will revise RFA's, where appropriate, to be integrated for climate change science
Climate change adaptation incorporated in NIFA strategic planning (d. i, ii)	Elevate external and internal climate change adaptation practices and protocols in agency planning by incorporating climate change adaptation into NIFA strategic plans	Executive Council, Climate Lead, Climate NSL, OGFM	Climate Change Priority Team, All Institutes, Human Resources, Communications, Policy	Upon appointment of new agency leadership	Planned	Presence of climate adaptation measures in NIFA strategic plan; Increased time for RFA development & revision	Introduction of these ideas into existing working groups within NIFA Operations is in planning
Agency Climate Change Lead identified (d. iii)	Identify a Senior Executive Service (SES) climate change "champion" to lead and unify NIFA's climate change science and actions	Executive Council, Climate NSL	Climate Change Priority Team, Communications	2022 & continuous	Ongoing	Senior Executive Service "champion" for climate change science identified	SES staff member assigned this role in FY2022; NIFA intends to maintain this role in the future

Target Outcome (Corresponding Actions)	Action Description	NIFA Lead	Inter- & Intra- Agency Coordination	Timeframe	Status*	Progress Metrics	Accomplishments to Date
Increased interagency coordination for climate change research, education, and Extension support and capacity building (e. i, ii)	Collaborate with Farm Production and Conservation (FPAC) and sibling funding agencies on climate change science opportunities to reach a broader stakeholder audience and expand impacts of climate change research, education, and Extension	Climate Lead, Climate NSL, Climate Change Priority Team	Climate Change Priority Team, All Institutes, Communication, NIFA Extension Liaisons, USDA FPAC & REE	2022 & continuous	Ongoing, Proposed	Number of working partnerships on climate initiatives within the U.S. government	NIFA currently coordinates with FPAC and REE agencies <u>Proposed:</u> Explore joint funding opportunities and conduct gap analysis of climate change science across sister funding agencies
Increased interagency coordination for improved portfolio analysis (e. iii, iv, v, vi, vii, viii)	Develop the USDA Enterprise Data Analytics Platform & Toolset (EDAPT) for data sharing and improve portfolio analysis and tracking through coordination with agencies, such as the National Agricultural Statistics Service (NASS), NSF's National Center for Science & Engineering Statistics (NCSES), Commerce's National Institute of Standards & Technology (NIST), the Treasury's Financial Literacy and Education Commission, and the U.S. Global Change Research Program (USGCRP) working groups.	Climate Lead, Climate NSL, Data Analytics National Program Leader, Climate Change Priority Team	Data Analysts, National Program Leaders, Program Specialists, EDAPT Working Group, NASS; External coordination with NSF, NIST, Treasury, and USGCRP	2022 & continuous	Ongoing	# Outputs from collaborations; # Climate-relevant databases shared on EDAPT; Climate change portfolio analysis complete	Continued involvement in EDAPT creation and coordination with NASS; Exploration of opportunities to work with external partners and initial portfolio analyses are underway
Grant procedure flexibility (f. i, ii, iii)	Use mechanism of no-cost extensions, RFA deadline extensions, flexibility in project objectives, and rapid response RFAs to serve stakeholders under weather extremes and challenges of climate change	Climate Lead, Climate NSL, Deputy Directors, OGFM, Policy	Climate Change Priority Team, All Institutes, National Program Leaders, Program Specialists, Communications	2022 & continuous	Ongoing, Planned	# NIFA staff trained on climate change granting flexibility procedures; # Stakeholders utilizing flexibilities	National Program Leaders currently have flexibility to provide no-cost extensions and modify RFA deadlines and project objectives; Further staff training is in planning
Programmatic impact analyses improved (g. i, ii)	Identify methods to assess the realized impacts of climate research funding on communities	Climate Lead, Climate NSL, Data Analysts	Climate Change Priority Team, All Institutes, National Program Leaders, Program Specialists, OGFM	2022 & continuous	Ongoing, Proposed	Case study for impact analysis completed on one model program, Improved impact analysis procedures established	Evaluation of new methods for investment portfolio analysis underway <u>Proposed:</u> Case study approach to develop Impact analysis methodology; action will require

Target Outcome (Corresponding Actions)	Action Description	NIFA Lead	Inter- & Intra- Agency Coordination	Timeframe	Status*	Progress Metrics	Accomplishments to Date
							considerable personnel time and financial resources
Open data and data visualization dashboards created and maintained (g. iii, iv)	Create climate-relevant data reporting and visualization dashboards that are accessible for internal and public use	Climate Lead, Climate NSL, Data Analytics National Program Leader, Data Analysts, OGFM	Climate Change Priority Team, All Institutes, National Program Leaders, Program Specialists, USDA EDAPT Working Group, Communications	2022 & continuous	Ongoing	# Open source databases available through the EDAPT Open Data platform; # NIFA data users; # Stakeholder data users	Working group developing machine learning methods to identify climate science projects; Ongoing collaboration with USDA EDAPT Working Group to facilitate Open Data access
NIFA Workforce better adapted to climate change (h. i, ii, iii)	Increase opportunities for NIFA staff to learn about climate change impacts on work procedures, implement remote work and continuity of operations policies, and utilize leave policies to help staff and services adapt to extreme weather events	Executive Council, Climate Lead, Labor Union Reps, Human Resources	Climate Change Priority Team, All Staff, Office of Equal Opportunity and Civil Rights	2022 & continuous	Ongoing, Planned	# Staff with telework or remote work agreements; Incorporation of climate change disasters into staff leave policy training; Creation of protocols for continuity of operations during extreme events	Climate Change Priority Team promotes climate change adaptation staff learning opportunities; all non-Senior Executive Service can choose telework or remote work; Plans underway for staff training about FMLA and ADA leave in response to extreme weather events
Stakeholder awareness of NIFA's climate-relevant funding opportunities increased (i. i)	Host public webinars about climate change funding opportunities across RFAs and priority areas to increase stakeholder knowledge of the resources available to them across disciplines	Climate Lead, Climate Change Priority Team, National Program Leaders	Climate National Science Liaison, Division Directors, Program Specialists, Communications	2022 & continuous	Ongoing	# Outreach webinars; # Webinar attendees; # Grants applications for climate change-relevant programs	Climate change science funding webinar planned for FY22 and in future fiscal years
Increased international partnerships (i. ii)	Promote new international partnerships, including engagement with the AIM4C initiative, to accelerate the flow of climate change adaptation information and technologies to and from the U.S.	Climate Lead, Climate NSL, Climate Change Priority Team, Center for International Programs	Division Directors, National Program Leaders, Program Specialists, Communications	2022 & continuous	Ongoing, Proposed	# Climate change projects that include international partners; \$ Value of projects	Engagement with AIM4C underway <u>Proposed:</u> International partnerships webinar to inform NIFA stakeholders of international opportunities including for climate change science proposed
Minority-Serving Institutions (MSIs) and Tribal Colleges and Universities (TCUs)	Foster inclusive climate adaptation science by increasing outreach and support for MSIs and TCUs through webinars,	Climate Lead, Climate NSL, Climate Change Priority Team,	Diversity, Equity, Inclusion & Accessibility Priority Team,	2022 & continuous	Ongoing, Planned	# MSI & TCU outreach activities; # MSI & TCU participants; # MSIs & TCUs applying for and	Evaluation of MSI grant application rates underway; Webinars to convey application opportunities

Target Outcome (Corresponding Actions)	Action Description	NIFA Lead	Inter- & Intra- Agency Coordination	Timeframe	Status*	Progress Metrics	Accomplishments to Date
engaged to build support and capacity (i. iii)	grant writing workshops, incorporating TEK, and collaborative working sessions about NIFA's climate change science, education, and extension opportunities	MSI National Program Leaders, TCU National Program Leader	Data Analysts, Equity Plan Action Team, Communications			awarded climate change science funding; \$ Value of projects	relevant for MSIs are in development
NIFA Liaisons equipped for climate change science outreach (i. iv)	Support National Science Liaisons, and regional, state, and multistate liaisons in effectively communicating NIFA climate adaptation funding opportunities and science-based climate change information	Climate Lead, Climate NSL, Climate Change Priority Team	All NSLs, All liaisons to partner institutions, Communications	2023 & continuous	Proposed	# Outreach materials prepared; # Outreach events that include climate change science information	Organization of a working group to develop standard materials for use by NIFA liaisons
Promoted climate change leadership through support of Land-Grants& Cooperative Extension supported for climate change leadership (i. v)	Support the nationwide Cooperative Extension System in promoting climate-smart agriculture and forestry to increase local community knowledge and resilience to climate change	Climate Lead, Climate NSL, Climate Change Priority Team	All Institutes, All NSLs, Cooperative Extension	2022 & continuous	Ongoing	# Outreach opportunities; # Funded projects; \$ Value invested	AFRI Program A1721 funds Cooperative Extension for climate change science outreach
CROSS-CUTTING Environmental Justice (EJ)	Increase MSI and TCU engagement in climate change science through outreach and inclusive RFA language and the incorporation of TEK; Track funding going to MSIs and TCUs and the impacts on underserved communities	Executive Council, DEIA Priority Team, Justice40 Initiative Taskforce, REE Justice40 Team	All Institutes, Data Analysts, Communications	2022 & continuous	Ongoing, Planned, Proposed	# Outreach events; # Participants from MSIs and TCUs; # RFAs with inclusive language; New procedures for investment tracking; New methods and procedures for measuring EJ impacts of investments	Continue MSI and TCU outreach and review opportunities for inclusive language in RFAs <u>Proposed:</u> Examine methods to better track climate science expenditures to MSIs and underrepresented applicants <u>Proposed:</u> Develop new methods for identifying EJ impacts of climate science funding
CROSS-CUTTING Workforce Development	Increase the capacity of NIFA staff to adapt to climate change, strengthen agricultural and food system workforce for climate change resiliency, & improve collaborations with universities & Cooperative Extension and other	Executive Council, Climate Lead, Climate NSL, Workforce Development Priority Team	Climate Change Priority Team, All Staff, IYFC, NSF NCSES	2022 & continuous	Ongoing, Planned, Proposed	# Climate change learning opportunities for staff; # NIFA staff participating; # Workforce development program	Climate Change Priority Team regularly updates staff on climate science learning opportunities; Climate change language to be incorporated into workforce development programs; FY22 Climate Science Summit with

Target Outcome (Corresponding Actions)	Action Description	NIFA Lead	Inter- & Intra- Agency Coordination	Timeframe	Status*	Progress Metrics	Accomplishments to Date
	U.S. government partners for climate change science; Contribute to the development of a diverse workforce better prepared to adapt to the effects of climate change					area priorities that consider climate change; Climate Change Roadmap for science for the NIFA-Land Grant University partnerships; Output from NSF NCSES collaboration	university and Extension partners to develop a roadmap <u>Proposed:</u> Work with NSF NCSES to assess climate change science funding on degree and workforce outcomes
CROSS-CUTTING USDA Climate Hubs	Invest in the Extension, Education and USDA Climate Hubs Partnership Program (AFRI A1721), Internships, and Sabbaticals	Executive Council, Climate Lead, A1721 National Program Leader	All Institutes, USDA Climate Hubs, Cooperative Extension	2022 & continuous	Ongoing	# Projects funded; \$ Funded projects; # All students supported; # Students from underrepresented backgrounds supported; # All Climate Hubs sabbaticals supported; # Climate Hubs sabbaticals supported for individuals from underrepresented backgrounds	A1721 funded in FY21 and FY22 and will continue contingent on future budgets

*Ongoing actions are actively being addressed; planned actions can be undertaken without new resources; proposed actions require additional personnel and/or financial resources.

ⁱ Pardey, P.G., and Alston, J.M. 2021. The drivers of U.S. Agricultural Productivity Growth. *Federal Reserve Bank of Kansas City*.

ⁱⁱ Williams, B.K and Brown, E.D. 2014. Adaptive management: from more talk to real action. *Environmental Management*. 53, 465–479.



Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

ERS Climate Adaptation Implementation Plan

2022 Edition



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I. ERS Mission, Goals, and Objectives



The mission of USDA's Economic Research Service (ERS) is to anticipate trends and emerging issues in agriculture, food, the environment, and rural America; and to conduct high-quality, objective, economic research to inform and enhance public and private decision-making. As one of the Federal Government's principal statistical agencies, ERS is responsible for ensuring the quality, objectivity, and transparency of the statistical information and analyses it provides. The agency anticipates and responds to decision-makers' needs. ERS provides research and data to a wide range of stakeholders and decision-makers on issues related to climate adaptation, risk, resilience, and mitigation.

Agriculture accounted for 11.2 percent of U.S. greenhouse gas emissions in 2020, including carbon dioxide emissions associated with agriculture electricity consumption. In addition, an ERS study found that 18.1 percent of total U.S. greenhouse gas emissions were linked to U.S. domestic food consumption. As such, agriculture and food play a significant role in affecting U.S. goals

addressing climate change. Agriculture is also one of the sectors most heavily affected by climate change.

The ERS Climate Adaptation Implementation Plan identifies how

ERS research contributes to understanding and assessing the risks, effects, adaptation, and mitigation of climate change on agriculture, food, and rural America.

II. Climate Change Effects and Vulnerabilities: Impacts on the ERS mission, priorities, stakeholders, and USDA programs and operations

ERS serves many stakeholders, including farmers, ranchers, rural communities, and the general public. In addition, ERS provides analyses to other governmental organizations and to key decision-makers who help create climate change policy. Consistent with the ERS mission, the agency provides research, data, and analysis to inform stakeholders and the public and to support decision-making processes.

Impact on ERS Mission

ERS devotes significant resources to the study of climate change and

climate change effects. As climate change effects become more pronounced and the need for policy analysis and strategies increases, ERS may need additional resources to meet the demand for information. As the agency engages in additional modeling and analysis, there will be a need for additional expertise and technology capacities.

ERS identified five broad categories of climate effects where research and data can inform the intersection of climate change and the agricultural sector.



Sustainability of the Agri-food Supply Chain

Climate change can adversely affect domestic and international agri-food supply chains. These impacts can limit farmers' access to export markets, as well as food acquisition markets, such as food stores, other retail establishments, restaurants and home kitchens. Climate change also can influence food choices through relative price impacts across different agri-food commodity markets.

Markets and Trade

Climate change can affect agricultural markets and trade flows, through climate-induced supply shocks on agricultural production and disruptions to transportation networks. For example, trade agreements and other policies can affect incentives to reduce greenhouse emissions in agri-

cultural and food systems. Climate change can also affect the demand for crop insurance and other risk insurance policies.

Drought Resiliency and Water Quality

Changing climatic conditions affect the quantity and quality of water available for agriculture and other purposes, such as drinking water. The institutions, policies, and economic incentives created by irrigation markets affect the sustainability of shared water resources and the resiliency of the agricultural sector.





Agricultural Productivity

Agricultural productivity increases are necessary to meet the food and fiber needs of a growing population. ERS developed and regularly updates metrics of agricultural total factor productivity for U.S. and international agriculture. These metrics show the impacts of technical and environmental change on agricultural production. Climate change can impact all aspects of agricultural productivity.

Rural Communities

Factors that can impact rural resilience to climate change include individual measures (e.g., income, poverty, health), natural factors (e.g., ecosystem type, location), built capital (e.g., broadband, energy system, healthcare system), and social capital (e.g., networks, trust). Climate change can influence places of residence, work, and recreation,

as well as the relationship between rural communities and energy development, particularly renewable energy development.

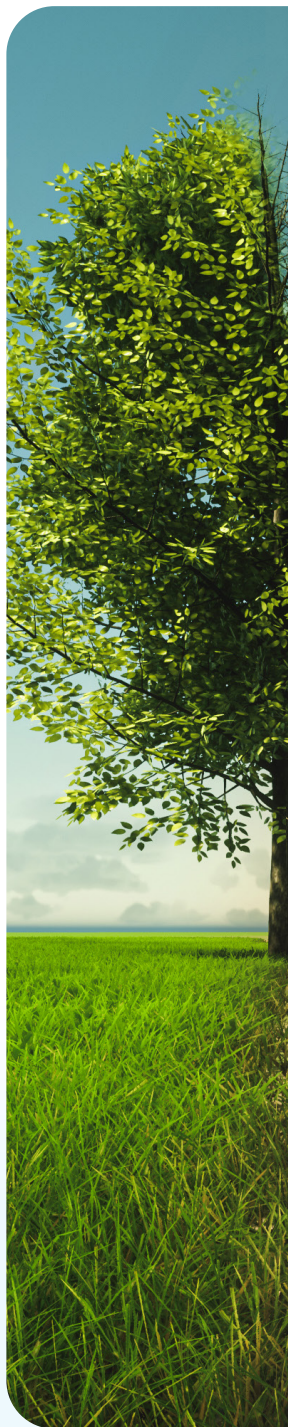


III. Climate Adaptation Actions: Identify and evaluate actions and implementation strategies that assess climate change risks

There are specific research initiatives that are designed to identify and assess the risks associated with the intersection of climate change and agriculture. ERS routinely and continuously engages with a wide range of stakeholders to inform and rank the ERS research portfolio. Consistent with the ERS mission to anticipate trends and emerging topics, ERS participates in many Department-wide initiatives and workgroups to ensure research informs policy decisions and actions. Often, the agency must pivot quickly to emerging issues (e.g., COVID-19 pandemic), while also maintaining its core research program. The following topics combine core research (e.g., USDA Baseline) and emerging issues (e.g., drought resiliency).

Climate Change and Productivity Impacts

ERS has a strong research program related to measuring domestic and international agricultural productivity. New research explores how U.S. historical crop production and agricultural productivity were affected by climate variability and climate change, taking into





consideration factors such as domestic needs for food, feed, and fiber; international trade; commodity prices; and government policies. ERS is also examining the relationship between weather and climate information and total factor productivity across selected countries.

In addition, research and development (R&D) investment can impact agricultural productivity growth. For example, R&D can identify land with high carbon sequestration potential or the conversion of land across uses to meet climate goals. ERS uses a model of the global agri-food economy to conduct policy simulations and examine implications for global agricultural output, food prices, land use, greenhouse gas emissions, and food security.

Conservation Practices and Cropland

USDA's Agricultural Resources Management Survey (ARMS) has been a critical tool for tracking conservation practice adoption for major commodities since 1996. These data can be used to estimate the use of different conservation practices that improve soil health or the ability to increase soil carbon sequestration, and new questions are continually considered to identify major climate smart practices and other management decisions with implications for net greenhouse gas emissions. This information can be used to better understand cover crop adoption, rotational grazing, rice irrigation methods, the use of enhanced efficiency fertilizers, and more.

In addition, ERS is exploring the payment levels and other aspects of conservation contracts needed to

encourage more farmers to begin planting cover crops and continue planting them. Understanding how farmers respond to different payment levels for cover crops is a critical first step in predicting levels of soil carbon storage and other environmental outcomes associated with current and future programs, policies, and markets that encourage cover crop planting.

Finally, ERS is developing a spatially detailed analysis of marginal agricultural and pastureland in the United States. The spatial analysis will examine how different policies affect forest management incentives to increase carbon sequestration.

Bioenergy and Renewable Fuels

ERS tracks U.S. ethanol and biodiesel production, consumption, and trade, and monitors and analyzes U.S. bioenergy policy and events that affect the domestic and international biofuel and feedstock markets. ERS continues to update the U.S. Bioenergy Statistics quarterly to present a picture of the renewable energy industry and its relationship to agriculture.

Underlying the growth in renew-

able fuels is a set of policies at the national and State level that encourage production. Understanding the magnitude of renewable diesel capacity growth over the near term and implications for major feedstock markets is important to evaluate the impacts of these policies on climate change.

Modeling Impacts and Outcomes

The ERS annual USDA Agricultural Projections (also known as the “Baseline”) provides USDA's domestic 10-year projections for the food and agriculture sector covering major agricultural commodities, agricultural trade, and aggregate indicators, such as farm income. The Baseline projections are a significant Department-wide activity conducted in conjunction with the World Agricultural Supply and Demand Estimates (WASDE) report. ERS is exploring how to integrate different climate conditions into the Baseline by examining how growing conditions can affect production and ultimately long-term agricultural plantings.

In addition, ERS has expertise in two global general equilibrium

models used to simulate alternative energy and climate policies through 2050. The Future Agricultural Resources Model (FARM) and the Global Trade Analysis Project (GTAP) enable ERS to examine a wide range of climate-related effects on the agricultural sector, such as the impact of trade shocks and global shifts in production.

ERS is also investing in models to simulate drivers that affect global and U.S. agriculture: population, income, agricultural productivity growth, climate change effects on agriculture, and climate change mitigation to provide an advanced economic modeling framework that links global level change to economic impacts in the U.S. through international trade.

Markets and Climate Change. ERS is examining the effects of climate change on domestic and international agri-food markets, in the aggregate and at various stages of the supply chain. This research includes examining the impact of water available for agriculture and food production; assessing future climate-induced grain and milk

supply chain location needs and cost implications; and measuring primary energy and freshwater use throughout the U.S. food system.

In addition, ERS is exploring the potential of animal production markets to participate in carbon operations, including assessments of greenhouse gas emissions for current animal production systems; technologies with carbon footprint reducing potential; production and market implications of such technologies; potential revenue streams including through carbon markets to producers implementing strategies to reduce their carbon footprint; and consumer preferences for products with reduced carbon footprints.

Drought Resilience of Irrigated Agriculture

ERS and the National Agricultural Statistical Service (NASS) conducted the 2019 Survey of Irrigation Organizations (SIO) as the first nationally representative, federal data collection effort focused on irrigation organizations since the 1978 Census of Irrigation. These data are being used to provide information on

irrigated agriculture and the institutional structure, including work on drought planning and irrigation infrastructure (e.g., canals, reservoirs); groundwater management organizations; water deliveries; governance; and water pricing. These data also allow researchers to examine trends in on-farm water management and characteristics of irrigation water supply organizations.

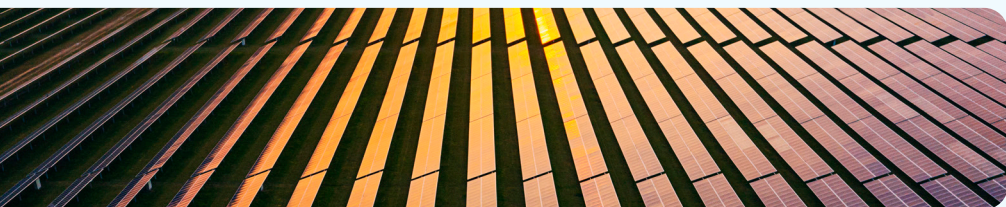
Rural Communities

ERS has ongoing research programs measuring persistent poverty, income, and health measures of rural people. Emerging research includes assessing broadband programs, energy systems and natural amenities of rural places.

IV. Monitoring Progress

ERS has multiple ways to monitor progress and ensure successful completion of research projects, including the necessary peer and inter-agency review steps that are implemented prior to the public release of research reports and data products. The details of these processes are outlined in the Administrative Report, *Publishing@ERS* (2017), which includes dis-

cussion of the directives and regulations governing ERS as a principal federal statistical agency to ensure the research is authoritative, timely, and policy neutral. ERS also measures the dissemination and use of ERS research by stakeholders by examining and tracking publication metrics, web usage statistics, briefing requests, webinars attendance, and staff analysis requests.



V. Special Topics

Environmental Justice

ERS research related to racial and social equity primarily occurs in two major program areas: (1) food access, food security, and nutrition assistance and (2) rural and farm income and wealth. Specific to the intersection between climate and equity, ERS conducts research in several areas related to rural resilience, such as an understanding of the factors around broadband access and heirs' property topics. ERS anticipates funding a climate equity workshop to discuss and advance the science around the intersection of climate, agriculture, and equity. Finally, ERS researchers are collaborating with others outside the agency to investigate how individuals respond to impaired water quality and how these effects vary across different demographic groups. Differences in the ability to access adequate supplies of clean water suggests that the damages of impaired water quality may fall disproportionately on low-income communities without the financial resources to avoid the use of contaminated water.

Workforce Climate Literacy

ERS is both a provider of climate change information and a consumer. ERS provides information by sharing the monthly USDA climate science webinar series with all staff and encourages wide participation. ERS has a representative on USDA's Agriculture, Forests, and Climate Science working group, which produces the webinar series. Topics for 2022 include climate effects and adaptation in crops, animal agriculture, and forests; climate extremes; greenhouse gas mitigation options in agriculture and forests; food systems and food security; and climate justice.

ERS has an on-going need for climate change data as well as the ability to generate new information as conditions evolve. ERS researchers must stay current in the field of climate change. ERS devotes resources to collaborative research and cooperative agreements, recruitment, conferences, and training.



Engagement with the Climate Hubs

ERS has a collaborative research investment with the Southwest and California Climate Hubs to catalogue and analyze water scarcity adaptation efforts in the Western United States. Under the agreement, funds are provided to develop the Water Adaptation Techniques Resource (WATR)-a geospatial tool to catalogue current water scarcity adaptation activities in the West. WATR helps share knowledge among the region's water managers, irrigation districts, State and local governments, and producers with irrigated lands. ERS researchers work with Climate Hubs staff and two postdoctoral researchers funded by the project to develop WATR. Additionally, ERS researchers work with the postdoctoral researchers to model the water conservation impacts for

a subset of the catalogued adaptation activities. These in-depth case studies will complement WATR's breadth of information while also advancing policymakers' and the research community's understanding of the water conservation benefits of differing water scarcity adaptation strategies. ERS is exploring additional ways to engage with other Climate Hubs to collaborate on economic analysis and expertise related to Hubs' initiatives.



CLIMATE ADAPTATION & RESILIENCE PLAN

PEOPLE ♦ SURVEYS ♦ DATA ♦ STATISTICS

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Section 1: Introduction

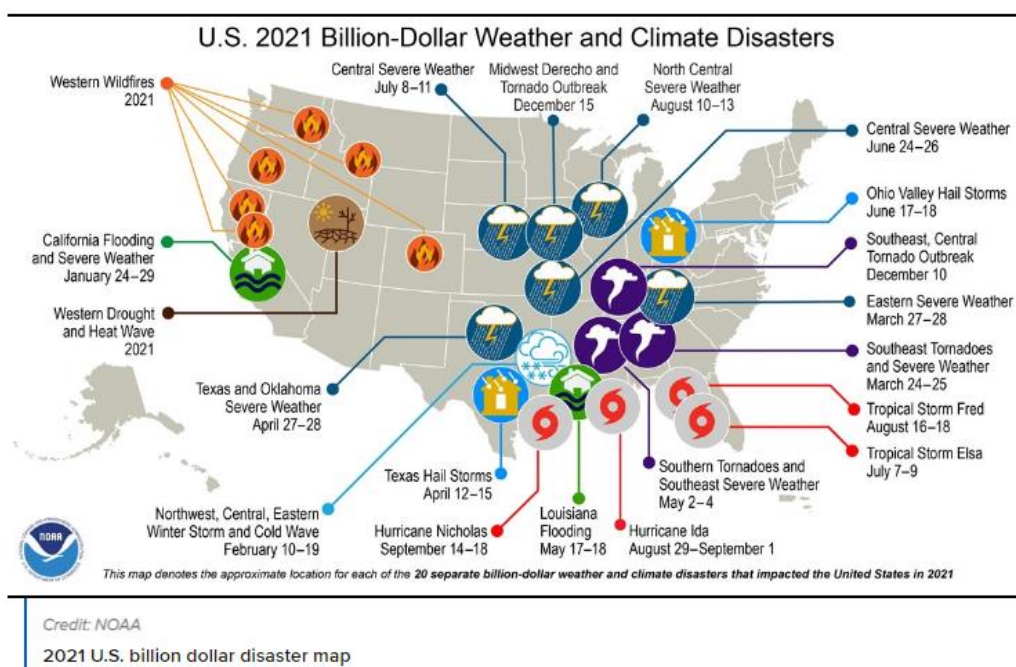
Climate change poses real and present risks to communities across the country. Its impacts are already being felt. The USDA's adaptation plan released in October 2021 describes USDA's climate vulnerabilities and steps the Department will take to bolster adaptation and increase resilience to the impacts of climate change. The USDA's Departmental Regulation 1070-001 directs USDA agencies to prepare detailed climate adaptation implementation plans that speak to how agencies will address risks to their mission and operations in the face of a changing climate.

MISSION

To provide timely, accurate and useful statistics in service to United States agriculture.

The National Agriculture Statistics Service (NASS) supports the USDA's adaptation and resilience path forward according to these guiding principles:

- Protecting NASS's assets (i.e., employees, facilities, IT infrastructure, secured data, etc.) from climate change impacts by assessing vulnerabilities, taking action to adapt to the changing environment, and making resilience a cornerstone of operations to ensure NASS has climate-ready sites to maintain programs, perform data collection efforts, and produce products and services for the U.S. agriculture sector and industry.
- Building upon all USDA agencies' scientific expertise and the world class research and development capabilities of USDA National Laboratories to ensure promising adaptation technologies are included within our Climate Change Adaptation Resilience Strategy.
- Partnering with the National Association of State Departments of Agriculture (NASDA), local agriculture commodity groups, and industry leaders to share and corroborate the benefits and ideas of the NASS climate adaptation, resilience, and environmental initiatives; and
- Leveraging NASS's options through collaboration with other federal agencies to spur innovation, identify and reduce climate-related financial risk, and enhance resilience to better enhance data collection efforts, programs, products, and services.



NASS will continue to leverage its unique climate science expertise, modeling, data infrastructure, and capabilities in partnership with other agencies and institutions to continuously improve its adaptation and resilience strategies.

Section 2: NASS Strategic Goals and Objectives

NASS's FY 2020 – FY 2025 Strategic Plan speaks to the agility and capacity required for tackling the climate crisis. The strategic goals and initiatives align well with the development of the NASS Climate Adaptation and Resilience Plan by demonstrating an ongoing commitment to strategic and operational planning processes anchored around these three goals:

- Strategic Goal #1: Workforce Transformation – Foster a diverse workforce to meet current and emerging needs
- Strategic Goal #2: Exceptional Customer Service – Proactively strengthen relationships with data users, providers, and partners
- Strategic Goal #3: Organizational Excellence – Operate as a strategic, integrated, efficient organization built on sound management practices and methodological principals

To achieve a data program that is more agile, efficient, and responsive to the needs of data providers, data users, stakeholders, and policymakers, NASS created three strategic initiatives tightly integrated within our five-year strategic plan:

- Strategic Initiative #1: Data Collection Dashboard and Respondent Portal
- Strategic Initiative #2: NASS Operating Model Reimagined
- Strategic Initiative #3: Customer Experience: Improving the Ag Data User Experience

Under President Abraham Lincoln in 1862, USDA first provided U.S. agricultural information to the U.S. government and the public. The first official report regarding crop conditions was published in July 1863. NASS continues to fulfill its original mission through its release of USDA forecasts and estimates publications. NASS's responsibilities are authorized under the Agricultural Marketing Act of 1946 (7 U.S.C. 1621-1627), the Census of Agriculture Act of 1997, and Public Law 105-113 (7 U.S.C. 2204g). Public Law 105-113 transferred responsibility for the Census of Agriculture and other special studies from the Department of Commerce to USDA in November 1997; entrusting NASS to perform them going forward. Conducted every five years, the Census of Agriculture provides comprehensive information about the nation's agriculture at the national, state, and county levels. NASS maintains a current list of farms and ranches in the U.S., one of its unique federal roles. The Agency performs important reimbursable agricultural survey work for other federal agencies, state governments, and producer organizations. NASS also provides technical assistance for agricultural statistics programs in developing countries.

As the principal statistical agency for USDA, NASS maintains relationships with many partners, customers, and stakeholders whom the agency serves with data products and services, and who use and advocate for the data NASS produces. Among them are:

- State departments of agriculture and land grant universities. Through cooperative agreements and memoranda of understanding dating back to 1917, NASS field offices serve jointly as the federal field office and the state government agricultural statistical office. In this role, NASS provides data collection and statistical services to other agencies and provides statistics to the public through agreements with private producer organizations.
- The National Institute of Statistical Sciences, which brings together the best academic and NASS researchers to provide recommendations for emerging challenges and opportunities in the agricultural statistics program.

- More than 40 community-based organizations (CBOs), as well as countless local associations, facilitate USDA outreach to limited-resource and historically under-represented producers. These groups work with NASS staff to ensure their constituents are represented and that the census includes all farms and ranches, regardless of size, location, or type of operation. NASS also partners with these groups to provide hands-on assistance and support to local producers—including non-English speakers—to complete their census forms. NASS targets media outreach to small, minority, and non-English-speaking producers.

With a rich, growing portfolio of integrated surveys, the census, remote sensing, and other products and services, NASS is strategically positioned to support the data needs of the Department to better monitor and measure climate-related concerns of the U.S. agriculture sector.

Section 3: Climate Change Vulnerabilities and Data Gap Analysis Assessment

The August 2021 *USDA Action Plan for Climate Adaptation and Agriculture* recognizes climate change presents many challenges to USDA and its stakeholders and identifies five key climate vulnerabilities:

- Decreased agricultural productivity
- Threats to water quantity and quality
- Disproportionate impacts on vulnerable communities
- Shocks due to extreme climate events, and
- Stress on public lands and infrastructure

Vulnerability assessments are an important tool to guide USDA's understanding of risk, priorities, and options to form adaptation strategies. NASS will partner with the USDA Climate Hubs in assessing vulnerabilities to climate change across the wide array of agriculture subdomains and underserved producer groups.

KEY CLIMATE VULNERABILITIES TO THE NASS MISSION, GOALS, AND OBJECTIVES

NASS strategic initiatives are inherently responsive to adaptation and resilience capabilities necessary to carrying out its mission in light of climate change impacts.

Vulnerability 1: Climate change impacts NASS's ability to gather survey information

NASS Strategic Goal #1, transforming the NASS workforce, is essential to adapting to climate change. NASS relies on a decentralized data collection structure with mail, web, telephone, and in-person data collection capabilities. More than 2,700 telephone and field enumerators make up the NASS data collection workforce employed in partnership with the National Association of State Departments of Agriculture (NASDA). Extreme weather and other climate events will disrupt standard respondent contact processes and protocols, especially face-to-face enumeration.

Response to Vulnerability 1: Further modernization of NASS data collection methods, strategies, and tools

As seen with the COVID pandemic, NASS actions, in response to climate-related disruptions to its workforce, would include further decentralization of its data collection team and dynamic support strategies to ensure their success. In addition, increased reliance on machine editing, transition from print documents to digital imagery, and fuller use of new web portal tools will further reduce more labor-intensive clerical processes as previously conducted in a typical office setting.

Vulnerability 2: Climate change impacts the effectiveness of NASS stakeholder engagement and its data portfolio

Objectives under NASS Strategic Goal #2 seek to increase the effectiveness of stakeholder engagement, raising awareness and use of NASS products and services; incorporate new data sources and data collection techniques to reduce respondent burden; and increase sample representation while maintaining confidentiality and privacy. As seen with COVID, disruptions to normal levels and modes of interaction with stakeholders increases the importance of relationships with its data users and customers.

Response to Vulnerability 2: Characterizing on-farm adaptation strategies and practices

NASS, as a routine business practice, evaluates the size, scope, and burden of its survey portfolio and how well that addresses data needs on agriculture. Climate change impacts will vary widely across the many types of farms and ranches in the United States. Vulnerability assessments, in which NASS data may play a key role, will help identify the why, where, when, and which agricultural resources are most at risk. Analyses informed by NASS data will help the agricultural sector understand climate exposure and sensitivity to change.

NASS is well positioned to begin serving climate-related data, analyses, and adaptation needs that are specific, spatially, and temporally situated. Agencies with new data requirements would need additional resources to collaborate through NASS. New methods and tools may be necessary to support integration of enhanced surveys, non-survey data, and perform more powerful analytical tasks.

DATA NEEDS IDENTIFIED IN PLANNING PROCESS

This next section describes new data needs where updating NASS goals and programs and filling data gaps would better inform climate adaptation strategies and actions across the sector. This role is central to NASS's mission to provide timely, accurate, and useful statistics in service to U.S. agriculture. As part of its own climate adaptation planning, NASS invited other USDA agencies to identify their climate data needs as a first step in understanding the climate data gaps. A description of those gaps follows below.

USDA Climate Hubs

- New Data Need – Renewable Energy On-Farm Capacity information on rates of adoption of practices and other innovations designed to advance sustainability in agriculture
 - Climate Hubs would like to know more about adoption rates for grass-fed/finished beef, and precision ranching technologies. The capacity to develop trustworthy models will depend in part on reliable data about rates of adoption.

Economic Research Service (ERS)

- New Data Need – Renewable Energy On-Farm Capacity for manure management practices in place, if no-farm crop application of manure exists, and if off-farm exporting of manure exists
 - The amount of manure produced, use of digester technology, amount of on-farm crop application of manure, amount of off-farm exporting of manure
 - Importing of manure for crop nutrient management
 - Further breakouts of the “other cattle” inventory to capture inventories such as veal cattle, beef and dairy calves, heifers, stockers, and beef breeding herds

Animal Plant Health Inspection Service (APHIS) Plant Protection and Quarantine

- Census of Agriculture – crop production data to support risk analysis
 - Specialty crop summaries, e.g., Citrus Fruits Summary
 - Agricultural economic data
 - New Data Need – Anticipated changes in crop production locations due to climate change could be useful
- Usual planting and harvesting dates
 - Specialty agriculture data, e.g., floriculture and honeybees
 - New Data Need – the ability to map NASS county level data by matching NASS Quick Stat American National Standards Institute codes with Economic Research Service (ERS)

county data tables would be nice. APHIS have manually created the 5-digit code using the State and County ANSI fields in the NASS quick Stat outputs to do this.

Vulnerability 3: Climate change will impact the pace of modernization necessary for NASS to meet its organizational excellence goals

Objectives under NASS Strategic Goal #3, Organizational Excellence, speak to the agency's need to modernize business processes to produce quality data and products at a faster rate, enforce enterprise-level strategic processes and tools to guide data-driven decision-making, and to manage risk using proven internal controls for processes and systems. Legacy systems and tools are more likely to fail under the increased organizational demands under climate change.

Response to Vulnerability 3: Further modernization of NASS data collection methods, strategies, and tools

NASS operational resilience during the COVID epidemic was achieved through innovation and leveraging internal expertise to devise effective, adaptive solutions. Further, ongoing decentralization of the workforce places new emphasis on all the attributes of organizational excellence under differing climate change scenarios.

NASS CONSIDERATIONS OF DEPARTMENT-LEVEL VULNERABILITIES FROM CLIMATE CHANGE

In addition to assessing threats to its own mission, goals, and objectives, NASS also considered its role in responding to several Department-level vulnerabilities identified in the USDA Action Plan for Climate Adaptation and Resilience (2021).

DECREASED AGRICULTURAL PRODUCTIVITY

NASS reports on agricultural productivity, released on a scheduled basis, are derived from hundreds of ongoing surveys and censuses. Timelier, more granular, and spatially based measures of agricultural productivity, while limiting burden on agricultural producers, is an ongoing part of the NASS mission. Among NASS data products are several spatially based, remote sensing assessments of crop condition, soil moisture, and land use on a variety of geospatial and temporal bases (on-demand, daily, weekly, or periodic). The strategies below align with NASS strategic goals.

- Develop new data products that leverage existing survey as well as non-survey sources of data.
- Expand remote sensing products that relate to the cropland data layer (CDL), especially those that characterize land use and productivity over time.¹

¹ NASS is collaborating with the Economic Research to release a new cropland data layer (CDL) derivative in summer 2022 that characterizes land use patterns over time.

THREATS TO WATER QUANTITY AND QUALITY

Through collaborative agreements and partnerships with other agencies in the Department, NASS provides ongoing support in the form of annual, periodic, and topical datasets which are used in complex program and policy analyses on the environment and farm economy. These strategies, below, support NASS's ongoing ability to partner on products that cover water quantity and quality, while minimizing burden to producers.

- Prioritize data needs and new product opportunities from using multiple sources of data tied to NASS frames, census and survey data, administrative records, and economic, environmental, and remotely sensed data.
- Strengthen and expand collaborations on new sources of non-survey data with other USDA agencies, federal agencies, and through public-private partnerships.
- Identify new analyses, products, and reports from multiple sources of data, when taken together with the NASS data portfolio, would provide fresh insights on water quantity and quality.

DISPROPORTIONATE IMPACTS ON VULNERABLE COMMUNITIES

The Census of Agriculture (COA) is designed to query every farm across the diversity of U.S. agriculture twice a decade. Data collection for the 2022 COA begins later this year and continues into 2023. Many agricultural operations represented on NASS's list frame master participate in farm programs. In addition, remote sensing data provides new opportunities to study land use's relationship to productivity and the farm economy over time. Engaging stakeholders through the methods below will help identify new reports that help characterize vulnerable communities more fully.

- Use existing stakeholder outreach mechanisms to identify potential new reports and analyses.
- Identify existing data collections and other sources that could meet those analysis needs.

SHOCKS DUE TO EXTREME CLIMATE EVENTS; STRESS ON PUBLIC LANDS AND INFRASTRUCTURE

In the USDA-level vulnerability assessment, NASS identified areas that would benefit from increased use of satellite data for disaster assessments. NASS's research program utilizes satellite, NASS census and surveys, and other data to characterize the impact of extreme weather events and related disasters. This is a small program that provides ad hoc analysis, and after review, posts that analysis for public use. New satellite data and computing capacities are enabling fuller assessments of disaster impacts over wider areas. As well, broader measures of climate impacts on yields, shifting growing seasons, and crop failure and damage are now possible by combining a wider variety of data types and sources.

One impetus for using more non-survey data is to manage the burden on respondents from a survey-only approach for climate change data needs. New non-survey data sources being used in NASS programs include administrative records, and remote sensing, environmental, and economic data. Climate impacts can be studied on smaller areas, more broadly across regions, and over longer periods of time. When data are combined on a spatial-temporal basis, choices in land use can be measured against changes in soil quality, soil moisture, and other environmental attributes that interact with productivity. A modern data program, however, requires new staff skills, different tools, and modern IT and other infrastructure to transition from promising demonstrations, pilots, and research to a production scale that is secure, sustainable, and stable.

These two steps below improve NASS's ability to respond with authoritative data in a timely, specific manner to an increasing number and variety of extreme climate events.

- Assess and fill staff and resource needs to address the rising number and variety of climate events.
- Develop a climate data portfolio, vet with stakeholders, and raise its visibility.

NASS MISSION VULNERABILITIES

Finally, the NASS team charged with developing this Adaptation Plan, representing all divisions in the organization and the full range of responsibilities, considered how the agency's vulnerabilities related to the Department's. The team identified five vulnerabilities that could impact the NASS mission, or its programs, operations, and stakeholders. These steps would mitigate these vulnerabilities.

1. Achieving a higher level of agility in deploying an effective mix of modes/methods of data collection within budgeted costs
2. Ensuring high reliability IT infrastructure, tools, and processes
3. Minimizing dependence on external services and supply chains
4. Adopting modern management strategies to continue to meet rigid production schedules for products and services
5. Reducing reliance on brick & mortar facilities to secure confidential and/or market sensitive data

Identifying methods and measures to address these vulnerabilities will increase mission resilience and abilities to serve Department and external partner data needs. When incorporated into NASS's continuity of operations planning at the Regional Office and Headquarters levels, these actions would help maintain the NASS mission of providing uninterrupted timely, accurate, and useful statistics in service to U.S. agriculture.

IMPROVING ACCESS TO DATA AND TOOLS FOR AGRICULTURAL PRODUCERS

NASS Strategic Initiative 1

Efforts to improve the NASS survey respondent/customer experience are well underway. This includes the February 3, 2022, launch of the Respondent Portal, which modernizes respondent access to survey requests and their ability to interact with and use their own data, NASS data products, and services [[Home | NASS \(usda.gov\)](https://home.nass.usda.gov)]. Operation-specific data previously reported to NASS and other USDA agencies are accessible in one portal via eAuth.

The image shows the USDA National Agricultural Statistics Service Respondent Portal. The page features a header with the USDA logo, navigation links (Home, My Surveys, Resources, Reports), and a Sign In/Sign Up button. The main content area includes a welcome message, a survey completion section, a help section, a NASS Reports section, a data visualization section, and a social media section. Red boxes and arrows highlight specific features: a survey completion form, a help section with a phone number, a NASS Reports section, an interactive map, and an eAuth section.

Complete a survey

Get help with a survey

Look up NASS reports

Interact with data near you

Figure: NASS Respondent Portal (Web-based)

Section 4: Agency Climate Adaptation Actions

NASS ADAPTION TO CLIMATE VULNERABILITIES

Adaptation to changes is both a strength and challenge for NASS due to the uniqueness of our efforts and responsibilities in service for and to U.S. Agriculture. Our responsiveness to the public and industry's data needs are routinely implemented when possible. Additionally, NASS frequently modifies programs in response to updated Congressional regulations, priorities, and Departmental guidance. The culture that NASS embodies and the authorities and regulations under which we adhere to in collecting and safeguarding the privacy and confidentiality of respondent and producer data are fundamental to the principals and practices of a federal statistical agency.

Our priorities are to publish essential reports of unbiased and official statistics on U.S. agriculture in a timely fashion, despite any challenges that may arise, which may include natural disasters, wildfires, lapse in funding, or any other difficulties that could affect the data collection, analysis, publication, and/or accuracy of data on a schedule established a year in advance.

In the production of official statistics, NASS also monitors local and/or national news sources, producer comments, and information from "boots on the ground" enumerators to ensure we obtain the most accurate, current, and up-to-date information to augment the accuracy of official estimates, reports, products, and publications. We take particular care to update both the crop and livestock estimates based on in-season environmental impacts. Many times, revisions due to these impacts are published in the next scheduled publication to ensure that the most current agricultural estimates are readily and consistently available. An example of NASS's responsiveness to natural disasters can be reflected in updates to estimates based on a mid-month fire that destroyed a statistically significant area of a cropland. In support of revisions, NASS studies impacted acres through ground reports and disaster assessments based on remote sensing and reviews administrative data. Revisions are published showing updated acreage and production values in the next monthly report.

In 2012, NASS underwent a reorganization that centralized several data collection processes and procedures, resulting in increased operational efficiency and a cost savings to the Agency. Operating in this manner enables NASS to quickly adapt to changes and continue operations should a natural disaster occur. The diversity in geography and experiences of our staff and NASDA enumerators is a strong asset to the Agency in navigating these special circumstances. NASS prioritizes maintaining the safety of staff while remaining operational in the face of floods, tornados, hurricanes, blizzards, fires, and other extreme weather events.

Remaining operationally resilient ensures that NASS can continue to collect, process, analyze, and publish official estimates for principal economic indicators on the agricultural economy as prescribed by law. This requires that our computer equipment (i.e., servers, iPads, computer) and systems are operating at an optimal level at all times. Additional investments and resources are necessary to prioritize operational resilience in the face of climate change and the growing number, variety, and cadence of data needs.

ACTIONS TO ENSURE CLIMATE-READY SITES AND FACILITIES

Climate resiliency is integral to ensuring the operational continuity of NASS programs. In preparation for severe weather impacts on buildings, infrastructure, operations, and mission-critical activities, NASS has established an emergency response team at each of its facilities that follows a Continuation of Operations Plan (COOP). The team plans and tests readiness on a yearly basis. COOP exercises include a climate

event scenario that disrupts critical NASS activities. NASS's physical infrastructure includes regional offices and a national operations center in leased spaces managed by the U.S. General Services Administration (GSA). NASS follows GSA's recommendations for our facilities on climate resilience.

GSA follows the *Facilities Standards for the Public Buildings Service, PBS-P100*, which describes design standards and criteria for climate-ready sites and facilities. Studies during the project formulation phase include identifying and developing adaptations to climate risk factors. NASS will work with GSA to improve processes that protect vulnerable, mission-critical sites, develop portfolio-wide data to better understand climate sensitivity and exposure to flooding risks, and continue piloting occupancy sensors to improve safety from climate-driven hazards. NASS will work with GSA to accomplish the following:

- Strategically relocate mechanical equipment, IT infrastructure, and other mission-critical equipment that could be disrupted by heavy wind, rain, floods, or fires.
- Review site drainage and landscaping to prevent flooding issues from intense storms.
- Commission new buildings and review existing buildings envelope systems for compliance with updated codes on water and wind resistance.
- Develop resiliency strategies for water reuse and reduction in drought-prone areas.
- Consider creating "clear zones" around facilities in areas with wildfire risks.
- Assess and address employee thermal comfort during extreme temperature shifts through design, while also addressing additional burdens on energy and water use during peak utility-use periods.
- Harness the power of procurement to ensure that the mechanical and operational equipment for its facilities, as well as materials, furnishings, and fixtures, are resilient to and adapt against the impacts of climate change (*e.g.*, windows, roofing, and cladding materials used in coastal areas will be both energy efficient and able to withstand high-level hurricane winds and floods).

USDA plans to develop a Departmental Manual to guide staff to align sustainable and resilient facility operations with the USDA *Departmental Regulations on Climate Change Adaptation and Sustainable Operations*. NASS will follow the guidelines set forth in that manual.

ENSURING CLIMATE-READY SUPPLY OF PRODUCTS & SERVICES

In addition to ensuring NASS's ability to carry out its mission should a climate-driven event impact its facilities, NASS has also been tested many times in delivering its products and services after major climate events that impact the data. For example, NASS has conducted re-interviews of the damaged population from the quarterly Acreage, Production, and Stocks Survey to validate previous published reports. A special section of the following month's Crops Production report summarizes the findings of the Re-Interview survey. NASS will continue to adapt to climate events by accounting for damages to agricultural production of many commodities.

Not only is NASS striving to provide up-to-date data that has been impacted by climate-related events, but it also conducts several surveys that serve climate data needs. The following table lists ten surveys and programs with a climate-nexus that can be used to identify agricultural trends and emerging actions that the farming community is undertaking to support U.S. agricultural production.

- Agricultural Resource Management Survey (ARMS)
- Agroforestry Survey (2022)
- Census of Agriculture
- National Resource Inventory - Conservation Effects Assessment Project (NRI - CEAP)

- Conservation Practices Adoption and Motivation Survey (2022 CPAMS)
- Crop-CASMA (online remote sensing data product)
- Cropland Data Layer
- Survey of Irrigation Organizations
- Irrigation and Water Management Survey
- Impacts of Agricultural Disasters

Table 1: NASS adaptation actions to address climate change effects and vulnerabilities

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Timeframe	Coordination	Progress Metrics	Accomplishments to Date
ARMS aligns with Identified Climate Vulnerabilities	Agricultural Resource Management Survey (ARMS) is the U.S. Department of Agriculture's primary source of information on the production practices, chemical use, fertilizer use, pesticide use, other resource use, and economic well-being of America's farms and ranches.	Data Collection, Data Analysis, Data Summary and Data Lab work	NASS	June - April	ERS	NASS Survey Dashboard	The results of this survey are the only source of information available for objective evaluation of many critical issues related to agriculture and the rural economy.
The Agroforestry Survey aligns with Identified Climate Vulnerabilities	United States Department of Agriculture's National Agroforestry Center (USDA-NAC) is "to advance the health, diversity, and productivity of working lands, waters, and communities through agroforestry.	Data Collection, Data Analysis, Data Summary and Data Lab work	NASS	Every 5-years	Forest Service Agroforestry Center	NASS Survey Dashboard and Forest Service will publish summary statistics available at the national and state level	Data Collection completed April 2022 and Forest Service Data Lab works begins soon
The Census of Agriculture aligns with Identified Climate Vulnerabilities	The Census of Agriculture is a complete count of U.S. farms and ranches and the people who operate them. Even small plots of land - whether rural or urban - growing fruit, vegetables or some food animals count if \$1,000 or more of such products were raised and sold, or normally would have been sold, during the Census year.	The Census of Agriculture, taken only once every five years, looks at land use and ownership, producer characteristics, production practices, income, and expenditures. For America's farmers and ranchers, the Census of Agriculture is their voice, their future, and their opportunity.	NASS	Every 5 years	All USDA Agencies and the US Public	NASS Survey Dashboard	Currently identifying and building the Census Mail List preparing for the December 2022 mail out
The Conservation Practices Adoptions Motivation Survey aligns with Identified Climate Vulnerabilities	The 2022 Conservation Practice Adoption Motivations Survey (CPAMS) collects data on conservation practices in the United States. The resulting State/Regional-level data will be used by the National Resource Conservation Service (NRCS) to educate producers in NRCS programs about conservation practices and to promote adoption of those practices.	The goal is to ascertain farmers' and ranchers' behaviors, as well as reasons for those behaviors, associated with adoption of conservation practices on cropland, grazing land, forest land and concentrated livestock feeding operations. In addition, the NRCS will use the data for a variety of policy analyses.	NASS	Annual, 2022 CPAMS for Cropland and Livestock, 2024 CPAMS for Grazing Land and Forestry	NRCS	NASS Survey Dashboard	Two Versions of CPAMS (Crop and Livestock) will be mailed out May 2022

Table 1: NASS adaptation actions to address climate change effects and vulnerabilities (Continued)

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Timeframe	Coordination	Progress Metrics	Accomplishments to Date
Survey of Irrigation Organizations aligns with Identified Climate Vulnerabilities	The survey provides a national representative assessment of irrigation water-delivery entities and groundwater management of districts serving the U.S. irrigated sector.	The dataset includes information on organization structure, irrigation infrastructure, system management practices, and water use by source. The special emphasis is on institutional measures and conservation initiatives that enhance drought resilience and long-term water supply management practices.	NASS	Not Defined	NRCS	Summary statistics available at national and state levels.	USDA - National Agricultural Statistics Service - Surveys - Irrigation Organizations
Irrigation and Water Management Survey aligns with Identified Climate Vulnerabilities	The NASS Irrigation and Survey (IWMS), last conducted in 2018, was sent to producers who indicated in the 2017 Census of Agriculture that they had irrigated sometime during the past five years. It is the successor to the Farm and Ranch Irrigation Survey Water Management.	Data Collection, Data Analysis, and Data Summary that provides statistical estimates on many aspects of irrigation of agricultural land and operations who irrigate.	NASS	Every 5 years	Summary statistics available at national and state levels	NA	NA
Impacts to agricultural productivity, drought, extreme weather events, etc.	Crop-CASMA (Crop Condition Soil Moisture Analytics) provides soil moisture measurements from NASA Soil Moisture Active Passive mission and vegetation condition measurements from the NASA MODIS (Moderate Resolution Images Spectroradiometer) sensor on a weekly cadence Monday - Sunday. Crop-CASMA provides both top and sub-soil volumetric, categorical and anomaly measurements that inform on water surplus or shortage issues.	Impacts of Agricultural Disasters	NASS	After each disaster (This program began in 2017 for agricultural flood monitoring from Hurricane Harvey and proved to be accurate, affordable, and efficient for operational use. This provides decision makers with an accurate and timely assessment of disasters on agricultural lands)	NASA	NA	https://modis.gsfc.nasa.gov/

Section 5: Enhancement of Workforce Climate Literacy

Climate science is a rapidly changing and challenging topic as new studies are released and more people become familiar with the science.

Action: NASS will build staff climate literacy through formal and informal training opportunities.

As climate literacy improves in the agency, staff can incorporate climate science into the decision-making process of daily operations and climate adaptation activities. NASS will research, develop, and implement a learning agenda for all staff with the goal of developing broad general knowledge of climate science. Current training assets such as AgLearn do not have climate science courses, but NASS will leverage available external resources to develop the initial curriculum for staff. Webinars, videos, and presentations from many experts are readily available. The USDA Office of the Chief Economist is building a webinar series that can be used as a foundation to build climate literacy for NASS staff.

Action: NASS will competently demonstrate how its data programs inform and support adaptation.

NASS will conduct more outreach to external groups to not only improve its understanding of climate science but to share with these same groups how NASS data can support climate adaptation initiatives. From this outreach, NASS can gather feedback to improve its current operational response and climate data programs, as well as to support other adaptation efforts. As resources permit, the NASS training plan will include internal training and external partnerships to achieve climate literacy goals.

Internal Curriculum, NASS

1. Course: Climate Science, Adaptation, and NASS
 - a. Format: instructor-led or self-paced online course
 - b. Learning objectives: knowledge and skills needed to develop mission resilience to climate impacts, responsive stature to data needs for adaptation assessments and actions, and responsible reporting strategies to the public on climate and agriculture.
 - c. Suggested content: introduction to adaptation, scenario planning, and facilities management.
2. Informal Training and Information Exchange: identify channels that provide continued learning and discussion opportunities on climate adaptation, e.g., seminars, AgLearn courses (currently not available); newsletters, and webinars. Below are readily available resources for NASS staff to begin to build climate literacy.
 - a. USDA Office of the Chief Economist Climate Change Office
 - i. [Climate Change | USDA](#)
 - ii. [Climate Change Science Seminar Series | USDA](#)
 - b. USDA Economic Research Service Climate Change Resources
 - i. [USDA ERS - Climate Change](#)
 - c. USDA Agricultural Research Service Climate Change Impacts Report
 - i. [Optimizing Agricultural Management to Mitigate Climate Change Impacts: USDA ARS](#)

External Partnerships:

1. NASS will conduct outreach with external groups.
 - d. Targeted groups: USDA partner agencies, non-USDA federal agencies; universities; and non-profit organizations.
 - e. Objectives: to further develop, expand, and share training to achieve mission resilience.

2. NASS will assess perceptions about the following:
 - a. Likelihood and severity of climate events that impact NASS mission, programs, operations, and stakeholders.
 - b. Areas of vulnerability and priorities for adaptation actions; and
 - c. Stakeholder expectations and data needs given increasing, disruptive weather events.

Section 6: Environmental Justice

The Justice40 Initiative was established by Executive Order 14008, which states that “40 percent of all overall benefits” of federal investments from covered programs should flow to underserved communities. To respond to this directive, each agency should establish a methodology for calculating the benefits that:

- a) Flow from each applicable covered program, and
- b) Accrue in underserved communities from each covered program.

When determining the benefits of a covered program, as specified in section IV(A) of this Executive Order, agencies are to consult with stakeholders, including state, local, and Tribal governments, as well as Native communities, to ensure public participation and that community stakeholders are meaningfully involved in what constitutes the “benefits” of a program. In addition, if the calculation of a benefit to a disadvantaged community includes investments outside of that community, the disadvantaged community is to be consulted. In engaging with stakeholders, agencies are to consider their obligation under Title VI of the Civil Rights Act of 1964 to ensure meaningful access for individuals with Limited English Proficiency (LEP), as well as their obligation pursuant to Section 504 of the Rehabilitation Act to take appropriate steps to ensure effective communication for individuals with disabilities. Where applicable, agencies are to also comply with the Paperwork Reduction Act, Federal Advisory Committee Act, or other relevant law, regulation, or guidance. Agencies are to review and incorporate, where appropriate, recommendations from the White House Environmental Justice Advisory Council (WHEJAC) and the IAC when developing metrics. (Examples of Stakeholder Engagement Plans will be available to agencies on the MAX Justice40 page.)

Forthcoming guidance will provide additional information on the tool agencies should use to report the above information discussed in sections IV and V, and specific instructions for submitting the data into that tool. The Administration’s overall progress towards the Justice40 Initiative’s goal will be tracked by the categories of covered projects (climate change, clean energy and energy efficiency, clean transportation, affordable and sustainable housing, training and workforce development, the remediation and reduction of legacy pollution, and the development of critical clean water infrastructure). NASS is prepared to play an important role in the Justice 40 Initiative as USDA receives this guidance.

To ensure the unique vulnerabilities of these communities are visible in the data, NASS can work with partners across government and stakeholders to bring new data to bear on them. Results of the 2022 Census of Agriculture (COA) can be combined with non-NASS data to provide a fuller understanding of the vulnerabilities, then aggregated in manner that protects privacy and ensures confidentiality of respondents. This approach would provide a stronger framework to study the interaction of contributing factors.

NASS will identify strategies to develop informative reports on vulnerabilities in Justice40 communities through the following steps:

- Use existing stakeholder outreach mechanisms to identify potential new reports and analyses.
- Identify existing data collections and non-survey data that could meet those analysis needs.
- Conduct outreach specific to stakeholders and researchers in this area and identify analyses and reports that would be responsive.

Section 7: USDA Climate Hubs

USDA's Climate Hubs are a unique collaboration across the Department's agencies. They are hosted by the [Agricultural Research Service](#) and [Forest Service](#) at ten regional locations, with contributions from many agencies, including the [Natural Resources Conservation Service](#), [Farm Service Agency](#), [Animal and Plant Health Inspection Service](#), and the [Risk Management Agency](#). The Climate Hubs link USDA research and program agencies in their regional delivery of timely and authoritative tools and information to agricultural producers and professionals.

The NASS web portal, CropCASMA (Crop – Crop Condition and Soil Moisture Analytics), serves daily and weekly soil moisture and vegetative condition information. A recent enhancement to CropCASMA is the addition of the ten Climate Hub regional boundaries as new areas of interest for analysis. This Climate Hub specific enhancement provide users with the ability to quantify assessments for early identification of climate induced anomalies or monitor long-term ecological stress events for the ten Climate Hub regions. The Climate Hub boundaries can now be used to calculate soil moisture or vegetation condition statistics, create maps, and download soil moisture and vegetation condition data for the specific Climate Hub regions.

Section 8: Conclusion

The Climate Adaptation and Resilience Plan provides a pathway for NASS to adapt to current and projected impacts of climate change, while also leveraging the co-benefits of partnering with other USDA partners. The actions identified in this plan will assist NASS in better understanding current and future risks and in assisting the Department with fulfilling the climate change mission and operations. These actions will also help to characterize areas of the USDA climate vulnerabilities where NASS can be of service, as well as inform the development of the climate science and resilience tools needed to adapt and respond to climate hazards. By assessing vulnerabilities, developing adaptation tools, and institutionalizing climate requirements and literacy throughout the workforce ensures NASS is adapting and becoming resilient to climate change. This plan will provide guidance for NASS to improve the current COOP mission plans and improve tools to deploy climate resilient technologies and practices throughout its complex methods of sampling, frame maintenance, data collection, data analysis, and data dissemination during future climate change events.

Section 9: References and Resources

[USDA NASS - Research and Science: Disaster Analysis](#)

[Climate Change 101: The Foundational Science](#)

[USDA Climate, Agriculture, and Forestry Seminar Series](#)

[Home | National Climate Assessment](#)

[USDA - National Agricultural Statistics Service - Research and Science - Disaster Analysis](#)

[Memorandum - Guidance for Providing and Using Administrative Data for Statistical Purposes](#)

Foden, W. B., Young, H. R. Akcakava, R. A. Garcia, A. A. Hoffman, B. A. Stein, C. D. Thomas, C. J. Wheatley, D. Bickford, J. A. Carr, and D. G. Hole. 2019. Climate change vulnerability assessment of species, Wiley Interdisciplinary Reviews: *Climate Change*, 10:e551

[Vulnerability Assessment | USDA Climate Hubs](#)

Workforce Climate Change Literacy: Needs Assessment and Strategy

U.S. Department of Agriculture. (2021). [U.S. Department of Agriculture 2021 Climate Adaptation Plan](#). Washington, DC.

U.S. Department of Agriculture. (2014). [USDA Climate Change Adaptation Plan](#). Washington, DC.

U.S. General Services Administration. (2021). [P100 Facilities Standards for the Public Buildings Service](#), Washington, DC.





Agricultural Marketing Service
U.S. DEPARTMENT OF AGRICULTURE



CLIMATE CHANGE ADAPTATION PLAN

AGRICULTURAL MARKETING SERVICE

JUNE 2022



INTRODUCTION

The Agricultural Marketing Service (AMS) facilitates the fair and efficient marketing of U.S. agricultural products, including food, fiber, and specialty crops. AMS administers programs that create domestic and international marketing opportunities. AMS also provides the agriculture industry with valuable services to ensure the quality and availability of wholesome food for consumers around the world. Over 4,000 AMS professionals support the country's diverse agricultural operations, which range from individual farmers to international businesses. These operations employ 1 in 12 people in the United States. AMS also administers millions of dollars in annual grant investments, creating opportunities by supporting economic development in small towns and rural communities.

Much of the Agency's support for agriculture is provided through commodity-specific efforts, such as our Dairy; Specialty Crops; Livestock and Poultry; and Cotton and Tobacco Programs; and Federal Grain Inspection Service. AMS also oversees the National Organic Program; Science and Technology Program; Transportation and Marketing Program; and the Fair-Trade Practices Program. AMS provides regulatory oversight for over 20 research and promotion programs and enforces other Federal regulations such as the Perishable Agricultural Commodities Act (PACA), the United Grain Standards Act (USGSA), the Agricultural Marketing Act (AMA), and the Seed Act. As part of our sector support activities, we administer a suite of services to support U.S. agricultural industries. These include, but are not limited to:

- **Market News:** For over 100 years, AMS has provided free, unbiased price and sales information to assist in the marketing and distribution of farm commodities. Each year, Market News issues thousands of reports, providing the industry with key wholesale, retail, and shipping data. The reports give farmers, producers, and other agricultural businesses the information they need to evaluate market conditions, identify trends, make purchasing decisions, monitor price patterns, evaluate transportation equipment needs and accurately assess movement
- **Quality Grading and Inspection:** AMS works within the commodity sectors to determine and issue USDA quality factors and grades. Often, the grade is used by wholesalers to determine price or meet contract terms. For consumers, these grade marks are sometimes listed on the product (beef, lamb, chicken, turkey, butter, and eggs) and sometimes unlisted (fresh and processed fruits and vegetables). These quality factors and grades are critical to trade and the ease of business transactions. Currently, AMS grades a variety of commodities to include grain, cotton, fresh and processed fruits and vegetables, poultry, eggs, livestock and meat, dairy products, and tobacco.
- **Auditing and Accreditation:** To protect the market value and opportunity for U.S. commodity producers, the certification and quality of products must be trusted both nationally and internationally. AMS is recognized as a competent and reliable provider of these services. AMS uses International Organization for Standardization (ISO), Hazard Analysis and Critical Control Point (HACCP) Principles and Guidelines to ensure fair, thorough, and consistent auditing and accreditation services. Use of these services is voluntary. They are available to U.S. producers and are paid for by user-fees.
- **Fair and Competitive Markets:** Fair and competitive markets are critical to the health of the U.S. agriculture industry and the economy. The health of these systems also contributes to an innovative and resilient marketplace. AMS plays a key role in ensuring legal, competitive, and fair markets to help protect both the producers and consumers from deceptive, unfair, discriminatory, or illegal practices.
- **Market Development:** AMS also builds new and expanded markets by delivering resources through a range of grant programs and by conducting oversight activities that support the National Organic Program and industry-driven commodity marketing programs. In terms of grants, AMS invests heavily in the development of markets through its Farmers Market and Local Food Promotion Program, which funds projects for local and regional food producers and businesses, and Regional Food Systems Partnership Grants, which fund the critical planning and convening functions necessary for a variety of stakeholders and multi-level government actors to coordinate development and enhancement of regional food systems, ensuring more intentional decision-making to benefit producers and contribute to a secure food supply. Additional market development grants to support local and regional food supply chains include the Dairy Business Innovation Initiatives, Meat and Poultry Inspection Readiness Grants, and Specialty Crop Block Grants. In terms of oversight activities, the AMS National Organic Program (NOP) is the federal regulatory program that develops and enforces consistent national standards for organically produced agricultural products sold in the United States, ensuring market integrity. Finally, AMS oversees 22 commodity boards that empower farmers, ranchers, and agricultural businesses to pool their resources and combine efforts to develop new markets, strengthen existing markets, and conduct important research and promotion activities.

BACKGROUND AND SUMMARY

On 27 Jan 2021, President Biden issued Executive Order (EO) 14008, Tackling the Climate Crisis at Home and Abroad. Amongst other requirements, this EO directed the USDA to build robust climate action plans, along with data and information products designed to improve adaptation and increase resilience to the effects of climate change. In response to this EO, USDA implemented Departmental Regulation (DR) 1070-001, USDA Policy Statement on Climate Change Adaptation. The DR created a process around which USDA agencies, including AMS, must create and implement climate adaptation plans. This process included climate change vulnerability assessment with risk identification and mitigation, and metric creation. As part of this, the DR acknowledged the need to complete budgeting analysis to plan and allocate resources to complete the required efforts.

This plan represents the first steps in AMS' process to meet the requirements under the DR. Our plan highlights ongoing and planned AMS initiatives supporting climate change adaptation and resilience, recognizing that climate change will impact all levels of the agriculture and food industry, from farms to consumers.

Disruptions in agriculture include, but are not limited to, high temperatures, droughts and floods, lower crop yields, strain or death of livestock, and increased frequency of extreme events that cause disruption in the supply chain. Although the impact of climate change on agriculture and the supply chain is understood at a high level, as part of adaptation planning and meeting the requirements of both the EO and DR, AMS's plan accounts for specific vulnerabilities and risks for each of its programs. On an ongoing basis, AMS will examine the current and future climate change impacts to our mission, programs, operations, and stakeholders.

OVERVIEW OF CLIMATE CHANGE EFFECTS AND VULNERABILITIES

Given the unique scope of AMS work, the vulnerabilities that directly impact the agency's mission are factors, such as extreme weather, that can prevent us from conducting our services and oversight activities in support of industry. These may impact mobility, facilities, supply chains, or operational safety.

The agricultural sectors that AMS supports may also experience a diverse array of climate change impacts, ranging from widespread production or processing capacity issues to more localized effects on individual facilities. To add to this complexity, certain commodities with more complex supply chains, such as livestock, may be additively impacted by threats (e.g., climate impacts on feed production for the livestock, drought conditions affecting animal health, and processing facility shutdowns due to extreme weather events). Examples of potential or probable climate change impacts include:

- Decreased crop yield
- Increased frequency of extreme events, resulting in flooding and field contamination
- Drought and water scarcity
- Shortened or longer growing seasons
- Pollinator loss
- Increased pests and disease
- Reduced or variable winter chill
- Impact of heat and drought conditions on forage sources
- Heat stress on crops and livestock
- Heat stress on workforce
- Extreme weather impacts on facility operations (e.g., flooding, loss of power, inability of workers to travel to operate plants, etc.)
- Costs associated with necessary adaptation actions

All of these impacts can create volatility in the marketplace, pose supply chain risks, and decrease food and water security. Appropriately planning for climate change adaptation requires planning for significant resource demand across the spectrum and addressing the often-disproportionate impacts on underserved communities.



CLIMATE CHANGE ADAPTATION ACTIONS

OVERVIEW

Adaptation planning is key to food security and the successful support of U.S. agricultural commodities. As AMS delivers on USDA's priorities, we will implement several initiatives that address climate change adaptation to support uninterrupted mission-critical services. To ensure success, AMS is implementing a phased approach that can be revisited on a cyclical basis (i.e., each fiscal year).

The first cycle of this work commenced in FY 2022 and includes:

- **PHASE I:** Identification of climate adaptation risks, opportunities, and on-going initiatives
- **PHASE II:** Ongoing implementation of targeted initiatives with metrics. Metrics are defined on a project-by-project basis, rather than globally itemized in this plan, and, if warranted, each project is scoped in terms of resource allocation and detailed implementation plans.
- **PHASE III:** Examine lessons learned and redesign, as needed. Continue to identify and address emerging adaptation initiatives.



AGENCY INITIATIVES

AWARENESS AND EDUCATION

- **Vulnerability:** The threats posed by climate change are not necessarily well understood across our workforce, which can result in a lack of preparedness in areas at risk for severe weather and difficulty responding to customer service needs during extreme events.
- **Action:** To build knowledge across our team, AMS will institute an employee awareness and education campaign. To achieve this, we will utilize existing USDA climate change training resources to improve awareness and education regarding the impacts of climate change on our operations, sectors, and stakeholders. This will be a critical step in helping us understand and assess our vulnerabilities. As we improve our knowledge of the issue, we may see additional risks and vulnerabilities in our systems and can prepare our adaptation actions accordingly.
- **Status:** Planned
- **Implementation Plan:** AMS will utilize existing programs and independent events to raise employee awareness of the risks posed by climate change and how they can be prepared to respond if impacted by its effects.

CONTINGENCY OPERATIONS PLANNING

- **Vulnerability:** Increased frequency of extreme events (hurricanes, derechos, etc.) or long-term impacts (such as changes in flood plains) could severely impact our operational and support capability in the field. These events could compromise the structures in which we work and/or put the safety of our personnel at risk. The complexity of this issue is increased by the fact that many of the facilities in which we operate are not owned by us (i.e., providing grading services in poultry plant). To ensure successful operations in the event of climate change impacts, we must highlight the risks within each of the areas in which we operate and build robust contingency operation (ConOps) plans to ensure we are prepared.
- **Action:** Review existing plans and/or assess need for new ConOps plans, to ensure all climate change-related vulnerabilities are assessed and incorporated. This action will be done in consultation with industry to jointly determine contingency plans that allow AMS to continue service delivery to our customers and/or to grant flexibilities during extreme weather events and other disasters. Areas of specific consideration, as needed, should include, but is not limited to:
 - Specific risk assessment (location and mission based geared toward contingency activities)
 - Scenario planning for different types of disasters
 - Ingress and Egress Routes
 - Personnel safety
 - Temporary housing for personnel
 - Access to food
 - Access to fuel
 - Access to internet and computers
 - Creation of information tools for personnel
 - Waiver planning, clearance, and implementation
 - Key resource list
 - Return to Work Planning
 - Facility damage assessment
 - Safety assessment (electricity, air quality, etc.)
- **Status:** Planned
- **Implementation Plan:** AMS will address these considerations in its next round of Continuity of Operations (COOP) planning, which is done on an annual cycle.

INDUSTRY SUPPORT (MARKETING)

- **Vulnerability:** Part of the agency's day-to-day mission is to provide support to industry. Some of this takes the form of inspection and process verification, whereas others support marketing approaches. AMS programs often work with different commodity boards and industry groups from a variety of sectors of U.S. agriculture. These stakeholders utilize AMS to review marketing materials that reference climate change (i.e., commodity boards) and to conduct process verification for new sustainability or climate related activities (e.g., process verified programs). To ensure consistency and clarity of information in the marketplace, the content of these materials and processes should be vetted and aligned with the most up to date USDA climate science and policy. In addition, there are opportunities for USDA to collaborate with the commodity boards on industry-driven research that supports the growth of climate smart practices and products in agriculture. By engaging in strategic partnerships (e.g., pairing boards with USDA's scientific community), we could additionally leverage and build out the climate-related research pursued by industry boards and amplify that work for broader reach and impacts across commodity areas.
- **Action:** Institute a process by which AMS engages Department-level climate experts to aid in review of climate related standards and marketing programs.
- **Action:** Encourage commodity boards to invest in climate adaptation and mitigation research.
- **Status:** In Process
- **Implementation Plan:** These efforts will be managed by the AMS commodity programs, as needed.

INDUSTRY SUPPORT (RESOURCES)

- **Vulnerability:** As industry works towards climate adaptation, they may define more specific resource needs from AMS than the marketing support listed above. To this end, industry may approach AMS through a variety of avenues, to include pursuit of grants to achieve their emerging climate change goals. For example, like many commodity sectors, specialty crops producers face a variety of climate change impacts, dependent on what the commodity is and where they produce it. Climate change impacts like, drought, increased pests, increased diseases, and floods are only part of the many climate change effects that these producers will encounter.
- **Action:** AMS will facilitate and promote opportunities to access USDA grants, programming, and climate change information to ensure stakeholders have access to resources to conduct and communicate climate change initiatives. To start, AMS has been encouraging investments through USDA's Specialty Crop Block Grant Program (SCBGP) toward projects that address climate adaptation and mitigation research and practices that will enhance the competitiveness of U.S. or U.S. territory-grown specialty crops.
- **Status:** In Progress
- **Implementation Plan:** These efforts will be implemented by AMS commodity and grant programs, and is part of the USDA Agri-Food Supply Chain Assessment: Program and Policy Options for Strengthening Resilience.

INDUSTRY SUPPORT (MARKET NEWS)

- **Vulnerability:** One of the largest risks the impacts of climate change pose is market instability. Extreme events, supply chain challenges, and long-term yield and quality issues within the commodity sectors mean that periods of instability are likely to increase. AMS plays a critical role in informing and supporting U.S. commodity markets through its market news functions.
- **Action:** Ensure consistent and continued report issuance, covering key wholesale, retail, and shipping information. This information is critical to maintaining a healthy market and supply chain for U.S. commodities, making the system much more resilient to the market impacts of climate change.
- **Status:** Ongoing
- **Implementation Plan:** This is part of AMS's core mission.

USDA PARTNERSHIP FOR CLIMATE-SMART COMMODITIES SUPPORT

- **Vulnerability:** The USDA Partnership for Climate-Smart Commodities initiative is a massive effort which will require a range of personnel resources and expertise. The Farm Production and Conservation (FPAC) team has already expressed the need for support to AMS, which has a primary function within its scope of grant review and approval.
- **Action:** AMS stands ready to support FPAC on their climate-smart ag work by providing marketing and grant expertise during proposal reviews and project implementation.
- **Status:** Planned
- **Implementation Plan:** These efforts will be managed by AMS commodity and grant programs, as needed.

SUPPLY CHAIN DISRUPTIONS (TRANSPORTATION)

- **Vulnerability:** Climate related vulnerabilities affect all transportation modes, creating bottlenecks in agricultural supply and distribution, and reducing the system's resiliency. Collaborative efforts to identify and build research and data in ways that can address these vulnerabilities and enact mitigation efforts are key to addressing increased frequency and severity of transportation disruptions.
- **Action:** AMS Transportation Services Division will utilize cooperative agreements to work with partners, identifying climate related disruptions to transportation networks. AMS will also continue to build new data and analytics, including those relevant to climate if/where available, into its AgTransport 3.0 dynamic data platform that stakeholders can use to assess supply chain challenges.
- **Status:** Planned
- **Implementation Plan:** This project is being implemented by the AMS Transportation and Marketing Program and is aligned under the USDA Agri-Food Supply Chain Assessment: Program and Policy Options for Strengthening Resilience.

ORGANIC TRANSITION INITIATIVE

- **Vulnerability:** Many organic production methods make agricultural systems more resilient to the impacts of climate change. However, transitioning to organic production requires technical and financial resources to convert an operation and achieve USDA organic certification.
- **Action:** AMS will facilitate transition to organic, including conservation practices and methods and climate-smart agriculture practices and methods. To achieve this, AMS will implement wrap-around technical assistance, including farmer-to-farmer mentoring and support building organic supply chains (including processing, storage, distribution, and other supply chain needs) in targeted markets through USDA's Organic Transition Initiative.
- **Status:** Planned
- **Implementation Plan:** This project is being implemented by the AMS National Organic Program.

ORGANIC AND CLIMATE-SMART AGRICULTURE

- **Vulnerability:** The marketplace does not fully acknowledge and reward the strong link between organic production and climate-smart agriculture. As such, there exists an opportunity to reinforce and capture the connections between climate-smart agriculture and what many certified organic farmers are already doing. This may help organic farmers better capture other incentives or more clearly align with other programs that reward or compensate farmers for climate-smart programs. It could also help transitioning farmers better understand the broader benefits of organic certification.
- **Action:** AMS will seek input from the National Organic Standards Board (NOSB), a federal advisory committee, on how to reinforce and capture these connections and to investigate how organic farmers can better connect with and capitalize on climate-smart programs, policy, and market infrastructure.
- **Status:** In Progress
- **Implementation Plan:** This project is being implemented by the AMS National Organic Program.

COTTON RISK TRENDING

- **Vulnerability:** Temperature, rainfall, and other impacts of climate change negatively impact both the yield and quality of cotton.
- **Action:** AMS Cotton and Tobacco Program is working with the team from TIBCO to compile a database tracking and trending system. The platform will help identify climate related impacts on crop quality and production, enabling USDA and industry to anticipate and adapt to the impacts of climate change.
- **Status:** Ongoing
- **Implementation Plan:** The project is being implemented by the AMS Cotton and Tobacco Program.



CROSS-CUTTING ADAPTATION ISSUES AND CONSIDERATIONS

- **ENVIRONMENTAL JUSTICE**

Many of our employees live and work in areas that may experience the disproportionate impacts of climate change. For many who live in areas that will be most impacted by the effects of climate change, housing, transportation, food, and internet connectivity can be cut off through extreme events. Acknowledging this and supporting our employees by placing their well-being as a priority is the first step in ensuring we can continue to support industry through these events. To address this, AMS fully supports our employees during contingency operations planning and will improve outcomes through our education and awareness campaign.

- **WORKFORCE CLIMATE LITERACY**

AMS has created an initiative to raise awareness and offer training for both the leadership and their teams in climate change impacts. Details of this effort are addressed above in the awareness initiative.

- **USDA CLIMATE HUBS**

Over the course of the coming year, AMS will assess opportunities in which we can support the Climate Hubs (e.g., ensuring our relevant grant announcements are distributed through the Climate Hubs network). New opportunities will be included in future action plans to support and facilitate climate priorities within USDA.

Table 1 AMS adaptation actions to address climate change effects and vulnerabilities

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Timeframe	AMS External Coordination	Progress Metrics	Accomplishments to Date
Climate Literacy	Awareness and Education of AMS Employees	Ongoing	Office of the Administrator – Training Officer	Ongoing	NA	# of courses or trainings offered; # of employees participated	Ongoing work
Shocks Due to Extreme Climate Events	Contingency Operations Planning; Consult with industry on needed flexibilities	Ongoing	Office of the Administrator – Compliance, Safety, and Security Division	Ongoing	Third-party Facilities with AMS Employees co-located	# of ConOps plans updated	Ongoing work
General (Industry Support)	Institute a process by which AMS engages Department-level climate experts to aid in review of climate related marketing programs.	Ongoing	AMS Grading and Auding Functional Committee	Ongoing	NA	TBD	Established a process for PVPs with OCE's climate experts
General (Industry Support)	Encourage commodity boards to invest in climate adaptation and mitigation research	Ongoing	AMS Research and Promotion Functional Committee	TBD	Engage with subset of commodity boards doing climate related research	TBD	NA
General (Industry Support)	Promote opportunities to access USDA grants, programming, and climate change information and communicate climate change initiatives	Ongoing	Cross-Programmatic (AMS Transportation and Marketing; others)	Ongoing	NA	TBD	Incorporated climate change priority language in grant RFAs where appropriate

General (Industry Support)	Ensure consistent and continued report issuance, covering key wholesale, retail, and shipping information given supply chain impacts of climate	Ongoing	AMS Market News Functional Committee	Ongoing	Industry cooperators	# reports issued and markets covered annually	Ongoing work
General (USDA support)	Support FPAC on their climate-smart ag work by providing marketing and grant expertise during proposal reviews and project implementation	Ongoing	Cross-Programmatic	Ongoing	NA	# of AMS reviewers or consultations provided	Ongoing work
Supply Chain Resilience	Utilize cooperative agreements to work with partners, identifying climate related disruptions to transportation networks	Ongoing	AMS Transportation and Marketing Program	2022-2023	University cooperators	# of agreements and research products produced	Ongoing work
Supply Chain Resilience	Facilitate transition to organic, including conservation practices and methods and climate-smart agriculture practices and methods.	Proposed	AMS National Organic Program	2022-2025	External cooperators; producer groups; certifying agents	# of transitioned operations and new partnerships	NA
Supply Chain Resilience	Seek input from the National Organic Standards Board (NOSB) on how to reinforce and capture connections between organic and climate-smart agriculture and capitalize on climate-smart programs, policy, and market infrastructure.	Ongoing	AMS National Organic Program	Ongoing	National Organic Standards Board	TBD	Ongoing work; Request sent to NOSB in February 2022
Supply Chain Resilience	Cotton Risk Trending to assess impact of climate on cotton quality	Proposed	AMS Cotton and Tobacco Program	Ongoing	Technology partners and cotton industry	TBD	NA



Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE



Climate Change Adaptation Plan

May 2022 to October 2025



Thunderstorm near Cuero, TX on June 3, 2021. USDA Photo by Lance Cheung.

Introduction

The US Department of Agriculture’s (USDA) Animal and Plant Health Inspection Service (APHIS) protects the health of the United States (US) agriculture and natural resources against invasive pests and diseases, regulates genetically engineered crops, administers the Animal Welfare Act, and helps people and wildlife coexist. APHIS also certifies the health of US agricultural exports and resolves phytosanitary and sanitary issues to open, expand, and maintain markets for US plant and animal products.

APHIS recognizes that climate change presents a threat to its ability to fully achieve its mission and advance its strategic goals. APHIS does not anticipate that climate change will require a modification of its regulatory authority. However, climate change will likely require new regulations and policies as well as innovative, non-regulatory approaches to address new or shifting scenarios.

The USDA Action Plan for Climate Adaption and Resilience, published October 2021, provides the framework for the APHIS Climate Change Adaptation Plan, which is a living document that will be regularly updated. The APHIS Climate Change Adaptation Plan describes the Agency’s mission and goals, identifies how climate change may impact those goals, and outlines adaptation and mitigation actions to address these potential effects.

Mission

To safeguard the health, welfare, and value of American agriculture and natural resources.

Driving Forces

Agriculture and the global marketplace continue to evolve, and APHIS must progress and change to keep pace. The driving forces below require that we take a critical look at how we strategically conduct our activities to best meet our mission. While some of these driving forces are predictable and have become established over time, other forces—such as the changing pest and disease landscape—are less predictable and present more uncertainties.

- Delivering Services with a Customer Focus
- Global Demand for US Agricultural Products
- Ensuring Protection is at a Reasonable Cost
- Rapid Advances in Science and Technology
- Changing Pest and Disease Landscape

Strategic Goals and Objectives (FY 2019-23)

To respond to these driving forces, APHIS must be fast and agile to meet the needs of our partners, stakeholders, and customers. APHIS will constantly strive to improve and deliver our services in a way that is less costly, faster, and more effective for American agriculture, farmers and ranchers, and the public. To accomplish the APHIS mission, our goals and objectives are as follows:

Goal 1. Deliver efficient, effective, and responsive programs

Objective 1.1: Improve the customer experience by modernizing information technology infrastructure, facilities, and streamlining the delivery of our services.

Objective 1.2: Maintain a high performing workforce through employee engagement and empowerment and provide a safe workplace.

Objective 1.3: Remove obstacles in APHIS programs by reducing regulatory burden and streamlining processes.

Objective 1.4: Maximize the return on taxpayer investment through stewardship of resources and focused program evaluations.

Objective 1.5: Leverage workforce differences to better serve the Agency’s customers.

Goal 2. Safeguard American agriculture

Objective 2.1: Prevent damaging plant and animal pests and diseases from entering and spreading in the United States to promote plant and animal health.

Objective 2.2: Manage plant and animal pests and diseases once established in the United States to promote plant and animal health.

Objective 2.3: Ensure effective emergency preparedness and response systems.

Objective 2.4: Manage conflicts caused by wildlife, detect and control wildlife diseases, and protect agricultural and natural resources.

Objective 2.5: Ensure the safety, purity, and effectiveness of veterinary biologics and protect plant health by optimizing our oversight of genetically engineered organisms.

Objective 2.6: Provide and coordinate timely diagnostic laboratory support and services.

Objective 2.7: Ensure the humane treatment of vulnerable covered animals.

Goal 3. Facilitate safe U.S. agricultural export

Objective 3.1: Create export opportunities for American producers.

Objective 3.2: Ensure resolution of sanitary and phytosanitary issues and trade barriers.

Climate Change Effects and Vulnerabilities

In assessing the impacts of climate change, APHIS found that climate change could pose challenges to two of the Agency’s Strategic Goals:

- Goal 2, Safeguard American agriculture
- Goal 3, Facilitate safe US agricultural export

Additionally, APHIS determined that potential effects to the Agency primarily corresponded with two of the five vulnerabilities identified in the USDA Adaptation Plan:

- Decreased Agricultural Productivity
- Shocks Due to Extreme Climate Events



Derecho damage to crops in Story, Marshall and Tama Counties in Iowa, September 2020. USDA photo by Jeremy Davis.



Aerial panorama of rain water that was added to cotton fields already saturated with days of heavy rain, during the past week in Bloomington, TX on June 3, 2021. Some of the plants have turned from a healthy green to stressed red color after prolonged suffocation/drowning under water. USDA Photo by Lance Cheung.

In this section, we review these two vulnerabilities to describe the greatest risks or potential impacts of climate change that may impact APHIS’ mission, programs, operations, and stakeholders.

Decreased agricultural productivity

The 2021 USDA Climate Change Adaptation and Resiliency Plan recognizes that climate change threatens growth in agricultural productivity through direct effects such as changes in temperature and precipitation patterns and secondary effects such as increased plant pests and disease pressures, decline in pollinator health, reduced crop and forage quantity and quality, and infrastructure damage. Additional threats include impacts to water supply and increased frequency and intensity of extreme weather events. Climate change will expand or shift the range of a pest, pathogen, or vector organism, increasing its ability to establish in areas not previously considered at risk, elevating the risks to agriculture and forestry. Climate change is projected to impact crop production by reducing quantity and quality of yields, altering optimal growing periods, and increasing the likelihood of crop failure and damage. Livestock production will likely be impacted due to a reduction in the quantity and quality of pasture and forage and a lowered yield of feed grain which will affect livestock health and foster the

spread and resilience of pathogens and parasites that affect livestock development. Beneficial insects and microorganisms are also directly affected by climate change. Climate change will also likely cause changes in wildlife migratory patterns, diseases, and predator-livestock interactions.

These increased pressures may impact how APHIS meets its mission requirements which are protecting the health of US agriculture and natural resources against invasive pests and diseases, regulating genetically engineered crops, administering the Animal Welfare Act, helping people and wildlife coexist, certifying the health of US agricultural exports, and resolving phytosanitary and sanitary issues to open, expand, and maintain markets for US plant and animal products¹. Some of the potential impacts from these climate change pressures and the resulting decrease in agricultural productivity on APHIS mission areas are discussed below.

Shifts in Geographic Distribution of Wildlife, Weeds, Pests, and Diseases. Climate change’s impact on ecosystem and habitat characteristics will cause animal and pest populations to shift into new or expanded habitats. This movement can result in increased spread of diseases (such as citrus greening) and other pests, as well as increased encounters with wildlife in populated areas potentially increasing

¹ Source: USDA APHIS | Mission



Feral swine rip and root their way across America in search of food impacting ranchers, farmers, land managers, conservationists, and suburbanites. Photo provide by NASA.

disease transmission among wildlife, livestock, and people (such as African swine fever, COVID19 and avian influenza). We expect increasing pandemics in the future when species expand and change their geographic locations and humans are available to host species that cause zoonotic diseases.

U.S. Agricultural Production and Trade.

Climate change and associated shifts in disease and pest prevalence may increase requirements for commodity and pathway risk analyses and could overwhelm the ability of offshore programs to provide real-time information regarding pest and disease potential. Additionally, existing surveillance and diagnostic networks for animal and plant health diseases (e.g., avian influenza, foot and mouth disease, citrus greening, fruit flies, etc.) may overwhelm existing capacities and increase risks to US agriculture.

Increased Demand for Plants Developed Using Genetic Engineering and Other APHIS Services.

APHIS expects an increase in the demand for crops that are modified to adapt to the effects of climate change and a commensurate increase in the numbers of permit and notification applications, risk assessments, field trials, inspections, compliance issues, and petitions for deregulation, thereby increasing demands on APHIS resources. Adapting to climate change will likely require innovations in agricultural technology, including the introduction

of novel traits. These innovations may create the need to revise and update protocols and approaches to risk assessments. The increased desire for genetically engineered plants to resist pests or pests engineered to prevent the transmission of plant pathogens is expected to result in increased complexity of assessments.

Furthermore, response to pest and disease outbreaks may require the increased use of treatment combinations, as well as the need for new treatments, and could therefore increase the complexity of environmental and risk analyses such as those required under the National Environmental Policy Act (NEPA).

Shocks Due to Extreme Climate Events

Climate change is causing more frequent and intense disruptive events including plant and animal health emergencies, as well as hurricanes, floods, drought, tornadoes, and fires—all of which can have significant impacts.

Emergency Response Systems.

In 2013, the Emergency Support Function #11 (ESF#11) Annex to the National Response Framework was revised and changed the scope of ESF#11 activities. Particularly, ESF#11 now includes technical assistance for animal and agricultural emergency management. As the delegated national coordinator for ESF#11, APHIS works with multiple Federal

Departments and Agencies and non-governmental organizations to coordinate Federal support for disasters exceeding the response capability and resources of the local, State, territorial, and Tribal governments. APHIS has established animal and plant health emergency frameworks to facilitate coordinated, timely responses to disease and pest emergencies. APHIS also has established frameworks to address all hazards (e.g., hurricanes, floods, wildfires) for impacts on plant and animal health and the needs of individuals with service animals and household pets, in addition to providing technical assistance for animal and agriculture emergency management. Climate change has the potential to overwhelm existing frameworks as a result of increases in extreme weather events, wildfires, and pest and disease outbreaks.



Animal safety and well-being during disasters is key to the safety and well-being of people. USDA photo by R. Anson Eaglin.

In the event of wide-ranging climate disruption events, capacity could be overwhelmed and assistance from other USDA and Department of Homeland Security (DHS) emergency response resources would be required. State, local, Tribal, industry, and other stakeholders with key roles in threat mitigation may also be overwhelmed. Changes in pest and disease biology will require APHIS to ensure that its emergency response strategies (including new pest and disease response guidelines) and capabilities are updated and coordinated with the DHS National Response Framework.

Food Distribution and Aid. APHIS regulations prohibit the importation of agricultural and food products that pose a risk to plant and animal health. Disaster relief (including food distribution) efforts associated with increased frequency of extreme weather events resulting from climate change will require enhanced coordination with other Federal, State, and local agencies to protect public and agricultural resources.

Novel patterns in the distribution and movement of regulated agricultural products may create new or increased risk for introduction of pests and diseases. APHIS will work with Federal and State partners to enhance capacity to meet the challenges encountered with export and import requirements related to food distribution and aid. The storage, deployment, and forward-staging of food aid materials may be compromised as climate change and associated extreme weather events hamper the distribution of aid, impacting its local availability and potentially increasing the risks of stored product pests (e.g., khapra beetle).

Climate Adaptation Actions

The vulnerabilities noted in the prior section identify the climate change related impacts and associated risks that APHIS has determined may affect its ability to accomplish Agency policies and programs and continue Agency operations. The impacts of pests, diseases, and wildlife conflicts on agricultural production, commerce, and trade can be astronomical. APHIS employs emergency response activities that minimize threats and their impacts on agricultural industries, adapting to changes in agricultural and climate risk by adjusting available resources to address these threats. APHIS works with its partners to include mitigation strategies into international agreements and movement protocols and to conduct monitoring and surveillance efforts to quickly detect and implement response efforts to foreign pests and diseases that may have evaded prevention measures. By employing effective prevention and mitigation tactics, APHIS will reduce the impact of agricultural pests and diseases (including zoonotic diseases that threaten human



APHIS' Sterile Insect Rearing Facility, in Sarasota, Fla., where APHIS processes 100,000,000 sterile Mediterranean Fruit flies a week. USDA Photo by Preston Keres.

health) and wildlife damage to ensure that US farms and ranches remain healthy and productive.

APHIS has identified the following actions that address the Agency's climate vulnerabilities. These actions include ongoing, planned, and proposed new efforts to mitigate and adapt to the effects of climate change, as well as to build resilience in the Agency for the benefit of our employees, partners, and stakeholders.

Decreased agricultural productivity

Shifts in Geographic Distribution of Wildlife, Weeds, Pests, and Diseases. Develop methods and procedures to sample for new zoonotic or agriculturally significant diseases in wildlife.

In FY 2023, APHIS will develop methods and procedures to sample for new zoonotic or agriculturally significant diseases in wildlife. APHIS currently reports on 15 diseases in wildlife populations, including avian influenza, rabies variants, chronic wasting disease, and SARS-CoV-2. APHIS will add new sampling methods based on those diseases that pose the highest risk to agricultural health or human health, in the case of zoonotic diseases.

Complete climate suitability maps that predict the changing suitability of an area for pest or disease occurrence. By FY 2023, APHIS will complete eight climate suitability maps for a cumulative total of 22 maps. APHIS develops the maps using a modeling framework that predicts

the changing suitability of an area for pest or disease occurrence based on the likelihood of three favorable conditions specific to the pest or the disease occurring. The maps will help guide efforts to determine where to conduct surveys. Importantly, the maps will help APHIS and cooperators use survey resources more effectively by eliminating the need to survey for some high-risk pests if suitable environmental conditions do not exist in an area.

Identify, monitor, and prevent introduction of animal and plant pests and diseases into the United States. APHIS is increasing efforts to alert and check travelers to the United States at predeparture stations in airports and seaports to prevent the introduction of animal and plant pests and diseases. APHIS will direct and coordinate its surveillance, reporting, and mitigation initiatives with Federal, State, and Tribal stakeholders to maintain human, animal, and plant health.

Enhance systems for monitoring invasive species, as well as pest and disease spread. APHIS is improving monitoring systems and responses to pest (including vectors) and disease spread, incorporating state-of-the-art modeling to inform surveillance, developing early warning systems, and identifying better options for pest and disease control. Increased coordination and collaboration with international partners developing predictive models will enhance APHIS' ability to prepare for pest and disease incursions and other changes driven by climate change.

Enhance information sharing on forest pest and diseases. APHIS will collaborate with partners, such as the U.S. Forest Service, and share information (e.g., risk assessments, forecast maps, pest surveys) to control invasive plant pests and diseases in national forests and grasslands.

U.S. Agricultural Production and Trade. Monitor and accelerate work related to pollinator health. APHIS will continue to monitor pollinator health through the annual National Honey Bee Disease Survey. APHIS will also work with USDA's Office of the Scientist (OCS) and USDA's Agricultural Research Service (ARS) to review actions to prevent population decline of pollinators due to invasive species and other threats, which may increase due to the impacts of climate change.

Research alternatives to methyl bromide. Climate change will foster some new pests and invasive species in our farms in the future. Agricultural trade requires that US send products that are free of invasive species and pests to other countries. APHIS must improve the process to guarantee clean agricultural products. Methyl bromide is a broad-spectrum biocide capable of effectively disinfecting commodities, structures, and soil from plant pests, including insects, plant pathogens, weeds, and nematodes. APHIS uses methyl bromide as a quarantine fumigation treatment to eliminate exotic plant pests in or on imported commodities. However, methyl bromide has been identified as an ozone-depleting compound that exacerbates the impacts of climate change. APHIS has been researching chemical and non-chemical alternatives that will continue to ensure safe agricultural trade while limiting contributions to climate change and adhering to NEPA requirements.

Continue to research and safely release biological control agents. APHIS will continue to collaborate with international partners and academia to support research and secure natural enemies that may be tested for biological control of invasive species in the United States. APHIS will also provide guidance to scientists working on biological controls to

ensure compliance with NEPA and the Endangered Species Act before organisms are approved for testing and release into the environment.

Continue the implementation of trade policies that encourage legal trade of timber and timber products. Climate change will alter the boundaries of forests and the species in their ecosystem. Forests are essential to capture carbon from the atmosphere and store it for decades. Using the Convention on International Trade on Endangered Species and the Lacey Act, APHIS will prevent illegal timber harvested from protected forests from being introduced to the United States. Prohibiting trade with the US on illegal timber closes an important market and promotes countries to foster forest conservation, management and legal harvest of timber. By this action, we are minimizing the destruction of forests around the world, which will allow them to provide the ecosystem services important to delay negative impacts of climate change.

Encourage collaboration with the World Organization for Animal Health (OIE) on climate change-related initiatives. APHIS will promote discussions and propose coordinated actions to mitigate the effects of climate change at the OIE. For example, APHIS will share the challenges, opportunities, and lessons learned from managing zoonotic diseases such as avian influenza and African swine fever with other countries and promote the adoption of similar strategies internationally.

Continue collaboration with the International Plant Protection Convention (IPPC) on climate change-related initiatives. APHIS will promote discussions and coordinated actions to mitigate the effects of climate change at the IPPC. For example, APHIS personnel are on the IPPC Focus Group on Climate Change and Phytosanitary Issues. From 2022 to 2025, this Focus Group will implement an action plan that raises awareness about the effects of climate change on plant health, enhances the evaluation and management of the risks climate change poses to plant health, and enhances recognition of phytosanitary matters in international climate change discussions. Examples

of implementation actions the Focus Group will conduct include giving webinars on climate change effects on plant health, exploring ways for countries to share information regarding changes in pest distributions due to climate change, and developing ways to incorporate climate change into pest risk analyses that are used to inform phytosanitary policy.

Seek additional collaboration with trading partners on climate change-related initiatives. Find opportunities to engage trading partners, bilaterally or multilaterally, to build capacity to identify, control, manage, and eradicate certain pests and diseases, as well as establish and manage sustainable animal and plant health programs that are consistent with the USDA and APHIS Climate Adaptation Plans.

Increased Demand for Plants Developed Using Genetic Engineering and Other APHIS Services. Evaluate APHIS’ regulatory framework for the movement and release of organisms developed using genetic engineering and support the development of climate-adapted crops. There is an increased interest in developing modified microorganisms, which can be used to enhance plant growth, combat biotic stresses and abiotic stresses, and help plants adapt to climate change. APHIS will develop guidance to clarify the regulatory review process for these modified microbes. Additionally, APHIS may provide regulatory exemptions, when appropriate, for climate-change resilient crops and forest tree species that include simple modifications that could be achieved through conventional breeding.

Explore and use forecasting models to assess potential changes in the distribution of modified organisms. APHIS has developed prediction models for the climate suitability of some crop species across the United States and its territories. The program will continue developing prediction models for more plant species.

Ensure that proposed regulated field trials remain outside of environmentally sensitive areas. As climate change impacts the geographic occurrence of species, APHIS will review data on the constantly changing range and status of the United States’

threatened and endangered flora and fauna to evaluate conditions at proposed field trial locations and will review permits related to confined field trials of regulated modified organisms.

Shocks Due to Extreme Climate Events

Emergency Response Systems. Ensure continuity of operations. APHIS will maintain a workforce that is resilient to weather and other climate change-related disruptions so that the work of the Agency can continue as seamlessly as possible. APHIS will employ flexible management policies (e.g., telework, remote work, maxi-flex schedule) to assist employees impacted by disasters related to climate change (e.g., floods, hurricanes, wildfires) so that they may return to work as quickly and safely as possible.

Reinforce animal and plant health emergency frameworks. APHIS has established, and will continue to review and update as needed, animal and plant health emergency frameworks to facilitate coordinated, timely responses to disease and pest emergencies. APHIS also has established frameworks to respond to extreme weather events (e.g., hurricanes, floods, wildfires), which may impact plant and animal health and prompt needs for technical assistance with agriculture emergency management. APHIS will coordinate assistance from other USDA and DHS emergency response resources in the event of wide-range climatic disruption events to bolster our response in the event that APHIS capacity is limited. Additionally, changes in pest and disease biology will require APHIS to ensure that its emergency response strategies (including new pest and disease response guidelines) and capabilities are updated.



USDA APHIS staff in the APHIS Emergency Operations Center coordinate resources and information to support Hurricane Harvey relief efforts. USDA photo by R. Anson Eaglin..

Prepare responses to assist producers in advance of a pending severe weather event. In coordination with extension offices, APHIS will assist producers in planning for pending weather-related impacts such as power and water disruptions to their farms that will affect their crops or livestock. APHIS will also work with producers and Federal, State, and Tribal partners in planning for potential large-scale animal mortality events that will require transportation and disposal plans.

Develop a web page to help with contingency plans for the handling of animals during emergencies. A critical part of ensuring animal welfare is making sure that facilities can continue to provide food, water, housing, protection, and appropriate veterinary care for animals during an emergency, especially if facilities are damaged or animal handlers cannot get to the facility. APHIS will develop a web page with information focused on specific contingency planning issues associated with various extreme weather events, such as hurricanes, fires, floods, and managing temperature extremes. This resource could be used by facilities regulated by the Animal Welfare Act to help update their required contingency plans and train their employees on implementing those plans during an emergency.

Food Distribution and Aid. Enhance capacity to meet the challenges related to food distribution and aid. Climate change will increase the number and frequency of devastating weather events that will impact food security in different countries. The US government has a robust food aid program that responds to alleviate the famine after disasters. APHIS regulations prohibit the importation and exportation of agricultural and food products that pose a risk to plant, human or animal health. Disaster relief (including food distribution) efforts associated with increased frequency of extreme weather events require prompt and intense efforts by the agency. APHIS will work with Federal, State, and Tribal partners to enhance capacity to meet the challenges encountered with export and import requirements related to food distribution and aid. Additionally, this cooperation with partners will be necessary to safely store and distribute aid locally.

Cross-Cutting Adaptation Issues and Considerations

Environmental Justice



Many people now keep backyard poultry. Good bio-security practices are imperative for managing disease impacts. Photo by Adobe Stock.

APHIS recognizes that those in underserved communities are particularly vulnerable to extreme weather events due to a greater direct dependency on agriculture, forestry, and outdoor recreation for income and employment. These communities may have existing challenges with infrastructure and connectivity and limited capacity to prepare and respond to extreme events, likely leading to long-lasting shifts in community structure and composition. To address some of the current and future needs, APHIS proposes taking actions to better identify (1) underserved communities and specific issues within those communities related to climate change and (2) opportunities to support and encourage (via funding programs, guidance, etc.) more climate-resilient investments in communities.

Identify underserved communities and specific issues within those communities related to climate change. Review internal and external data to identity underserved communities and climate change issues related to APHIS programs. APHIS has some existing data sets to review demographics and equity issues for underserved communities. APHIS may also be able to use the Environmental Protection Agency’s Environmental Justice Mapping and Screening Tool, data from USDA’s National Agricultural Statistics Service, and information from academia



Vaqueria Ceiba Del Mar, in Arecibo, Puerto Rico, is one of the largest dairy producers on the island. USDA Photo by Preston Keres.

to help identify underserved communities and issues that APHIS would be able to help address.

Conduct outreach to and increase access for underserved communities to better understand and address issues. APHIS would like to increase our outreach to and access for underserved populations. APHIS will ensure inclusive stakeholder consultation on changes to the Agency's programs, policies, and operations, as well as promoting diversity in the workplace and in the composition of Federal Advisory Committees. APHIS hopes to effectively use a network of community organizations and groups to increase the Agency's presence at outreach events to underrepresented groups, such as in Minorities in Agricultural, Natural Resources and Related Sciences and Hispanic Association of Colleges and Universities. APHIS will expand partnerships with our minority serving institutions, such as Hispanic Serving Institutions, Tribal College and Universities, and Historically Black College and Universities. Additionally, APHIS intends to establish new networks with minority farming organizations.

Develop a unified approach on how to address climate change impacts in environmental compliance documents. APHIS will develop guidance on how to address impacts associated with climate change, including those on low income, minority, and Tribal communities in environmental

compliance documents. APHIS will develop an analytical framework to assess impacts associated with climate change for Agency actions subject to the National Environmental Policy Act, consistent with Council on Environmental Quality guidance.

Identify opportunities to support and encourage more climate-resilient investments in underserved communities. Increase opportunities and climate-resilient investments in underserved communities. APHIS will encourage diverse and inclusive participation in the cooperative agreement process to ensure that the Agency is responsive to increased demand for collaboration and partnerships with others on climate change issues. APHIS intends to host presentations at various stakeholder conferences to share funding opportunities for underrepresented groups.

Workforce Climate Literacy

APHIS seeks to enhance climate literacy for APHIS employees, producers, farmers, and other stakeholders. APHIS currently relies on resources within USDA and plans to provide training opportunities for the APHIS workforce to learn more about climate change and its impacts. Additionally, APHIS will build external partnerships to further enhance training and availability of informational resources.

Identify potential training and informational resources for APHIS employees. Identify existing and develop new training modules regarding climate change to incorporate into AgLearn.

APHIS will reach out to Federal partners to gather existing training modules that seeks to inform workforces about climate change and add the modules to AgLearn. APHIS, in coordination with the USDA Climate Hubs, will also develop new training that is more specific to the USDA mission, employees, and stakeholders.

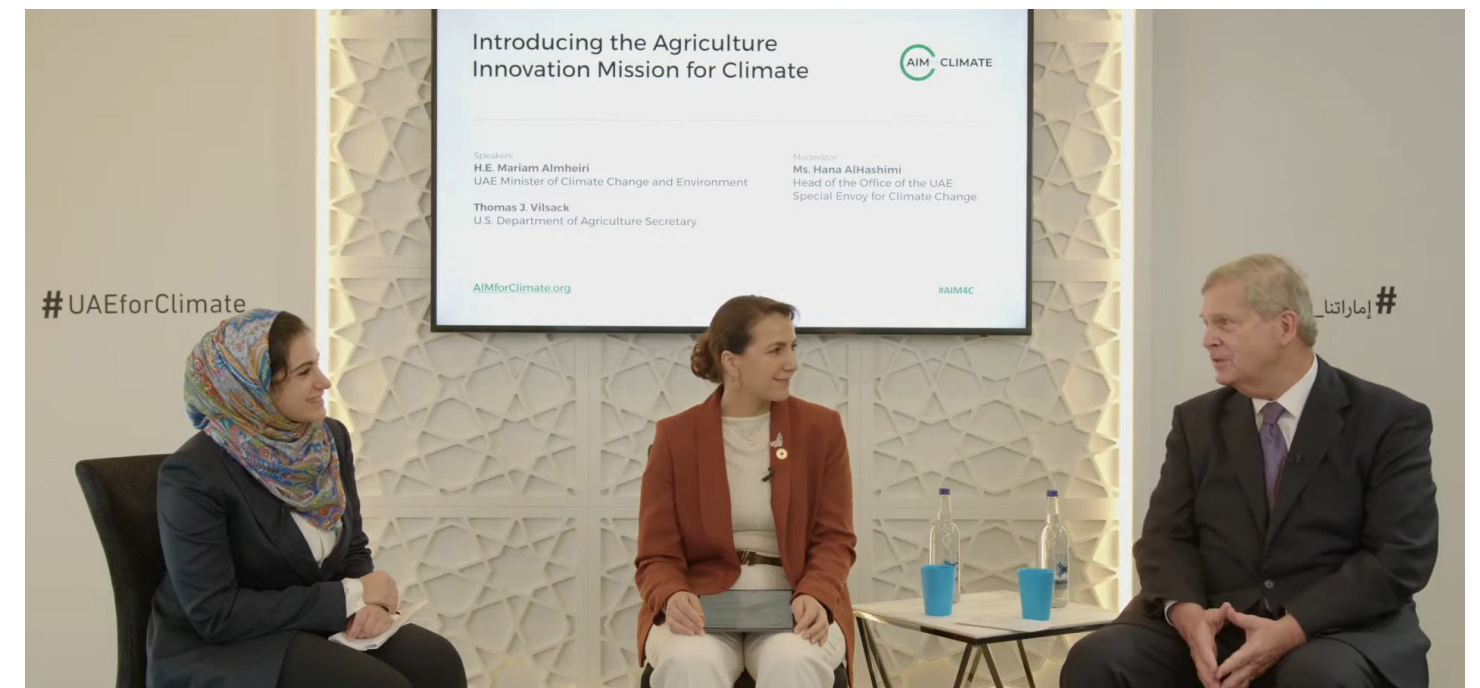
Develop informational resources on USDA and APHIS related climate change actions and initiatives. In coordination with the USDA Climate Hubs, APHIS will develop reader-friendly informational resources on recent Executive Orders regarding climate change actions and initiatives. APHIS will also promote the USDA Action Plan for Climate Adaption and Resilience, as well as the APHIS Climate Change Adaptation Plan.

Encourage APHIS staff participation in USDA's Climate Science Seminar Series. Coordinated by the USDA's Office of Energy and Environmental Policy

and the USDA Agriculture, Forestry, and Climate Science Working Group, APHIS will participate in these monthly seminars. The series will be science-focused, accessible to a general audience, and will provide opportunities for employees to ask questions to dispel misconceptions related to climate change. Potential subjects include greenhouse gases in agriculture, climate impacts on crop production and animal agriculture, options for climate adaptation and mitigation, and human preparedness and resiliency.

USDA Climate Hubs

APHIS will partner with the USDA Climate Hubs to support the enhancement of workforce climate literacy; the delivery of climate adaptation science, technology, and tools; to increase APHIS ability to recognize vulnerabilities to the Agency as a result of climate-related impacts; and to synthesize and interpret data, develop new technology and tools; and discuss possible initiatives that can be implemented across the Department to adopt climate-smart, sustainable strategies for the USDA facilities, fleet, and administrative policies.



Agriculture Secretary Tom Vilsack joins with UAE minister of Climate Change and Environment Mariam bint Mohammed Almheiri and Ms. Hana AlHashimi, Head of the Office of the UAE Special Envoy for Climate Change at the COP26 in Glasgow, Scotland in November 2021. USDA photo.

Table 1 APHIS adaptation actions to address climate change effects and vulnerabilities

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Time-frame	APHIS External Coordination	Progress Metrics	Accomplishments to Date
Impacts to agricultural productivity	Develop methods and procedures to sample for new zoonotic or agriculturally significant diseases in wildlife	Ongoing	Veterinary Services, Wildlife Services	Ongoing	NA	# of zoonotic and agricultural diseases sampled in wildlife	APHIS currently reports on 15 diseases in wildlife populations
Impacts to agricultural productivity	Complete climate suitability maps that predict the changing suitability of an area for pest or disease occurrence	Ongoing	Plant Protection and Quarantine	Ongoing	Academia	# of priority pests for which climate suitability maps have been completed	APHIS currently has 6 climate suitability maps
Impacts to agricultural productivity	Identify, monitor, and prevent introduction of animal and plant pests and diseases into the United States	Ongoing	Plant Protection and Quarantine, Veterinary Services	Ongoing	U.S. Customs and Border Protection (CBP), and other Federal, State, and Tribal Partners	# of inspections, # of seizures, # of outreach events and materials	Ongoing work
Impacts to agricultural productivity	Enhance systems for monitoring invasive species, as well as vector and disease spread	Ongoing	Plant Protection and Quarantine, Veterinary Services, Wildlife Services	Ongoing	International Partners	# of system enhancements	Ongoing work
Impacts to agricultural productivity	Enhance information sharing on forest pest and diseases	Ongoing	Plant Protection and Quarantine	Ongoing	U.S. Forest Service	# of info resources shared	Ongoing work
Impacts to agricultural productivity	Monitor and accelerate work related to pollinator health	Ongoing	Plant Protection and Quarantine	Ongoing	OCS, ARS, State Partners, Academia	# of National Honey Bee Disease Surveys	Annual survey since 2009
Impacts to agricultural productivity	Research alternatives to methyl bromide	Ongoing	Plant Protection and Quarantine, Policy and Program Development	Ongoing	ARS, Academia	# of alternatives researched	Ongoing work
Impacts to agricultural productivity	Continue to research and safely release biological control agents	Ongoing	Plant Protection and Quarantine, Policy and Program Development	Ongoing	ARS, Academia	# of biological controls under testing and released	Ongoing work
Impacts to agricultural productivity	Continue the implementation of trade policies that encourage legal trade of timber and timber products	Ongoing	Plant Protection and Quarantine	Ongoing	U.S. Fish and Wildlife Service, CBP	# of declarations, # of seizures	Ongoing work
Impacts to agricultural productivity	Encourage collaboration with the OIE on climate change-related initiatives	Proposed	Veterinary Services	TBD	OIE	# of meetings, # of actions	NA
Impacts to agricultural productivity	Continue collaboration with the IPPC on climate change-related initiatives	Ongoing	Plant Protection and Quarantine	Ongoing	IPPC	# of meetings, # of actions	Focus Group on Climate Change and Phytosanitary Issues was established in April 2021
Impacts to agricultural productivity	Seek additional collaboration with trading partners on climate change-related initiatives	Proposed	International Services	TBD	International Partners	TBD	NA
Impacts to agricultural productivity	Evaluate APHIS regulatory framework for the movement and release of organisms developed using genetic engineering and support the development of climate-adapted crops	Proposed	Biotechnology Regulatory Services	TBD	NA	TBD	NA

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Time-frame	APHIS External Coordination	Progress Metrics	Accomplishments to Date
Impacts to agricultural productivity	Explore and use forecasting models to assess potential changes in the distribution of modified organisms.	Proposed	Biotechnology Regu- latory Services	TBD	TBD	TBD	NA
Impacts to agricultural productivity	Ensure that proposed regulated field trials remain outside of environmentally sensitive areas	Ongoing	Biotechnology Regu- latory Services	Ongoing	NA	# of reviews	Ongoing work
Shocks Due to Extreme Climate Events	Ensure continuity of operations	Ongoing	Emergency and Regulatory Compli- ance Services	Ongoing	NA	NA	Ongoing work
Shocks Due to Extreme Climate Events	Prepare responses to assist producers in advance of pending a severe weather event.	Ongoing	Emergency and Regulatory Compli- ance Services	Ongoing	Federal, State, Tribal Partners	TBD	Ongoing work
Shocks Due to Extreme Climate Events	Develop a webpage to help with contingency plans for the handling of animals during emergencies	Proposed	Animal Care, Legislative and Public Affairs	TBD	TBD	TBD	NA
Shocks Due to Extreme Climate Events	Enhance capacity to meet the challenges relat- ed to food distribution and aid	Proposed	Emergency and Regulatory Compli- ance Services	TBD	Federal, State, Tribal Partners	TBD	NA
Environmental Justice	Review internal and external data to identity underserved communities and issues related to APHIS programs	Proposed	Office of Civil Rights, Diversity, and Inclusion; Policy and Program Development	TBD	Federal, State, Tribal Partners, and Academia	TBD	NA
Environmental Justice	Conduct outreach to and increase access for underserved communities to better understand and address issues.	Ongoing	Office of Civil Rights, Diversity, and Inclu- sion; Legislative and Public Affairs	Ongoing	Federal, State, Tribal Partners, and Academia	# of events attended, # of stakeholder consultations	Ongoing work
Environmental Justice	Develop a unified approach on how to address climate change impacts in environmental compliance documents	Proposed	Policy and Program Development	TBD	TBD	TBD	NA
Environmental Justice	Increase opportunities and climate-resilient invest- ments in underserved communities	Ongoing	Office of Civil Rights, Diversity, and Inclusion; Legislative and Public Affairs; Marketing and Regulatory Programs Business Services	Ongoing	Federal, State, Tribal Partners, and Academia	# of events attended, # of cooperative agreements	Ongoing work
Climate Literacy	Identify existing and develop new training modules regarding climate change to incorporate into AgLearn	Proposed	Marketing and Regulatory Programs Business Services	TBD	TBD	TBD	NA
Climate Literacy	Develop informational resources on USDA and APHIS related climate change actions and initiatives	Proposed	Office of the Admin- istrator, Legislative and Public Affairs	TBD	TBD	TBD	NA
Climate Literacy	Participate in USDA’s climate literacy working group	Proposed	Office of the Administrator	TBD	TBD	TBD	NA

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at [How to File a Program Discrimination Complaint \(www.usda.gov/oascr/how-to-file-a-program-discrimination-complaint\)](http://www.usda.gov/oascr/how-to-file-a-program-discrimination-complaint) and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

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APHIS-22-024

Issued May 2022



2022 Climate Adaptation Plan

Together, America Prospers

USDA Rural Development Climate Adaptation Plan

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USDA Rural Development's Mission

Our mission is to improve the economy and quality of life in rural America.

USDA Rural Development comprises three agencies: Rural Housing Service (RHS), Rural Business-Cooperatives Service (RBCS), and Rural Utilities Service (RUS). Each agency provides financial support through loans, grants, loan guarantees, or rental assistance. They also address the often urgent need in rural communities for technical assistance and training.

RHS offers a variety of programs to build or improve rural housing and essential community facilities in eligible areas. Projects and investments include single and multifamily housing – including housing for farm laborers – and to build and equip essential community facilities such as first responder stations, child care centers, hospitals, libraries, nursing homes, schools, and much more.

RBCS programs help provide capital, training, education, and entrepreneurial skills to help those living in rural areas start and grow businesses, or find jobs in agricultural markets and in the biobased economy.

RUS provides much-needed infrastructure or infrastructure improvements to rural communities, including water and waste treatment, electric power and telecommunications and broadband internet services.

Rural Development Priorities

- Economic recovery from the COVID-19 pandemic
- Equity
- Climate Impact

Climate Change Executive Order

Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad (available at this link: <https://go.usa.gov/xuVga>)

Part Two: Taking a government-wide approach to the climate crisis

Section 201 - Requires federal agencies to combat the climate crises by:

- Reducing climate pollution
- Increasing resilience to the impact of climate change
- Protecting public health
- Conserving land, water, and biodiversity
- Delivering environmental justice through the innovation, commercialization and deployment of clean energy technologies and infrastructure

Section 211 - Requires federal agencies to develop climate action plans to improve adaptation and increase resilience. To improve transparency, agencies must provide annual progress reports demonstrating their implementation efforts.

Climate Impacts and Vulnerabilities

What does the landscape of climate risk look like for our communities and for Rural Development programs and policies?

Climate change represents a risk to Rural Development's assets and the communities it serves. Climate-related damage to infrastructure and facilities will increase demand on RD to provide financial assistance to repair, replace, relocate, reduce barrier to access, or otherwise improve such assets. Additionally, climate-related impacts – such as decreased biodiversity – can disproportionately affect rural communities. Adverse impacts to regions dependent on natural resources for their livelihoods and social structures will also increase over time, proving disruptive to local rural economies. The potential for increased demands on financial resources could divert such resources from normal RD program operations, impacting the mission area's ability to achieve its goals. An increase in financial assistance requests could burden all aspects of RD operations, including underwriting, engineering, and environmental reviews.

Rural Development supports rural communities through loans, loan guarantees, and grants. For some programs, RD holds liens or other security interests in facilities and related infrastructure across diverse geographies impacted by climate change. No longer just an existential threat, climate decline is already

producing conditions that threaten human health, safety, and well-being, and creating adverse financial and economic issues. Examples of impacts that can damage homes, buildings, utility facilities and infrastructure include:

- Hydrological changes and sea-level rises resulting in inundation and erosion
- Increased frequency and severity of weather events such as tornados and hurricanes
- Increased likelihood of drought, as well as changes in drought severity and frequency, precipitation predictability, and water availability
- Wildfires fueled by heat and drought; longer fire seasons
- Extreme heat
- Deluge rains and flash floods
- River floods
- Migration of pests and insects that threaten structural and health resilience
- Extreme ice and snow events
- Increasing size and intensity of hail
- Compounded and co-occurring impacts with environmental chemicals and toxins

Climate change creates stress on community infrastructure. Climate events such as storm damage, global warming, hurricanes, and flooding threaten aging infrastructure, causing it to deteriorate and impact the development of future community infrastructure. Roads and bridges can be damaged or lost due to catastrophic floods, preventing access to federal lands.

Mental health deterioration due to climate stressors compounds all of these challenges. Rural communities have limited capacity to prepare and respond to these events.

What does this look like by agency?

Rural Housing Service

Climate change has a profound effect on the RHS portfolio because of direct structural impacts to the portfolio's single and multifamily properties, and also RD's support of essential community facilities. Damage to existing structures from weather events, fires, floods, and so on – which may not be covered by insurance – will require disaster mitigation financing. The likelihood of foreclosure or borrower insolvency in the aftermath of such events (as property values drop, or employment centers close) also rises. Looking forward, RHS programs will increasingly be required to consider financing for pre-disaster, resilience-related construction and improvements. Older building codes will need to be reevaluated to improve the inadequate construction of existing facilities and remove any barriers to accessibility.

These climate impacts cause properties – and thus, USDA – to incur additional costs. Increased climate risks also pose a threat to the financial stability of the rural communities RD serves. Rural areas unable to recover

from climate-related events mean residents may have to relocate to urban areas, threatening the fabric of community life in rural America.

Climate change continues to have a significant impact on rural communities. Many rural economies are less diverse than their urban counterparts. Changes in the viability of one economic sector – such as health care – will place disproportionate stresses on community stability, and could result in barriers to advancing racial justice, equity, and opportunity. Most rural communities already face daunting health care challenges in comparison with urban areas, so climate change-associated health risks may compound existing health issues in rural, Tribal, and Alaska Native communities. In the last two calendar years, more than a dozen RD Multifamily Housing properties have been impacted by extreme climate events such as hurricanes, tornados, and wildfires. In our Single Family Housing program, climate shocks may increase damage to – or create the destruction of – RD-financed or guaranteed properties.

Many underserved communities – particularly low income, minority, Tribal, and rural populations – are more likely to be disproportionately vulnerable to climate change impacts. Rural communities often are more exposed to environmental hazards, and have a harder time recovering from the negative impacts of climate change, resulting in barriers to equity and environmental justice. It often takes a lower-income community longer to rebuild after a natural disaster. Climate impacts may also lessen the ability of single family homeowners, multifamily housing property owners, organizations responsible for maintaining community facilities, and rural businesses to get flood insurance at reasonable rates and terms.

Rural Utilities Service

RUS provides much-needed infrastructure and infrastructure improvements to rural communities. Through loans, grants, and loan guarantees, RUS funds water and waste treatment, electric power, telecommunications and broadband services to help expand economic opportunities and improve the quality of life for rural residents.

RUS addresses threats to water quality and quantity, shocks due to extreme climate events, and stress on infrastructure and public lands, all of which can disproportionately impact vulnerable communities.

RUS Water and Environmental Programs finances projects to help improve water quality and quantity for rural communities. Climate change is predicted to lead to increased precipitation variability and decreased water storage in snow and ice. This influences the variability of river flow (including both flooding and drought) which results in a less reliable surface water supply. Drought, storms, and flooding all have an effect on water quality and quantity.

RUS finances utility infrastructure projects in the most rural, remote, and un- or underserved communities in our nation. Overall, RUS programs make water and waste, electric power, and telecommunications services available in our country's least-served communities. By definition, RUS programs' target communities that

lack the resources to support basic utility infrastructure, increasing their vulnerability to climate change impacts, and their ability to adequately prepare and respond.

Extreme weather events have already damaged utility infrastructure and put pressure on utility infrastructure projects financed by RUS. For example, hurricanes overwhelm water and waste infrastructure. Thus, Water and Environmental Programs (WEP) staff are often deployed to help repair WEP infrastructure in communities impacted by hurricanes and severe storms. In January 2021, heavy snowstorms shut down the Texas electric grid, and RUS Electric Programs responded with special financing to help electric cooperatives in the region.

The Telecommunications Program has seen less of an impact from climate events such as hurricanes, because telecom infrastructure – such as fiber optics – largely is located underground. However, some telecom infrastructure – such as cables and wireless systems – is aerial, and can be affected by extreme climate events. Also, given that nearly 30 percent of people in rural areas don't have access to broadband internet service (information is available at this link: <https://go.usa.gov/xumth>) this makes post-recovery in these communities more difficult. Furthermore, powering telecom facilities can sometimes be affected by long power outages caused by extreme climate events. Generally, after a power outage, telecommunications facilities can maintain power for a short period using battery backups and generators to ensure continuity of service. However, the length of back-up power is regulated by the Federal Communications Commission (FCC) and state-based Public Utilities Commissions.

Rural Business-Cooperative Service

RBCS programs help provide the capital, training, education, and entrepreneurial skills to help those living in rural areas start and grow businesses, or find jobs in agricultural markets and in the biobased economy.

While there are not direct climate risks or vulnerabilities associated with Rural Development funding, certain businesses RBCS indirectly supports through guarantees and intermediary lending are more at risk of climate-related default or loss of collateral.

Actions and Implementation Steps to Address Climate Vulnerabilities

To support long-term community sustainability and build trust, a successful plan must address both foreseeable and unforeseeable vulnerabilities with an emphasis on preparedness and post-event response.

In this context, preparedness must extend beyond tackling the direct impact of the underlying climate event to addressing larger disruption issues, recognizing that communities hit hardest by climate events are often those

with vulnerable populations that lack the resources to quickly identify, triage, and resolve complex, climate-related problems.

For these reasons, climate plans must include predictive analytics, risk assessment, and some type of cost analysis. They must also include maps, visualizations, and if possible, simulations to illuminate community needs and highlight potential responses to ensure the broadest possible stakeholder engagement. While it is important to understand the probability of an event, unless that information is translated into guidance with respect to how a community must prepare and respond to the event, its usefulness will be limited.

Using mapping tools from our Innovation Center-based Data Analytics Division, RD is experienced at creating effective mapping tools. Examples include office optimization, obligation funding, and demographic diversity – all used to meet RD mission-area goals and priorities. There is capacity to apply this form of modeling to assess and better understand climate risk.

Primary Action: Create a New Tool to Empower Rural Communities

Rural Development can develop a tool that combines mapping climate risks, social vulnerability, and resilience measures with an overlay of the RD investment portfolio to enhance awareness of risks and opportunities, and improve rural resilience and adaptation to climate change. From a portfolio protection perspective, developing this tool will also help RD adapt to increased risk from climate events, and build resilience in its housing and infrastructure portfolio.

There are several tools RD can use to create this tool:

- The Federal Emergency Management Agency's (FEMA) National Risk Index (information is available at this link: <https://go.usa.gov/xumum>).
- The Rural Development Investments in areas of Concern mapping tool (available at this link: <https://tinyurl.com/mry9v3w8>) shows RD investments as they relate to fire, earthquakes, and other weather-related hazards.
- The National Oceanic and Atmospheric Administration's (NOAA) U.S. Climate Resilience Toolkit Social Vulnerability Index (information is available at this link: <https://go.usa.gov/xumuS>) provides subject matter expertise to build climate resilience.

Ideally, the development of this principal tool will allow RD to collaborate with other USDA mission areas engaged in geospatial and GIS mapping to provide a comprehensive understanding of the climate risks confronting rural America, as well as identifying opportunities to promote resilience. As envisioned, the tool

will be designed for internal USDA use, but could support climate initiatives throughout the department and facilitate information flow to the public.

The tool will be developed as a living mechanism that can be updated with new information to address challenges and take advantage of opportunities. It will be capable of providing information on state and local requirements, laws and policies related to climate resilience, building codes and above-code standards, and tax programs and incentives. And it will be able to help USDA's leadership and underwriting staff design and target programs across rural America.

In addition to these tools, RD potentially can develop a mapping tool designed to take user input – think of it as a user-generated, interactive satellite navigation system for rural American resilience – that can offer a much more granular understanding of the critical, nuanced differences for each community. The U.S. Census Bureau's Opportunity Project (TOP – available at this link: <https://opportunity.census.gov/>) offers a 12-week program designed to help develop solutions of this kind.

Creating a tool that USDA RD staff can use internally to identify rural challenges and opportunities in the context of climate risk would be extremely useful in years to come. These challenges extend beyond climate to include equity issues like communities with limited English proficiency, accessibility and aging, and other isolating factors that impede community connectedness.

How the Tool Will Help Rural Development Address Climate Change

The tool RD will develop to support this plan will help RD better serve rural communities whose economies depend on RD-financed infrastructure, and better position its own \$232.6 billion portfolio for future climate-related changes. As noted, climate change represents a significant risk for RD from financial and mission fulfillment perspectives. The tool will enable a better understanding of underlying socioeconomic conditions, community need, climate risk exposure, and costs that must be borne to address resiliency concerns. Its primary focus will be areas with acute and actionable needs that can be addressed by RD agencies. The tool can help identify which communities need construction projects to promote resiliency in the face of adverse climate events, and also can help them prioritize investments. This tool can also be used to map water systems vulnerable to climate risks like flooding. RUS' Water and Environmental Programs can then direct investments to mitigate such risks.

The tool will enable an integrated approach to understanding climate risk in the context of social vulnerability and need. These risks are of particular concern to RD because many distressed communities are in rural areas. Furthermore, 86 percent of "persistently poor" counties (they have poverty rates exceeding 20 percent over the past 30 years) have entirely rural populations.

These counties are vulnerable to climate risk since they do not have the capacity to withstand or recover from the adverse effects of climate events. RD is uniquely positioned to help these communities adapt to rising climate risks by continuing to integrate equity into decision making by investing in underserved communities.

By overlaying climate risk with community vulnerability, the tool will enable a better understanding of the factors underlying this disproportionate impact. It will facilitate the coordination of a broader mission area response to specific vulnerabilities by increasing awareness of communities' relative capacity to respond to climate risks.

There are several ongoing initiatives where targeting programs is helping direct funding to the most vulnerable communities.

- RD uses a priority points system to incentivize funding projects that fall in line with the Biden-Harris Administration's priorities: recovering from the impacts of the COVID-19 pandemic, Equity, and Climate Impact. For Climate Impact, RD recommends prioritizing proposals that tackle the climate crisis through projects that reduce climate pollution, spur well-paying union jobs, promote economic growth by deploying clean energy technologies and infrastructure, focus on clean energy research and development, or advance environmental justice.
- RD is participating in the Biden-Harris Administration's Justice40 Initiative (available at this link: <https://go.usa.gov/xuVqA>) which sets a goal of delivering 40 percent of the investment benefits from certain federal programs – like RD's Rural Energy for America Program (REAP – available at this link: <https://go.usa.gov/xuV3G>), Rural Energy Savings Program (RESP – available at this link: <https://go.usa.gov/xuV3m> - PDF), and the High Energy Cost Grant program (available at this link: <https://go.usa.gov/xuV39> - PDF) – to disadvantaged communities.
- RD can partner with USDA Climate Hubs (available at this link: <https://go.usa.gov/xuV3t>) to deliver local tools and resources to help build climate adaptation capacity. RD can leverage its field offices to help Climate Hubs connect with rural communities.

Further Climate Adaptation Activities for Rural Development

Although central to RD's approach to climate adaptation, RD's actions to mitigate climate risk are not limited to the development of a climate-centric tool. There are other actions to be taken.

- RUS can use existing authorities and programs to provide support for infrastructure improvements needed to repair damage to facilities caused by extreme climate events
- RUS can offer financing options to support utility providers (and their customers) impacted by extreme climate events in which their facilities were not directly damaged. RUS's authority to

finance smart grid systems is crucial to helping utility systems and communities prepare for – and respond to – climate change and extreme climate events.

- RHS can improve building and housing resilience by supporting interagency efforts around the adoption and enforcement of modern building codes, and by incentivizing above-code building standards in the areas of climate and energy resilience.
- RD can build resilience to wildfires and their effects, partnering with the U.S. Forest Service to identify opportunities to connect post-wildfire restoration efforts with bioenergy generation.
- RD can look at funding resources that can be utilized for resilience, like repurposing Stafford Act (available at this link: <https://go.usa.gov/xuVxp> - PDF) federal disaster response funds for adaptation and mitigation activities in rural communities.
- We can engage directly with community-level leaders and environmental justice-focused organizations to understand vulnerabilities and risks, identify barriers to climate adaptation, and develop collaborative solutions for adaption.
- We can provide state and regional public agencies, nongovernmental organizations, academics, and other interested members of the public with informational trainings and workshops detailing best practices, database access information, and other important information to help increase environmental justice awareness and opportunities.
- We can update programing guidance to require environmental justice considerations be included in cost-benefit analyses, and to encourage agency-wide adoption of environmental justice into our decision-making processes.

Emerging Risks

The Biden-Harris Administration's placement of climate change at the center of U.S. foreign policy and national security in Executive Order 13990 underscores the secular nature of climate risk, and the far-reaching implications of increasingly frequent and extreme weather events around the nation and the globe. Some climate-related risks are not as evident today as the floods, fires, hurricanes, and other extreme weather events that fill headlines, but these risks almost certainly will have broad demographic, social and financial impacts in the future.

One such risk is outmigration. Climate events that destroy property, degrade transportation infrastructure, or reduce available telecommunications, water, and electrical services could compel businesses to relocate operations to larger, more resilient towns and cities. Job loss in rural areas accelerates the familiar rural-to-urban exodus. It is often led by younger job seekers, worsening the population aging that already strains rural economies.

Climate change also results in more expensive insurance coverage or reduced insurance availability, which can slow down post-event economic recovery. The cost of insurance reflects the probability and magnitude of expected loss; both calculations most certainly are impacted by climate events. Health insurance, reinsurance, and securitization markets can effectively mitigate risk that is uncorrelated, but global climate change will increase correlation. (An illustration of this would be a connection between drought that causes livestock loss in Texas, and wildfires causing business losses in California.) Without affordable insurance options, rural communities may find it more difficult to access critically-important capital markets (and thus, sources of rural business loans).

Obviously, Rural Development programs cannot alter underlying event probabilities. However, they can support a robust community response by financing resilience measures and facilitating informed decision making. By requiring stout construction standards and the use of climate-forward technologies RD can help mitigate losses caused by climate-related events, and increase the insurability of critical community assets financed through our programs.

Table 1: Rural Development Adaptation Actions to Address Climate Change Effects and Vulnerabilities

Climate Vulnerability	Action Title and Description	Type of Activity	Lead Office	Timeframe	Coordination	Progress Metrics
Shocks created by extreme climate events	Climate Adaptation Tool	Proposed	Innovation Center	To be determined when a workplan is established	Potential coordination with OBPA or Forest Service	To be determined when a workplan is established



United States Department of Agriculture

USDA Foreign Agricultural Service Climate Change Adaptation Plan

April 2022

Introduction

The U.S. Department of Agriculture (USDA), Foreign Agricultural Service (FAS) has defined its mission in its 2023-2027 strategic plan as, “FAS is a trade agency that promotes U.S. agricultural exports.” FAS maintains a global presence that helps inform stakeholders on international markets, works to expand access for U.S.-produced food and agricultural products, and builds new markets by assisting developing countries to develop capacity for trade. FAS’s global presence and international focus is critical in promoting the U.S. climate agenda and assisting countries to adapt to a changing environment.

Mission	FAS is a trade agency that promotes U.S. agricultural exports
Goal 1	Liberalize global agricultural trade by developing and enforcing agreements, policies, and addressing trade barriers
Goal 2	Expand U.S. agricultural exports through implementation of trade-supporting initiatives
Goal 3	Inform global agricultural markets and advise U.S. decision-makers by providing relevant intelligence, expertise, and analysis
Goal 4	Operate FAS and administer its programs efficiently and effectively, with a focus on excellent customer service
Goal 5	Promote a supportive trade environment for sustainable and climate-smart commodities, while encouraging the adoption of global agricultural climate solutions
Goal 6	Recruit, build, and retain a well-qualified, diverse, and inclusive workforce, and ensure FAS programs are equitably promoted and available to underserved communities

FAS’s strategic goals listed above, and FAS’s approaches to adapting to climate change, are identified as priorities in FAS’s Strategic Plan Fiscal Year (FY) 2023-2027. The FAS strategic plan describes activities that address climate change factors and incorporate adaptation and mitigation strategies and actions.

While Goal 5 is particularly relevant to climate change, all the strategic goals incorporate responses to climatic changes, variability, and seek to establish mechanisms to respond to agricultural and food systems challenges, such as increasing natural disasters and the spread of pest and disease, among many other risk factors.

Various U.S. laws, departmental policies, and directives define specific duties FAS is obliged to undertake. These include: (1) acquiring and reporting information pertaining to agricultural trade; (2) implementing market development programs; (3) administering and directing the Department’s programs in international development, technical assistance, and training; and (4) carrying out specifically authorized food aid programs. Furthermore, USDA Departmental Regulation 1051-001 states FAS is the lead agency responsible for coordinating Department agencies’ functions involving foreign agricultural policies and programs and their operations and activities in foreign areas, including those agencies having representatives stationed abroad.

In linking U.S. agriculture to the world, FAS has a unique role in addressing climate change. Limiting global temperature increases to 1.5 degrees Celsius (as outlined in the Paris Agreement) cannot be achieved by only focusing on U.S. practices; through our international agency, we must assist countries in accessing U.S. research, innovations, and climate smart and sustainable practices, while enabling a trade environment that promotes these innovations, practices, and agricultural products. It is within this mindset that we outline our programming and goals to expand USDA’s reach globally.

Climate Change Effects and Vulnerabilities

Shifting global trade patterns and decreased food security: Many countries are already experiencing rapid price increases for basic food commodities, a trend at least partially due to production losses associated with more frequent weather extremes and unpredictable weather events. Some regions will face higher risks, while others will face new risks, with a disproportionate effect on and need for adaptation assistance by developing countries. Cascading risks with impacts on multiple systems and sectors also vary across regions. The stability of food supply is projected to decrease as the magnitude and frequency of extreme weather events that disrupt food chains increase. Increased atmospheric CO₂ levels can also lower the nutritional quality of crops.¹ However, these trends are not consistently understood nor explicitly addressed in FAS's current program planning and risk management processes. Improved planning and risk management aids, along with increased data analysis and attention to hot spot regions increasingly threatened by food insecurity, will be required to adequately adapt operations.

Furthermore, developing countries are facing enormous challenges and climate risks to their food and agricultural systems and capacities to participate in international agricultural trade. For the foreseeable future, demand for international capacity building activities and technical exchanges to educate and promote climate resilience are likely to increase significantly. For countries, especially low- and middle-income ones, to be food secure and good trading partners with the United States, they need food and agricultural systems that are resilient to climate change. As the U.S. government (USG) engages more on climate programming, there will be a need to provide capacity building to cooperating countries' ministries of agriculture and other agricultural institutions, promoting U.S. climate-smart innovations. Capacity building will also be needed for international partner regulators and other relevant stakeholders to ensure other countries' policies and regulations do not negatively impact agricultural trade. FAS anticipates the increased demand for such assistance will place stress on existing agency resources and human capital, unless such capacity is enhanced, and markets and applicable climate programs are prioritized.

An additional benefit is that increasing capacity building and/or food assistance opens doors to greater trade facilitation and cooperation, which will help increase developing countries' economic stability. A synthesis of food security-related adaptation options showed opening new markets and trade pathways are two transformational adaptation options to reduce food insecurity, along with implementing new technology and improving food storage infrastructure, among others. Capacity building and extension programs work as enabling conditions to ensure such transformative adaptation.² FAS can position itself to proactively address both the risks and opportunities of changing global trade patterns and food insecurity, including in the areas of data collection, modeling, international and internal capacity building, personnel, and addressing shifting consumption patterns. In doing so, there will be increased opportunities for FAS to promote U.S. international cooperation on climate-smart agriculture through its existing programs.

Decreased agricultural productivity: Climate change has the potential to adversely impact agricultural productivity at local, regional, and continental scales. Crop and livestock production in certain regions has been adversely impacted both by direct effects of climate change (such as increasing trends in daytime and nighttime temperatures; changes in rainfall patterns; and more frequent climate extremes, flooding, and drought) and consequent secondary effects (such as increased weed, pest, and disease pressures; reduced crop and forage production and quality; and damage to infrastructure). Access to solutions for these adverse impacts is often limited by a partner country's enabling environment, infrastructure deficiencies, barriers to trade, and other factors that FAS engagement can help address.

¹ IPCC Land Report Summary for Policymakers p. 17

² IPCC Land Report, Chapter 5, p. 467

Overall decreased agricultural productivity will require adapting reporting mechanisms. FAS will have to consider the timescale and frequency with which commodity reports are submitted, as well as reconsider long-held assumptions, such as what constitutes baseline “normal weather” in the partner countries. Satellite imagery is an important part of this reporting. To adequately capture both direct and secondary climate change impacts at a high spatial and temporal resolution, optical and radar satellite imagery will need to be continually updated, along with cloud storage capabilities, augmented analytical tools, and mining existing global data sets.

The global changes in agricultural productivity, and its cascading impact on food security and international security, means international and domestic organizations are increasingly focused on agricultural production and trade. There is a risk in not having adequate staff resources to cover the multiple fora where agricultural trade inequities may arise. However, this increased interest offers an opportunity to engage with global partners and create coalitions of like-minded countries to advance U.S. agricultural trade policy objectives. Consideration must also be given to how existing FAS-administered programs can contribute to USDA’s climate-related international initiatives (Aim for Climate, Sustainable Productivity Growth Coalition, and Global Methane Pledge) and help to inform and amplify U.S. exporters’ sustainability strategies. In addition, increased international engagement and reporting will require flexible staffing mechanisms for foreign service operations.

Increased stress on trade (including SPS) infrastructure: Climate change creates additional stress and exacerbates existing risks to livelihoods, infrastructure, and food systems. Trade infrastructure will be tested; shipping routes are likely to change; and port facilities, roadways, buildings, and other important infrastructure will be at risk of damage from rising sea levels and increased frequency of extreme weather.

Already, U.S. trade with partners in developing countries is sometimes inhibited due to lack of adequate infrastructure such as storage, including cold chain storage, warehousing, and distribution channels. Managed by FAS, the Facility Guarantee Program provides credit guarantees that facilitate the financing of goods and services that are inputs into projects that primarily benefit the expansion of U.S. agricultural goods in a specific market. In this program, FAS already evaluates the environmental and social impact of a project as a primary eligibility criterion and may also require a full Environmental and Social Impact Assessment if preliminary findings warrant.

Expanded and changing incidences of pests, diseases, and food safety risks: Climate directly influences the range and natural evolution of agricultural pests, diseases, and food-borne pathogens, and their risk pathways, including international trade flows.

In addressing changing, and sometimes increasing, pests, diseases, and food safety risks, there is a need for increased sanitary and phytosanitary (SPS) capacity building to help countries address current and emerging threats, including support for innovative tools and technologies. FAS manages numerous projects intended to enhance foreign countries’ SPS capabilities and systems and expects there will be increased demand for such capacity building and technical assistance programs. Additionally, FAS may need to increase, or augment, existing Global Agricultural Information Network (GAIN) reports to adequately account for changing international trade dynamics, resulting from increased and/or changing pest and disease outbreaks. Without reallocating or increasing internal resources toward climate adaptation, these requests will likely strain existing human capital resources.

In addition, regulatory officials have the opportunity to recognize the contribution by plants and animals developed through biotechnology in reaching climate goals, including resilience to animal and plant diseases and pests. The availability of such products depends upon partner countries having science-based approaches to providing regulatory approvals, without which the products cannot be used in the country. Capacity building should focus on the adoption of proactive national and regional biosafety frameworks that take a trade- and innovation-facilitative approach that meets the countries’ needs, but which are also based on appropriate evaluations of risk, protection of developers’ intellectual property rights, local access to, and acceptance of, the technology, and which are consistent with the countries’ obligations under international agreements.

The need for systems approaches in the agriculture and forestry sectors: The agriculture and forestry sectors face particular challenges of institutional fragmentation and often suffer from a lack of engagement between the many, various stakeholders and narrowly focused policy objectives.³ In addition, changes in climate can amplify environmentally induced migration, both within countries and across borders, reflecting multiple drivers of mobility and available adaptation measures.⁴ Coordination with other sectors, such as public health, transportation, environment, water, energy, and infrastructure, can increase co-benefits, such as risk reduction and improved health. Addressing desertification, land degradation, and food security in an integrated, coordinated, and coherent manner can assist climate resilient agricultural development and provides numerous potential co-benefits.

Clear communication of the many climate change initiatives across the U.S. Government and within USDA, and engagement with external stakeholders on the purpose and utilization of such initiatives, will contribute to FAS's operational efficiency. It will be crucial to improve existing cooperative mechanisms to reduce fragmentation and adequately seize the opportunity to further FAS's mission. Without proper engagement of the extensive list of stakeholders along the agri-food supply chain, USDA runs the risk of reducing the uptake of climate smart practices both domestically and internationally, if climate-related policies decrease U.S. competitiveness in foreign markets. Continuing engagement, both formally and informally, with FAS stakeholders will be crucial in identifying, designing, and implementing climate-related agricultural policies and practices. Programmatically, technical assistance and capacity building should seek to incorporate a whole-of-government approach and include topics such as biodiversity, One Health, antimicrobial resistance, energy, and infrastructure.

In addition, increased collaboration and coordination with stakeholders, across USDA, and the U.S. government, of U.S. science and agricultural innovation offers new opportunities for adaptation, mitigation, international cooperation, research and development collaboration, and local engagement. Adaptation also involves use of current genetic resources, as well as breeding programs, for both crops and livestock. More drought, flood, and heat-resistant crop varieties and improved nutrient and water use efficiency, including water quality (such as salinity), are aspects to factor into the design of adaptation measures. Availability and adoption of these varieties is a possible path for adaptation and can be facilitated by proactive, country-specific outreach and capacity building.⁵

Additionally, increased international cooperation on climate change and agriculture may enhance bilateral, plurilateral, or multilateral cooperation and create new opportunities for agricultural market access expansion. Regional coordination, as may be required, can also enable various FAS/Posts to work together to advance climate adaptation and resilience on a larger scale. Such international and regional coordination will include promoting and engaging on USG initiatives such as the Agriculture Innovation Mission for Climate (AIM for Climate), the Global Methane Pledge (GMP), the Sustainable Productivity Growth Coalition, Feed the Future, among others.

Reliable and improved data mechanisms: A key function of FAS includes analyses and forecasts of international commodity markets and trade flows, commodity production forecasts, and the export sales report. Increased climate variability is expected to exacerbate the need for, and importance of, reliable and flexible data collection methods and programs. FAS already utilizes various remote sensing technologies and international agricultural production data sets. Augmenting these technologies can improve FAS's ability to identify climate-related impacts such as those resulting from drought, famine, and floods to accurately forecast global production and trade. Current optical and radar satellite imagery at high spatial resolution will need to be continually updated to account for the increased severity and frequency of extreme weather events.

³ IPCC Land Report Summary for Policymakers, p. 30

⁴ IPCC Land Report Summary for Policymakers, p. 18

⁵ IPCC Land Report, Chapter 5, p. 471

Additionally, while FAS's traditional data analysis has focused on major crops in top producing countries, climate change will disproportionately affect smaller producers and developing countries, with cascading effects on food security, governance, and societies. FAS may need to increase its analysis of food insecure "hot spot" regions and climate change policies that directly, or indirectly, impact global agricultural trade. Also, because much of the agricultural data FAS utilizes is produced by the countries themselves, helping to build their capacity to produce reliable agricultural data and market information improves the host country's ability to assess and respond to the effects of climate change, and veracity of data reported by FAS posts.

Climate Adaptation Actions

Adapting to climate change will be critical for the success of FAS and our ability to implement our mission. To that end, we have a lot of existing, ongoing work that we can build upon. We have already begun to assess climate risks across our programming, received numerous voluntary climate change GAIN reports detailing foreign countries' approach to climate policy and programming in the agriculture sector, established a climate team in the FAS Office of the Administrator, and successfully promoted the role of U.S. agriculture as a leader in the climate sphere at the 2021 UN Climate Change Conference (COP26). As an agency, we continue to promote trade policies that benefit U.S. producers and create an enabling environment to export U.S. agriculture innovations and climate smart tools, while marketing the sustainability of U.S. commodities. Through various programs, FAS applies the technical expertise of USDA agencies and land grant universities, and U.S. technological innovations to build low- and middle-income countries' capacities to adapt their agricultural systems to climate change, to reduce or mitigate agriculture's contributions to climate change, and to be better enabled for international trade. Our base is strong, but there is more to be done.

FAS has identified several actions to reduce potential vulnerabilities to our mission, stakeholders, programs, and operations as a result of climate change. Adapting and building resilience to climate change is of upmost importance to ensure our work is long-lasting, impactful, and benefits U.S. farmers and ranchers. However, doing so will not be easy. There is a need to expand internal climate literacy, rework funding mechanisms, increase staffing, and increase attention to this new threat facing U.S. agriculture and trade. Now, more than ever, it will be crucial to coordinate across stakeholders, work with foreign governments, and leverage international partnerships as FAS works to ensure climate change solutions and mitigation measures are science-based, equitable, and help create more, and better market opportunities for U.S. food and agricultural exports. In addition to the narrative of actions (below), the table of actions at the end of this document provides a comprehensive explanation of action descriptions, their linkage to the aforementioned vulnerabilities, along with additional information on expected time for implementation, the lead office, and more. For clarity, we have delineated our efforts to adapt to climate change into four categories: increased capacity building and technical exchanges related to climate change; augmented internal data collection and analysis; encouraging climate-smart agriculture and trade policies; and improved USDA and USG coordination on climate issues.

A. Increased Capacity Building and Technical Exchanges Related to Climate Change

Given the international conversation around climate change, and USDA's role as a leader in the climate change and agricultural space, FAS as an initial step will adjust capacity building and technical exchanges to reflect this focus, as appropriate. However, in order for FAS to fully respond to the increase in demand for climate change technical expertise present in USDA, FAS would need to request additional appropriations for FAS programs focused on 1) advancing USDA resilient and climate smart agriculture practices and innovations, capacity building and technical cooperation in bilateral and multilateral fora that accelerate climate adaptation and mitigation in the food and agriculture sector; and 2) international SPS programs that address climate-related drivers of pest and disease. In addition, FAS can leverage existing programs such as USDA fellowships and scientific exchanges, Food for Progress and other USDA programs, along with new funding for new climate change focused capacity building that can be scaled and assist developing countries with the implementation of

adaptation strategies. This will assist FAS in strengthening efforts on food security, the trade environment, and bilateral relationships with foreign governments. Internally, developing standard operating procedures to work with other USDA agencies to share technical assistance internationally will provide a good foundation for increased and improved cooperation and coordination.

B. Augmented Internal Data Collection and Analysis

FAS will also take steps to address the need for new, or augmented, internal data collection and analysis of FAS programs. Initial steps include amending, and expanding the use of, existing screening tools to identify climate-related risks to all FAS programs. New analytical tools and data storage mechanisms or partnerships with other institutions who have such tools may be necessary to better assess impacts from extreme weather or biological events. Similarly, augmenting existing GAIN reports to address issues such as climate initiatives undertaken, food insecurity, extreme weather events, natural disasters, and to generally account for rapidly changing weather environments will improve FAS global trade reporting and information for U.S. stakeholders.

C. Encouraging Climate-Smart Agriculture and Trade Policies

Engaging in international conversations to encourage climate-smart farm policy will not only help ensure positive environmental outcomes, but also policy formulation that benefits USDA stakeholders. FAS needs to take the lead in engaging with foreign governments, and in international institutions, to guard against the implementation of measures that discriminate against imports of U.S. agricultural products and also encourage the development of policies that promote the adoption of more climate-smart agricultural practices for foreign producers. This work will keep overseas markets open for U.S. products, develop new markets for climate-safe commodities, and encourage the application of more climate-smart production practices globally. Furthermore, FAS will support industry efforts to market climate-smart commodities, in line with ongoing domestic initiatives, and highlight the sustainability of U.S. commodities and products during trade promotion activities.

D. Improved USDA and U.S. Government Coordination on Climate Issues

Another major action for FAS will be to improve coordination on climate issues across other U.S. government agencies and within USDA. Specific actions to improve coordination include developing or improving existing FAS, USDA, and U.S. government working groups; leveraging existing climate initiatives to improve bilateral trade relations and cooperation; and creating targeted lists of topics and countries to engage in the climate smart agriculture space. With its whole of government approach, FAS's participation in the President's Emergency Plan for Adaptation and Resilience (PREPARE), which aims to support developing countries and communities in vulnerable situations around the world in their efforts to adapt to and manage the impacts of climate change, will ensure coordination on pressing issues such as food security, climate information services, and water. PREPARE offers another forum for coordinated bilateral and regional engagement on climate and agricultural related technical assistance.

Cross-Cutting Adaption Issues and Considerations

FAS authority extends to the administration of USDA's export credit guarantee and food aid programs, assisting in improving income and food availability in developing nations by mobilizing expertise to support agriculture-led economic growth. FAS also works to enhance U.S. agriculture's competitiveness by providing a bridge to global resources and international organizations. The primary programs operated by FAS are market promotion, trade capacity building, and food aid. Traditionally, several of our capacity building programs are already

congressionally defined as focusing on low-income countries, many of which have large indigenous and minority group populations. For all aforementioned programs, FAS continues to take the appropriate affirmative steps to remove barriers in accessing programs, increasing program delivery, and increasing the diversity of program participants.

While developing this climate adaptation and resilience plan, FAS considered possible impacts to environmental justice communities. Capacity building and technical assistance efforts undertaken as part of this plan will continue to undergo risk assessments that consider the social, environmental, and economic impacts of proposed programming. Furthermore, in recognition of the disproportionate impact climate change is expected to have on developing countries, FAS has proposed increased capacity building efforts focused on climate smart agriculture, food safety, animal and plant health, and regulatory environments in emerging markets.

In addition, when considering promoting and recruiting for various events and positions, FAS will continue to utilize its memorandum of understanding with various minority serving institutions (Hispanic Association of Colleges and Universities, Conference on Asian Pacific American Leadership, 1890s, Wallace Carver, Thurgood Marshall). One of our proposed adaptation actions includes expanding collaboration with partner organizations and private industry to draw on external climate-related knowledge, research, and practices being undertaken. In doing so, we will also utilize this memorandum of understanding and ensure FAS collaborates with and supports minority serving institutions.

FAS seeks to continue and expand collaboration with USDA's Climate Hubs. The goal of Climate Hubs is to develop and deliver science-based, region-specific information and technologies to natural resource managers and communities, enabling climate-informed decision making and providing assistance to implement those decisions. FAS will leverage the Climate Hubs as a framework to support FAS in sharing climate adaptation science, technology, and tools. The Climate Hubs offer many resources to promote with foreign counterparts during international technical exchanges and as a way to promote U.S. best practices. In addition, the Hubs can serve as one tool to improve workforce climate literacy across the agency. FAS is prioritizing climate literacy for all staff, both in Washington, D.C., and across our Foreign Service Officers and Locally Employed Staff, to ensure our agency can respond to the changing demands of international markets and advance new market opportunities. Already in FY22, FAS has held several events and webinars related to climate change and agriculture and plan to offer a minimum of six internal training opportunities in FY22.

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Timeframe	Coordination	Progress Metrics	Accomplishments to Date
Shifting global trade patterns and decreased food security; decreased agricultural productivity; increased stress on trade infrastructure; expanded and changing incidences of pest and disease; reliable and improved data mechanisms	Establish funding for a new FAS program focused on (1) internationally advancing USDA resilient and climate smart agriculture practices and innovations through capacity building efforts, (2) international SPS capacity building and (3) technical cooperation programs that will address climate-related drivers of pest and disease risks to U.S. products and agricultural trade flows.	Proposed	GP	FY22-24	USDA Technical Agencies, Cooperators and Land Grant Universities. Coordination with USTR, DOS, FDA, EPA, USAID to determine areas of collaboration and possible leverage points.	New program concept, operational framework, budget, and funding plan developed by FY22	FAS funded and initiated ad hoc activities to advance adaptation.
Shifting global trade patterns and decreased food security; decreased agricultural productivity	Leverage Food for Progress and other FAS-administered programs to help contribute to USDA's international adaptation leadership and objectives.	Proposed	GP	FY24	USDA technical agencies, Cooperators, Land Grant Universities. Coordination with DOS, USAID, U.S. IDFC.	Food for Progress portfolio of climate-smart agriculture activities is expanded in FY22; USDA and stakeholders develop concept for new FAS adaptation program in FY24.	Food for Progress developed established climate-smart agriculture as a priority theme for new activities.
Shifting global trade patterns and decreased food security; decreased agricultural productivity; the need for systems approaches in the agriculture and forestry sectors	Develop SOP for FAS to request assistance from other USDA agencies and offices, including USDA Climate Hubs, as well as FAS internal expertise to address climate issues.	Proposed	OA	FY22	Across USDA	Finalize SOP by May 31, 2022.	N/A
All	Create a channel or adapt an existing mechanism for Posts to direct climate programming to countries.	Proposed	OA; FA; GP	FY22-23	Climate Hubs, OCE, OCS, FS, ARS, NIFA, FPAC, others. Coordinate with other USG agencies on issues related to trade, climate, and agriculture.	Mechanism for Posts to direct climate programming to their country(ies) established. Add Climate Hub training to Global Attaché Conference.	N/A

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Timeframe	Coordination	Progress Metrics	Accomplishments to Date
Shifting global trade patterns and decreased food security; decreased agricultural productivity; increased stress on trade infrastructure; expanded and changing incidences of pest and disease; reliable and improved data mechanisms.	Develop a logic model, performance indicator(s), metric method(s) and knowledge system for FAS capacity building and technical cooperation programs, to better target select markets/regions for climate adaptation and climate-related trade issue trainings and exchanges.	Proposed	OA; GMA; GP	FY22-23	USDA Coordination. Consult USG agencies on existing MEL systems for international projects/ programs.	Logic Model, performance indicator and metric methods are established by FY23 and tested by FY24.	In FY22, FAS developed a new job aid for program planning quality, including purpose (logic model) and evidence (metric).
Reliable and improved data mechanisms	Add datasets, create new analytical tools or amend existing tools (such as GADAS) to assess impacts from extreme weather or biological events (for example, pathogen spread) that impact crop production. Potentially develop an alert system informing relevant analysts of the risk.	Proposed	GMA and GP	FY22-25	ARS, OCE, NIFA; NASA, DOD, and USGS	Needs assessment of data tools completed FY22; increased training on existing or augmented data tools provided to Posts/LES by FY23; additional funding secured for GADAS and underlying databases.	Many existing applications (GADAS, Google Earth Engine, Crop Explorer) already supply decades of climate data and vegetation indices.
Reliable and improved data mechanisms	Expand big data storage/ processing capacity on a cloud infrastructure and continuous updates for satellite data and additional data streams coming online in the future.	Ongoing	GMA	FY22-25	ARS, OCE, NIFA; NASA, DOD, and USGS	Big data storage/ processing created by FY24; dedicated funding for in-house tools (such as GADAS, Crop Explorer, CropSignal) and broader USDA use and awareness of these tools.	Process is already underway for an enterprise licensing agreement (for entities such as Google) for access to cloud storage and big data processing.
The need for systems approaches in the agriculture and forestry sectors; reliable and improved data mechanisms	Create new GAIN report to capture country climate change policies, actions, and impacts. Update existing GAIN reporting requirements to account for hotspot areas of food insecurity, extreme weather events, and other factors.	Proposed	GMA, OA	FY22	None	Climate GAIN reporting instructions developed in FY22	Voluntary climate GAIN reporting completed by many Posts

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Timeframe	Coordination	Progress Metrics	Accomplishments to Date
All	Screen FAS program plans and funding opportunities for climate risks and, as appropriate, include risk analyses and risk management as criteria for implementing partners.	Proposed	GP	FY22-FY23	Across USDA, USAID	By FY2024, planning processes for FAS programs identify and address relevant climate risks.	FAS program-level climate risk assessments are initiated; FAS job aids for program planning quality are underway.
Shifting global trade patterns and decreased food security; decreased agricultural productivity; the need for systems approaches in the agriculture and forestry sectors	Engage in international conversations to encourage climate-smart trade policy and practices, and to discourage policies that reduce access to climate smart agricultural tools and/or negatively impacts minority communities.	Ongoing	OA; TPGA	FY22-25	OCE, OCS; USTR, USAID, DOS	Develop target list of top priority countries and adaptation strategies by August 31; strategize USDA's position regarding climate-smart farm policy by FY22.	Successful engagement at COP26
All	Expand internal trainings to improve FAS staff climate literacy. Expand collaboration with partner organizations and private industry to draw on external climate-related knowledge, research and practices being undertaken.	Ongoing	OA	FY22-25	Climate Hubs, OCE, OCS, FS, ARS, NIFA, FPAC, others. Coordinate with other USG agencies on issues related to trade, climate, and agriculture.	Host 6 internal training/educational opportunities in FY 2022.	N/A
The need for systems approaches in the agriculture and forestry sectors	Enhance and broaden our public facing communication and marketing plan, highlighting climate initiatives, research, and practices undertaken by FAS/USDA to promote climate programs in support of science-based decision making.	Ongoing	Comms OA	FY22-25	Across USDA. Input from interagency on joint initiatives or programs.	Climate GAIN reporting Develop 6 public facing announcements focused on climate related initiatives/projects/engagements in FY 2022.	N/A

Climate Vulnerability	Action Title/Description	Type of Activity	Lead Office	Timeframe	Coordination	Progress Metrics	Accomplishments to Date
All	Increase FAS's dedicated climate staff to administer climate-related workstreams.	Proposed	OA; Human Capital	FY22-25	None	Resources dedicated to administering climate-related workstreams have been allocated by FY23.	Establishment of OA Climate Team
All	Improve USG climate coordination, as it relates to international trade, agriculture, and climate impacts.	Ongoing	OA; TPGA	FY22-25	Across USDA and USG	Climate coordination mechanism improved or better utilized by end of FY22.	None
Shifting global trade patterns and decreased food security; decreased agricultural productivity; the need for systems approaches in the agriculture and forestry sectors; reliable and improved data mechanisms	Utilize USG and USDA initiatives, coalitions, and resources to strengthen trade infrastructure; dilute climactic impacts to international trade flows; and improve food security.	Ongoing	OA; TPGA	FY22-25	CPA external stakeholder meetings; technical agencies with roles in existing USDA initiatives/coalitions	Strategy session held in FY22 Coalition/Initiative goals in relation to strategy are defined by end of FY22	None



U.S. DEPARTMENT OF AGRICULTURE



STAFF OFFICES AND DEPARTMENT ADMINISTRATION CLIMATE CHANGE ADAPTATION PLAN

June 2022



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INTRODUCTION

In October 2021, USDA released its Action Plan for Climate Adaptation and Resilience in response to E.O. 14008 Tackling the Climate Crisis at Home and Abroad Sec. 211 and in accordance with guidance from the White House Council on Environmental Quality. This plan, otherwise known as USDA's Adaptation Plan, highlights the importance of investing in soil and forest health, stakeholder outreach and education, the development of useful and usable tools, and strategic research and innovation to ensure that America's producers, forest landowners, and rural communities are poised to face the impacts of climate change.

At the same time, USDA updated its Departmental Regulation (DR) 1070-001 Policy Statement on Climate Adaptation to reflect the priorities of the Biden-Harris Administration and the renewed urgency of addressing the already-observable and future consequences of climate change. DR 1070-001 directs the Office of the Chief Economist (OCE) to issue guidance to USDA Mission Areas, agencies, and staff offices to complete or update their own climate adaptation plans. In fall 2021, the Office of Energy and Environmental Policy (OEEP) within OCE issued guidance to agencies and offices who contributed significantly to the Department's plan and/or participate regularly in USDA's climate coordinating body, the USDA Global Change Task Force.

In accordance with USDA's mission-based approach to climate adaptation, the guidance directed each organization to consider the impacts of climate change to their mission-delivery and develop adaptation actions that address and integrate these risks into their planning, programs, operations, and management. The guidance also asked each organization about the climate-related professional development needs of their staff, how to enhance their work with USDA's Climate Hubs, and the alignment of these climate adaptation efforts to departmental initiatives on environmental justice.

Departmental offices report directly to the Secretary. They provide support to Department officials and employees at all levels, and they support USDA programs and services by working with USDA agencies, Congress, organizations, and Tribal governments. Presented here is the climate adaptation plan of four USDA departmental offices:

- The **Office of the Chief Economist (OCE)**, which provides expertise, analysis, and coordination on a wide range of Departmental activities and initiatives, including climate change, sustainability, food loss and waste, pest management policy, biotechnology, agricultural markets, and regulations.
- The **Office of Budget and Program Analysis (OBPA)**, which coordinates and directs USDA's budget, legislative, and regulatory functions and provides analysis and evaluation to support the implementation of critical policies,

- The **Office of Homeland Security (OHS)**, which leads the Department in all its programs and initiatives that support the National Preparedness Goal, including Prevention, Protection, Mitigation, Response, and Recovery, and
- The **Office of Property and Environmental Management (OPEM)**, which provides Department-wide administration, leadership, oversight, and policy in the areas of property, fleet and environmental management.

As OEEP continues its department-wide efforts on climate adaptation, it will continue to reach out to other Departmental Staff Offices, as appropriate, to help address climate vulnerabilities or seize opportunities to enhance action and collaboration on climate adaptation at the department level.



OFFICE OF THE CHIEF ECONOMIST

The Office of the Chief Economist (OCE) provides expertise, analysis, and coordination on a range of Departmental activities and initiatives. OCE conducts economic and policy analysis and advises the Secretary on the economic impacts of changes in USDA policies and programs, proposed legislation, and market conditions. Below we describe how OCE addresses the effects of climate change on USDA's mission delivery, through its sub-offices and workstreams.

Office of Energy and Environmental Policy/Climate Change Program Office

The Office of Energy and Environmental Policy (OEEP) serves as a focal point for the Department's energy, environmental markets, and climate change activities. OEEP houses the Department's Climate Change Program Office (CCPO) which works to ensure that climate change is considered and integrated into the research, planning, programs, management, and decision-making processes of the Department. CCPO represents USDA to the US Global Change Research Program and co-chairs the USDA Climate Hubs Executive Committee.

CCPO manages climate adaptation efforts across USDA, working to ensure that the Department is preparing for the current and future effects of climate change on its mission and stakeholders, including through preparation of USDA's Climate Adaptation Plan and implementation of DR 1070-001. CCPO supports USDA agencies, mission areas, and staff offices in preparing and implementing their own climate adaptation plans and is responsible for ensuring that the agencies monitor and evaluate their progress towards implementing their plans. As appropriate, CCPO will continue to work with additional USDA agencies and offices to develop climate adaptation plans.

CCPO will support the agencies by addressing common or urgent climate adaptation knowledge and data needs; examples may include initiatives related to climate literacy of USDA's workforce, climate projections to support planning and decision-making, and attribution of climate adaptation benefits to agricultural conservation practices. CCPO is also responsible for liaising with the White House on Council on Environmental Quality (CEQ) on these efforts and reporting on progress and updating the Department's adaptation plan, as directed. In addition to these primary lines of effort, CCPO will continue to coordinate with other USDA agencies, offices, and programs to elevate and mainstream climate adaptation.

World Agricultural Outlook Board

The World Agricultural Outlook Board (WAOB) coordinates, reviews, and approves the monthly World Agricultural Supply and Demand Estimates (WASDE). The WASDE also provides annual forecasts for supply and use of U.S. and world wheat, rice, coarse grains, oilseeds, and cotton. The report also covers U.S. supply and use of sugar, meat, poultry eggs and milk, as well as Mexico's supply and use of sugar.

Meteorologists in WAOB provide weather assessments and real-time yield intelligence for global crop conditions in support of the WASDE; how climate change has affected their area of responsibility is integrated into their assessments as appropriate. In addition, they are responsible for publication of the Weekly Weather and Crop Bulletin and contribute to the U.S. Drought Monitor, released weekly by the National Drought Mitigation Center. WAOB meteorologists also work with the international community through partnerships led by the World Meteorological Organization, and directly with their counterparts in partner countries as with the North American Drought Monitor.

The Chief Meteorologist serves in a leadership capacity on several interagency groups supporting efforts to make the nation more resilient to a changing climate, with a focus on drought and other severe weather conditions affecting agriculture. These include: the National Integrated Drought Information System (NIDIS), the National Drought Resilience Partnership (NDRP), and the Interagency Council for Advancing Meteorological Systems (ICAMS).

Sustainable Development

USDA's Director for Sustainable Development provides leadership in planning, coordinating, and analyzing USDA's policies, programs, and activities related to sustainable agricultural, natural resource, and community development. USDA's approach to sustainability considers the balance of economic, social, and environmental dimensions in the context of providing safe and nutritious food for all, providing decent incomes and wages for farmers and others across the food system, and conserving natural resources for the benefit of current and future populations. USDA's efforts on sustainability and climate change intersect around the idea of sustainably enhancing agricultural productivity growth to meet the world's growing food demand, while mitigating and adapting to climate change. Agricultural productivity growth helps to mitigate greenhouse gas emissions from agriculture through more efficient use of resources and reduced land conversion including reduced deforestation. Agricultural productivity growth adapted to climate change will help farmers meet the world's food needs while simultaneously conserving resources. To mobilize efforts internationally to advance sustainable productivity growth in the transition to more sustainable food systems, the United States launched the Coalition on Sustainable Productivity Growth for Food Security and Resource Conservation at the 2021 UN Food Systems Summit. Through this initiative, USDA is working with partner countries, international organizations, academic and research institutions, the private sector, foundations and other organizations to motivate the acceleration of sustainable productivity growth within and across agriculture sectors.

Food Loss and Waste

Within OCE also sits USDA's Food Loss and Waste Liaison, who works across USDA and in the interagency to advance efforts to prevent food loss and waste. In the context of climate adaptation, addressing food loss and waste can increase the resilience of the food system to shocks, like those due to climate change, while also increasing the economic resilience of producers.

Office of Risk Assessment and Cost Benefit Analysis

The Office of Risk Assessment and Cost Benefit Analysis (ORACBA) reviews risk assessments required for USDA proposed regulations that regulate issues pertaining to the environment, human health, or human safety and reviews economic analyses for USDA regulations. As the effects of climate change become more pronounced, especially related to invasive species, animal diseases, drought, wildfire, and other

risks to human health or the environment, there may be increased demands on ORACBA to review risk assessments for regulations designed to mitigate these risks or coordinate risk analyses of hazards exacerbated due to climate change.

Office of Pest Management Policy

The Office of Pest Management Policy (OPMP) develops and coordinates USDA policy on pesticides, biotechnology, integrated pest management, and other topics. As described in the climate adaptation plan of the Animal and Plant Health Inspection Service (APHIS), climate change will alter the geographic distribution and behavior of pests; thus, the work of OPMP will likely have to respond to these shifts and changes in agricultural practices as a result of climate change. OPMP supports the registration of safer, new pesticides and continued approval of older chemicals found to be safe under regulatory review. These products are needed to address pests and diseases in new geographic areas, including biological pesticides that have reduced environmental impacts.

USDA's Biotechnology Coordinator sits within OPMP and supports the development, coordination, and implementation of USDA's biotechnology policy. Agricultural biotechnology can be an important tool for addressing the causes and consequences of climate change. For climate adaptation, agricultural biotechnology can be used to develop plants and animals that are adapted to increased temperatures, drought, new diseases, and other stressors. OEEP and OPMP will continue coordinating to ensure that their efforts are complementary in supporting the needs of farmers and other producers in a changing climate.



OFFICE OF BUDGET & PROGRAM ANALYSIS

The Office of Budget and Program Analysis (OBPA) is a Departmental Staff Office within USDA whose mission is to ensure that USDA programs are delivered efficiently, effectively, and with integrity by incorporating performance, evidence, and risk into decision making while simultaneously advocating for necessary budgetary resources and executing the budget to ensure that USDA can effectively and efficiently accomplish its mission for the benefit of the American people.

In accordance with E.O. 14008 Tackling the Climate Crisis at Home and Abroad and the Department-wide Action Plan for Climate Adaptation and Resilience, OBPA has developed its own adaptation plan to best address climate change within its functions. OBPA will ensure that employees have basic climate literacy, especially within their Mission Area or agency, to understand how to build climate change programs within the context of the budget. Additionally, while OBPA does not deliver programs like other mission areas within the USDA, it leads the Department's strategic planning process, enterprise risk management, performance management and reporting, budget analysis and review, and legislative and regulatory process. With these overarching functions, OBPA can provide support for the Department's Action Plan for Climate Adaptation and Resilience in the following ways:

- **Strategic Planning, Performance, and Evidence Building.** OBPA coordinates the development of many Department-wide documents, such as the USDA Strategic Plan, Annual Performance Plan and Report, Learning Agenda, Capacity Assessment, and the Annual Evaluation Plan. OBPA engages with USDA senior level leadership as well as Mission Area staff across the Department to ensure cross departmental collaboration. The 2022 -2026 USDA Strategic Plan supports the Department-wide Climate Adaptation Plan and USDA leadership's commitment to address the climate change crisis by setting its first strategic goal to "combat climate change to support America's working lands, natural resources, and communities." This is to be accomplished through measurable objectives such as increasing the sustainability of our forest, crop, and livestock systems by deploying climate and environmentally smart management practices and increasing carbon sequestration practices to reduce greenhouse gas emissions. OBPA will partner with the various Mission Areas to develop performance metrics that accurately track progress towards climate change related activities and ensure USDA can measure progress in meetings its goals by looking at quarterly strategic updates.

OBPA will also work closely with agencies such as the Natural Resources Conservation Service (NRCS), Forest Service (FS), Office of the Chief Economist (OCE), Office of the Chief Scientist (OCS), Research, Education, and Economics (REE), and Office of Property and Environmental Management (OPEM) to identify the current evidence building activities and learning gaps in crosscutting priorities such as climate change, environmental justice, etc. through the development of the Department's Capacity Assessment and Learning Agenda. OBPA will

encourage cross collaboration in evidence building efforts and ensure activities are being accounted for in the development of the Strategic Plan and implementation strategies.

- **Enterprise Risk Management.** OBPA is currently developing the framework for USDA's Enterprise Risk Management program, led by OBPA's Director who is named as USDA's Chief Risk Officer. OBPA will engage with leadership across the Department to identify different risk classes that are threats to strategy, mission support, and overall governance. The risk framework will allow for all Mission Areas to identify risks, categorize them in a coordinated approach, and allow for a holistic vision to address cross-Departmental risk such as climate change. Once the framework is fully developed and implemented, Mission Areas will be able to proactively identify the risk posed by factors such as climate change. OBPA will ensure that stakeholders have a clear understanding of their roles and responsibilities, as well as assist Mission Areas in identifying opportunities to leverage climate mitigation approaches and incorporate more data-driven decision making by creating measurable risk indicators.
- **Budget Formulation Process.** OBPA creates guidance for agencies to develop and formulate their budget estimates. In order to address pressing climate change needs, OBPA will provide guidance and direction for agencies to establish climate change activities as priorities that are detailed in their budget submissions. In the Chapter 11, 12, and 13 guidance that is sent out to the mission areas and agencies, OBPA will ask agencies to highlight the climate change activities occurring across the Department and incorporate the goals of the Departmental adaptation plan in the justifications. OBPA already began incorporating performance elements into the FY23 budget process at the agency estimate and department estimate stages and will continue working with Mission Areas to ensure that their performance metrics align with the Strategic Objectives laid out in the Strategic Plan. Additionally, OBPA will continue to feature climate change crosscutting activities in the annual budget summaries that are released with the President's Budget and provide examples of climate change related increases in the Budget.
- **Budget Data Collection and Requests.** OBPA works with OMB and USDA leadership to coordinate Department-wide budget data requests and crosscuts to report on funds spent on US Global Change Research Program, Clean Energy and Emission Mitigation, Climate Adaptation and Resilience, International Climate Assistance, Justice 40, etc. This includes close coordination with OCE to set definitions and guidelines to ensure that data collection is helpful and accurate. While this data is currently collected more retrospectively, OBPA will more proactively leverage the climate funding data to inform decision making and program investments during budget formulation. This can help provide a more complete picture for policymakers to evaluate climate change programs and align budgetary resources accordingly. This will build up on the role that OBPA has already played in coordinating climate hub funding across Mission Areas. OBPA is also working closely with the Office of the Secretary to implement the Justice40 initiative, a response to section 223 of E.O. 14008, by providing support in developing a benefit calculation methodology and overall coordination and implementation.
- **Regulatory and Rulemaking.** Executive Order (EO) 13990, "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis," directs all federal agencies to immediately review and take action, as appropriate and consistent with applicable law, to

address any regulations or other actions from the previous Administration that conflict with national objectives to combat the climate change crisis, and propose new regulations to establish the comprehensive standards of performance and emission guidelines for methane and volatile organic compound emissions. As such, OBPA has been assisting Mission Areas in identifying any existing regulations, orders, guidance documents, and policies that are inconsistent with national objectives and by providing comprehensive support and review for the addition or rescission of regulations to further the objectives of the EO.



OFFICE OF HOMELAND SECURITY

The vital mission of the Office of Homeland Security is to mitigate risk and safeguard USDA personnel, customers, assets, and information by leading government-wide initiatives and championing USDA's equities in homeland and national security. OHS leads the Department in all its programs and initiatives that support the National Preparedness Goal. This includes all Departmental activities that fall under the Goal's five mission areas of Prevention, Protection, Mitigation, Response, and Recovery. As a department with worldwide equities, USDA faces a variety of challenges in a diverse threat environment. OHS provides coordination on security policy of the Department including Homeland Security, Agro-Terrorism, and serves as liaison with the Intelligence Community. As a department with an extremely diverse workforce, USDA faces a variety of challenges to support the daily operations of its employees. In a rapidly changing threat environment, OHS must provide coordination and leadership on security policy activities and information to the USDA community including Insider Threat, Continuity of Operations, Emergency Response, and the proper management of radiological materials.

Component Missions

Office of the Director (OD). The OD oversees OHS's five Divisions, provides regular updates to the Office of the Secretary, the Assistant Secretary for Administration, and the Subcabinet, and coordinates all budget, procurement, human resources, and other cross-divisional initiatives. OD champions the security and protection of USDA workforce and facilities by chairing the USDA Security Council and partnering with all Agencies to strengthen security for USDA locations. OD serves as the Departmental Continuity Coordinator for all continuity of government events. The National Security Systems Program Office provides the Secretary of Agriculture, Executive Staff, Staff Offices, and Agencies with the ability to communicate Classified National Security Information (CNSI) within, and external of the Department in a secure and cost-effective manner; and ensures that the requirements as directed by the White House, for the Continuity of Operations (COOP) and the Continuity of Government (COG) are met.

Continuity of Planning Division (CPD). CPD assists the USDA Continuity Coordinator with providing oversight and coordination of the development and administration of the Department Continuity Program. This includes:

- Providing guidance and direction regarding continuity of operations to the Office of the Secretary, Departmental staff offices, mission areas, and agencies.
- Representing and acting as a liaison for the Department in contacts with other Federal entities and organizations concerning matters of assigned continuity program responsibilities.
- Overseeing the Department continuity of operations and emergency relocation facility planning, development, equipping, and preparedness to ensure that resources are in a constant state of readiness.

Emergency Programs Division (EPD). EPD serves as the focal point for emergency management and coordination of senior leadership notification and awareness to responses to natural or man-made disasters within the scope of the USDA mission.

EPD manages the 24/7 Operations Center which assists in the development and coordination of policies, capabilities, and procedures for reporting and alert notification of emergencies impacting the USDA mission or personnel globally.

National Security Division (NSD). NSD coordinates with USDA agencies to deliver a unified voice to the White House and interagency on national security policy initiatives which align with USDA's mission areas; collaborates with Food and Agriculture Sector partners to protect the Nation's critical infrastructure from all hazards and emerging threats; and works to enhance the preparedness, mitigation, resilience, and response activities of the agricultural sector.

NSD also provides strategic warning and orchestrates policy to counter threats to address national security; seeks to deter, prevent, detect, and mitigate threats in order to protect intellectual capital and classified national security information from exploitation, compromise, or other unauthorized disclosure; and provides direct support to the impact of investment of foreign business environments to our economic viability.

Personnel and Document Security Division (PDSD). PDSD focuses on safeguarding national security information within USDA, managing security clearances, and determining Suitability for Employment for USDA employees in public trust positions.

PDSD is responsible for establishing and implementing USDA's classified national security program to safeguard national security information.

PDSD provides oversight to USDA Agencies concerning classified information and Controlled Unclassified Information (CUI) and controls access to classified information by establishing and implementing USDA's Access to Classified Information program.

Radiation Safety Division (RSD). The RSD is the operational radiation safety office for all of USDA; implementing policies and procedures established by the USDA Radiation Safety Committee to ensure the safe acquisition, use, and disposal of ionizing radiation sources within USDA.

RSD provides technical assistance to all of USDA during its response to nationally significant radiological emergencies (such as nuclear power



plant accidents). RSD coordinates USDA's participation on the Federal interagency Advisory Team for Environment, Food, and Health; providing human health protective action recommendations to State, Tribal, and local governments during radiological emergencies.

Climate Change Effects and Vulnerabilities

In accordance with E.O. 14008 Tackling the Climate Crisis at Home and Abroad and the Department-wide Action Plan for Climate Adaptation and Resilience, OHS has developed its own adaptation plan to best address climate change within its functions. OHS will ensure that employees have basic climate literacy, especially within their own OHS office, to understand how to build climate change programs within each office area in the following ways:

Interagency Coordination. OHS recognizes that there is an increasing need for more intensive interagency coordination due to increased severity and duration of weather impacts that affect all areas of OHS including continuity of operations planning, interagency policy development, and emergency response and recovery. OHS will enhance interagency coordination at meetings with Agency Emergency Coordinators, Continuity Coordinators, and Security Council to focus on the potential impacts of climate change on USDA emergency response and recovery, COOP planning and policy development.

Importance of Intelligence Briefings. OHS will ensure that intelligence briefings provided by the National Security Division (NSD) incorporate the latest information related to the five climate vulnerabilities outlined in the USDA Action Plan for Climate and Adaptation. These vulnerabilities are based on prior vulnerability assessments by USDA and the best understanding of the threats posed by climate change and its impacts in the Fourth National Climate Assessment. OHS will also incorporate I.C. Products into briefings related to the climate vulnerabilities outlined in the USDA Action Plan for Climate and Adaptation that can be shared with varying levels of USDA leadership.

Operations Center Importance. OHS recognizes that there is an increasing workload for our 24/7/365 Operations Center due to longer and more intense fire, flood and hurricane seasons resulting in need to operate at a higher tempo for longer durations of time. In the future, there may be a need for different staffing patterns or additional personnel. OHS will examine flexibilities with our current Operations Center contract to allow us to expand personnel as needed during fire, flood and hurricane seasons. Recognizing the importance of GIS software to track impacts, OHS will work with interagency partners on enhanced GIS products and share information in a timely manner.

Agency Alternative Sites. OHS will ensure that agency alternative sites have properly accounted for risks posed by climate change, specifically concerning threats that may not have been considered (or considered using a very different model) when sites were originally chosen. This includes considering the potential for intense and severe heat. OHS will work closely with the Agency COOP Coordinators to ensure that they are accounting for the risks posed by climate change to their alternate sites.

Headquarters Building Potential Impacts on Operations. OHS operations are increasingly vulnerable to the flooding risk posed to USDA HQ Department's Emergency operations by having many of its offices in the basements of the Whitten and South Buildings, which have been known to flood. OHS will continue to exercise alternate work opportunities for watch officers so that they can perform the majority of their work from HQ and alternate locations.

Collaboration. OHS will ensure that we collaborate closely with our USDA and external partners and their own climate initiatives. Whenever possible OHS will incorporate identified climate change threats and vulnerabilities into the Department's Emergency Response and Preparedness Exercise Program to enhance climate literacy and incorporation of climate considerations into USDA and its agencies COOP and COG planning. This can provide an important avenue for USDA employees to practice integrating climate preparedness into USDA's mission, programs, operations, and management.

Resilience. OHS will continue to assess climate vulnerabilities pre and post disaster, ultimately to build resilience.

Climate Hubs. OHS will continue to support Climate Hubs interactions with the diverse offices within FEMA and find audiences for their vital climate information.

OFFICE OF PROPERTY AND ENVIRONMENTAL MANAGEMENT

The Office of Property and Environmental Management (OPEM) provides Department-wide administration, leadership, policy, and program oversight in the areas of property, fleet, and environmental management. This includes issuing guidance and policy, managing data, leasing oversight and compliance; real property management; fleet and aviation management; environmental response and restoration; environmental compliance; and sustainable operations for energy and water, sustainable buildings, solid waste and recycling, sustainable acquisition, and electronic stewardship. To successfully accomplish its mission goals, OPEM recognizes that it is critical to incorporate climate change adaptation and to address climate change in its operations.

In the January 27, 2021, Executive Order (EO) 14008 Tackling the Climate Crisis at Home and Abroad, President Biden laid out a vision for a United States governmentwide approach. This approach is based on a set of coordinated domestic actions to address the risks and opportunities posed by climate change. In EO 14008, the White House directs USDA to submit an action plan with steps to bolster adaptation and increase resilience to the impacts of climate change across our mission and operations. USDA published its Climate Action Plan in October 2021.

Previously, in 2014, in response to EO 13653 Preparing the United States for the Impacts of Climate Change, USDA wrote its first overarching Climate Adaptation Plan. The plan included a vision for integrating climate change considerations into operations and mission objectives in the context of



USDA's strategic goals. Since 2010, the OPEM has developed the USDA Sustainability Plan annually. In this plan, USDA reports on its progress in sustainable operations, and provides the necessary strategies to increase its climate adaptation and resilience as well as sustainability levels.

In 2021, USDA leadership drafted a 2022-2026 USDA Strategic Plan to align with the Biden- Harris Administration's priorities, including to address climate change. Subsequently, the OPEM has developed its internal Strategic Operations Plans and Key Performance Indicators to lead and assist USDA agencies and staff offices to achieve the USDA strategic goals.

The OPEM develops this Climate Adaptation Plan to meet the requirement of Departmental Regulation 1070-001. This Climate Adaptation Plan identifies how climate change is likely to affect the office's ability to achieve

mission, operations, and program objectives, to develop and prioritize actions integrating climate risks into strategic planning and decision-making, and to implement and evaluate progress. To measure progress towards achieving climate adaptation goals, OPEM is to develop metrics relevant to its mission and adaptation strategies.

OPEM Climate Vulnerabilities

Climate change increases vulnerabilities and presents many additional challenges to OPEM and its agencies. OPEM's program management vulnerabilities arise from diminished resources availability to functions and decision making in managing multiple OPEM programs, including facilities energy and water, sustainable buildings, managing real and personal property, as well as fleet vehicles, sustainable acquisition, and environmental response and restoration.

Climate change threatens facility operations as well as resources and infrastructure availability. The increasing frequency and intensity of extreme weather events challenge OPEM's mission and the department's external-facing mission. OPEM identifies the following climate vulnerabilities building on prior USDA vulnerability assessments.

USDA mission-related stresses, energy, water, and natural resources availability

Resource availability is threatened by climate change, including quantity and quality of energy and water available. Climate change impacts on the water cycle results in reduced water supply, degraded water quality, more intense and frequent drought, and more intense and frequent flooding. This results in operational and mission accomplishment challenges and threats to resilience. Key threats and impacts related to energy and water infrastructure include threats to OPEM customer agencies' land and facility management in these areas:

- **Energy and water availability.** The energy and power supply at many USDA facilities are susceptible to the increased frequency and severity of storms. Dual fuel equipment is critical for USDA's remote buildings, as these remote facilities require secondary fuels as a backup. USDA's beneficial operations rely on fossil fuels for heat, usually interruptible natural gas supplies, which are frequently subject to supply shortages. Outages can result in damage to heating equipment and extremely high costs.
USDA owns miles of aging overhead and underground electrical wiring, steam pipes, natural gas pipes, and domestic water and sewer lines, which are vulnerable to severe weather events. This infrastructure requires periodic maintenance to improve and maintain reliability, functionality, and resilience.
- **Surface water quality and availability.** High-intensity wildfires introduced by weather extremes and drought can cause erosion rates at much higher rates than lower-intensity fires due to destruction of the litter layer. A heavy rainstorm following a wildfire can cause excessive runoff and erosion, depending on the local soils and topography, whereas light rain could have minimal impact and increase plant growth. The streams, rivers, or lakes within a watershed can experience increased sediment loading following a wildfire. Runoff from erosive upland areas can transport sediment to surface waters. Eroding stream banks can also contribute sediment if increased runoff volumes have altered the physical characteristics of a stream channel, such as

width, depth, and cross-sectional area, to the point the stream channel becomes unstable. The loss of vegetation that, prior to the fire, helped hold stream banks together can also lead to bank instability and erosion. Increased sediment loads in surface waters can affect aquatic habitat, food webs, fish spawning grounds, and, in severe cases, can directly cause fish kills.

- **Riparian, aquatic, and terrestrial ecosystems.** Changes in climate and the water cycle are affecting aquatic and riparian ecosystem structure and function, potentially resulting in loss of at-risk species, new species being put at risk, the introduction of additional or expansion of existing invasive species, and the establishment of new diseases and pathogens. Declines in forest health because of drought, excess soil moisture and flooding will lead to increased vulnerability to natural disasters such as wildfires, severe storms, and forest insect and pathogen outbreaks. These natural disasters will impact OPEM customer agency's operations and mission.
- **Target existing programs to support water issues.** Projected changes in water availability will require programmatic shifts to address emerging needs.

Supply chain disruptions in procuring supplies and services that fulfill sustainable acquisition requirements

OPEM leads USDA efforts to comply with sustainable acquisition requirements by implementing policies and practices to purchase energy efficient, sustainable, and USDA- designated biobased products in compliance with statutory requirements and the Federal Acquisition Regulation. USDA reports annual progress on meeting sustainable acquisition requirements and monitors USDA agency progress quarterly. Climate change can cause supply chain disruptions for procuring any supplies and services. This can affect the department's ability to obtain products and services that comply with sustainable acquisition requirements and reduce the department's ability to meet those requirements.

Stress on facilities, fleet, infrastructure, and federal land

Climate change causes more frequent and intense disruptive events, including hurricanes, floods, drought, and fires, which can have significant impacts. The increasing frequency, severity, and extent of extreme events have far-reaching consequences on facility and fleet operations, on supply chains, and on natural and built infrastructure on National Forest System and other federal lands. Increasing flood frequency, wildfire intensity, sea level rise, and extreme precipitation events can damage low-elevation infrastructure and utilities, threaten engineered solutions on environmental restoration sites, degrade air quality, and endanger coastal communities.

- **Facility operations.** Extreme events such as floods, wildfires, sea level rise, and storms can disrupt access to and safe use of USDA facilities, as well as resource availability. Adaptation strategies include assessing sustainable buildings, proactively engineering and building structures to account for extreme events, and building-in workplace and system redundancies. In addition, to help USDA agencies adapt, the department must position itself to write facility planning, construction, and operations guidance that accounts for these climate stresses.
- **Fleet operations.** Climate change and extreme weather events pose significant, ongoing challenges and risks to fleet operations. Fleet-related assets can be affected by climate change

as they are exposed to weather conditions while their protection or adaptation requires substantial planning and investment. Changes of the current climate conditions that can affect fleet operations include sea level rise, increase of the intensity and frequency of storms and winds, increase of temperature, changes in the intensity and frequency of extreme precipitation events, floods, and droughts. Potentially vulnerable to these changes are both infrastructure and operation, while the impacts can be either permanent from loss of infrastructure, or temporary from disruption of services.

Fleet operation disruptions primarily arise from the effects that cause an immediate and extended loss of electric power. Following these disruptions, the infrastructure, notably the fueling stations, becomes unusable. As a result, the vehicles themselves are unavailable, inaccessible, or inoperable resulting from physical damage, or not reliable and performance-ready for the length of a sustained outage.

One major disruption to fleet operations is the effect of extreme weather events that heavily impact fuel and its corresponding transport, delivery, storage, and dispensing infrastructure. Regardless of infrastructure designs meant to handle the assortment of stresses along their useful life, increases in the frequency and severity of extreme weather events will, nonetheless, increase the rate of their deterioration. Structural damage resulting from severe weather can also impact the service life of the vehicles themselves.



Environmental cleanup

Extreme weather events can undermine the effectiveness of the engineered remedies that are designed to protect human health and the environment at remediation sites. Flooding, drought, and fire can adversely affect the original site remediation design. These events can also impact the site characteristics that formed the basis of the design. Affected site characteristics may include contaminant toxicity, exposure, organism sensitivity, and contaminant fate and transport. Similarly, the long-term operations, management, and stewardship of remediation sites are vulnerable to extreme weather events. As a result, climate change can not only decrease the effectiveness of the remedy, but also increase the cost of cleaning up contaminated land. Increased temperatures increase the mobility of contaminants in soil, water, and air. Adverse weather events can delay operations and damage

equipment. Increased flooding and changes in drainage patterns could render contaminated areas inaccessible or alter migration pathways, distributing contaminants over a wider area.

Stress on vulnerable and underserved communities

Climate change is likely to disproportionately impact vulnerable and underserved communities via several pathways. These include:

- **Environmental Sustainability and Human Health.** Many communities who are exposed to the impacts of climate change are already burdened by air and water pollution and other environmental health hazards. The impact of climate change on hazardous waste sites could increase exposure to pollutants in vulnerable underserved communities.
- **Ecosystem services and livelihoods.** Climate change threatens community ecosystem services including clean air and water, subsistence foods, medicine, fiber, fuel, and cultural services. Rural communities and migrant workers are particularly vulnerable to climate change impacts.
- **Extreme weather event impacts.** The impacts of extreme weather events influenced by climate change are expected to have a disproportionate impact on populations lacking resources to cope with economic and environmental shocks and uncertainty. Risk-prone communities face cumulative exposure to multiple pollutants and climate event impacts. Extreme weather could flood risk-prone communities with contaminated water.

See the Environmental Justice discussion in Part III OPEM Priority Adaptation Actions.

OPEM Priority Adaptation Actions

OPEM will implement following priority adaptation actions via its programs mission relative to USDA operations and management of real property, federal land, sustainable procurement, fleet and environmental protection.

Enhance workforce climate information sharing and literacy

OPEM acts to enhance climate information sharing and literacy efforts, both internally and externally to assist USDA agencies. USDA will use its Sustainable Operations Council and various interagency working groups to facilitate information sharing and climate literacy through the agency and office senior leaders and program managers.

OPEM will leverage existing communication channels to provide information on and increase awareness of the value of adopting and applying climate-smart adaptation strategies. Also, OPEM will foster discussion of climate change adaption strategies specific to its programs including to:

- As a priority, share climate information regularly in the quarterly USDA Environmental Coordinator's meeting. This meeting includes USDA Environmental Program Leads representing each mission area, agency, and staff office that addresses USDA environmental issues;
- Communicate, in OPEM work group meetings and directly with staff, regarding the science of climate change and effects of climate change policy on USDA programs. Raise awareness of climate change influences and impacts on USDA practices; and
- Highlight information on climate change and adaption resources and training offered by other federal agencies as part of the Quarterly EnviroPost Newsletter distributed widely across USDA.

Develop USDA climate-smart policy and guidance to incorporate climate risk considerations

OPEM incorporates climate adaptation in the departmental policies and guidance to assist agencies to implement climate-smart policies and practices for effective adaptation, mitigation, and resilience. This will effectively increase sustainability and operational adaptation strategies. Many collaborative actions already exist or are positioned to begin soon, using existing resources and programs.

Additional efforts will enable OPEM to effectively address actions that rely on new data or expertise or require significant program enhancements. In the near-term, OPEM measures progress using existing systems, and can use existing data to plan for climate risk considerations in policies and practices.

OPEM will take the following actions to manage climate-related risks:

- Evaluate and monitor climate risks to facilities, fleet, and property acquisition processes,
- Implement incentives to encourage mitigation, resilience, and adaptation practices,
- Implement procedures that facilitate access to energy, water, and other natural resources, and
- Provide guidance and an online compilation of resources for the mitigation of climate risk to cleanup actions.



Issue policy and guidance to increase facility energy and water resilience

OPEM will issue policy and guidance to USDA agencies to support facilities' energy and water management adaptation actions that lead to enhanced climate resilience. These actions include:

- **Increase onsite renewable energy capacity and installation of microgrids.** OPEM will issue policy and guidance to increase onsite renewable energy capacity and install microgrids to improve resilience at its facilities. This will include guidance for transitioning from propane/diesel generators to mobile solar energy systems with battery backup at remote sites and installing solar panels to enable facilities to operate off-grid; and using energy performance contracts to install solar energy equipment, geothermal energy systems, and microgrids at remote facilities to mitigate impacts from future storms. This guidance will help reduce the cost of electricity and eliminate the dependence on unreliable and poor-quality power at remote sites.

- **Improve the condition and resilience of government owned infrastructure.** OPEM will issue guidance for performing leak tests on water systems that show inconsistent consumption or lack of integrity, conducting cost-effective maintenance and repair on equipment and infrastructure, and establishing and maintaining good communications with local utility providers.
- **Switch fuel types, use dual fuel equipment, and reduce the carbon footprint of facilities.** OPEM will issue guidance for converting to dual fuel heating equipment, selecting secondary fuel types with the best GHG emission ratings, and converting heating equipment from fossil fuels to electric heat pumps that can be powered by solar panels.

Develop and implement an Energy Management System

OPEM will develop and implement an ISO 50001-based Energy Management System (EnMS) to integrate sustainable energy and water management into USDA's policies and practices. An EnMS will help provide a framework for USDA to develop policies, objectives, and actions for more efficient use of energy and water. An EnMS will enable USDA to better manage its energy and water needs and infrastructure, while also maintaining the capacity to adjust its essential energy and water use to the effects of climate change.

Foster strategic planning for climate adaption and resilience in cleanup projects

OPEM will include a requirement to evaluate climate impacts and opportunities to incorporate sustainable practices in all requests for funding from the Hazardous Material Management Account. USDA agencies will be required to demonstrate a consideration for adaptive and resilient design as part of the project funding process. Strategic goals for cleanup projects should emphasize approaches to address climate vulnerabilities, such as the following examples:

- Design and construct remedial systems to handle severe storms, flooding, wildfire, and other impacts that are expected to result from a warming climate,
- Model design solutions based on future climatic conditions as much as possible, rather than relying on past data,
- Create systems that will maintain working conditions in the event of extended loss of power or heating fuel through energy load reductions and reliance on passive heating and cooling strategies (passive survivability),
- Optimize the use of on-site renewable energy,
- Carry out water conservation practices and rely on annually replenished water resources, including, potentially, harvested rainwater, as the primary or backup water supply,
- Find opportunities to use gray water, defined as domestic wastewater excluding sewage, for plant irrigation, or for toilet flushing as required on-site,
- Specify products and materials that will not off-gas or leach hazardous substances in the event of flooding or fire damage, and
- Provide redundant electric systems with at least minimal back-up power capacity, such as a fuel-fired electric generator with adequate fuel storage or a solar-electric system with islanding capability.

Build climate change resilience in USDA facilities and on USDA land

OPEM will build resilience across the real property portfolio, emphasizing those assets found to be most vulnerable to climate change impacts. OPEM will take action to:

- **Implement priority USDA real property resilience projects.** Assess asset-specific resilience requirements throughout USDA's real property portfolio and plan and develop resilience projects, prioritizing assets that are found to be most vulnerable to climate change impacts,
- **Integrate climate adaptation into sustainable facility and fleet policy, practice, and guidance.** OPEM integrates adaptation and resilience actions related to operations, sustainable construction, and sustainable acquisition,
- **Leverage existing USDA collaboration mechanisms.** OPEM continues to lead collaborations across the department,
- **Increase support for research and development of climate-smart facility and fleet practices and technologies.** USDA will act to encourage agency research and development of climate-smart facility and fleet practices,
- **Enhance green infrastructure and use a landscape-wide approach to address water issues at USDA land.** OPEM shares information on using green infrastructure technologies and practices to enhance natural water infiltration and decrease surface runoff and downstream flooding on USDA land. Successful adaptation actions are integrated contiguously across landscapes to manage water resources and restore ecosystems to enhance their climate resilience. OPEM will assess requirements, plan, and develop green infrastructure projects, and prioritize sites that are found to be most vulnerable to climate change impacts from extreme events, and
- **Explore innovative technologies and approaches.** Innovative technologies and approaches help USDA agencies to follow sustainable practices. For example, in conserving and managing the department's water and energy resources, reducing its greenhouse gas emissions, and in minimizing the USDA fleet's carbon footprint. OPEM supports innovative technologies and approaches. These will help USDA to reduce lifecycle costs, improve fleet efficiency, and meet environmental goals.

Enhance operational climate resilience in facilities, on sites, and in fleet

In response to the threats and impacts to OPEM's internal operations and mission, OPEM will work internally on operational resilience & externally with its counterpart agencies to integrate adaptation, mitigation, and resilience actions. USDA will facilitate integrating these agency actions into installation, building, facility, fleet, and natural and built infrastructure operations and management.

OPEM will continue to improve the climate resilience of sites and facilities and implement its Departmental Regulation for sustainable operations of sites and facilities. OPEM is responsible for coordinating with



agencies, setting annual strategic goals, developing actions, and measuring progress by creating agency scorecards for improvement. OPEM will construct and operate a climate-ready USDA real property portfolio, acting to:

- **Leverage OPEM sustainability policies.** The department is raising its standards for design, construction, operation, and maintenance of facilities and infrastructure by increasing renewable energy use and equipment efficiencies to conserve energy and reduce its GHG footprint,
- **Elevate building performance levels.** New buildings are required to perform 30 percent more energy efficiently than the industry standard. Over 45 percent of USDA-owned buildings with 10,000 gross square feet and larger are required to meet the Guiding Principles for Sustainable Federal Buildings. USDA uses third-party certification systems such as LEED or Green Globes to validate its green buildings,
- **Build with sustainable construction materials.** For construction materials, USDA prefers wood for new buildings due to its capacity for lower embodied energy and its carbon sequestration potential. Equipment performance is monitored throughout system lifecycles,
- **Select sustainable and environmentally equitable real property facility locations for leased and owned buildings.** USDA increasingly locates sustainable facilities that are third-party certified green and ENERGY STAR facilities with access to public transit. However, to meet its mission, USDA often leases facilities in remote and rural markets with limited options. USDA will achieve further emissions reductions in facilities in the future by building community climate resilience and sustainability, and



- **Practice operational resilience relative to flooding and rising sea levels.** USDA chooses utility equipment and central data center locations so as to improve operational resilience to flooding and rising sea levels. These centers feature direct digital controls, thermal aisle design, emergency power, and redundant cooling for continuity, lower operating costs, and higher capacities.

Transition to a low-emissions fleet and telematics rollout

OPEM is committed to reducing the fleet's carbon footprint in USDA. This effort includes using acquisition strategies to identify and eliminate inefficient vehicles and replace them, as needed, with vehicles that use less petroleum per mile and use alternative fuels where available. Looking ahead, OPEM plans to incorporate fleet replacement initiatives to transition from fossil fuel vehicles to a combination of biofuels, fully electric, and hybrid-electric vehicles to reduce costs, improve fleet efficiency, and meet environmental goals. OPEM will also identify locations to install biofuel and electric vehicle infrastructure.

USDA is expanding the rollout of telematics technology. Increasing the number of vehicles with telematics devices installed will support replacement strategies by helping to identify and match ideal petroleum-fuel vehicle candidates for conversion to plug-in hybrids and all-electric vehicles. Telematics technology will also help to identify prime locations for electric vehicle charging stations. Leveraging telematics technology will support the agency's key aims of optimizing vehicle performance; improving safety; increasing efficiency; reducing operating costs; and streamlining compliance with minimizing its environmental footprint.

Prepare for climate-ready supply of sustainable products and services

OPEM will work with USDA mission areas and agencies to determine the potential for increasing the resiliency of supply chains for products and services that comply with sustainable acquisition requirements, and steps that can be taken to improve the availability of those products across USDA. This has the potential to help agencies source sustainable products such that they will be available when needed, and despite any weather events that might disrupt supply chains, thus improving resilience. This will be discussed at USDA's Green Purchasing Work Group, which is led by OPEM and comprised of representatives from USDA Agencies that report data to the Federal Procurement Data System on sustainable acquisition.

Environmental Justice

OPEM will focus on environmental justice in Hazardous Materials Management Appropriation (HMMA) funding to meeting the Environmental Justice 40 initiative, and in real property facility location selections, acting to:

- **Address adaptation limitations and constraints within vulnerable communities through HMMA funding allocations.** Forty percent of HMMA funding will be allocated to disadvantaged communities in accordance with the Environmental Justice 40 initiative. Socially disadvantaged, low-income, minority, and rural populations as well as American Indians, Alaska Natives, and sovereign Tribal governments are more likely to be vulnerable to the impacts of climate change.

These communities' ability to adapt to a changing climate is often limited by financial, social, and other constraints. Providing HMMA funding to these communities will help minimize impacts of climate change on contaminated sites.

- **Select customer-friendly real property lease locations.** The OPEM Lease Compliance Officers (LCOs) consider access by disadvantaged community customers when working to select the best facility locations. In selecting facility locations, OPEM addresses how to best serve disadvantaged communities by:
 - Collaborating across the department with USDA community outreach agencies, such as the Office of Civil Rights, the Office of Small Disadvantaged Business Utilization, the Farm Services Agency, and Rural Development,
 - Supporting all USDA agencies in their work directly with tribal and other socially disadvantaged communities, and
 - Serving USDA disadvantaged community customers, by providing space in these specific locations in conjunction with state contract officers.

USDA will demonstrate, in implementing this Climate Action Plan, how adaptation actions lead to greater resilience, both internally and externally for the Department's stakeholders. USDA is addressing emerging and future climate risks and adjusting its efforts and resources to prepare USDA mission stakeholders for climate resilience in both rural and urban communities.

TABLE 1: OCE CLIMATE ADAPTATION ACTIONS

Action	Lead Office	Coordination	Accomplishments to Date
Climate Adaptation	OEEP/CCPO	USDA & interagency	<ul style="list-style-type: none"> May 2021 Revision of Departmental Regulation 1070-001 October 2021 release of USDA's Action Plan for Climate Adaptation & Resilience USDA Climate, Agriculture, and Forestry Seminar Series (ongoing) Inclusion of climate adaptation in USDA's 2022-2026 Strategic Plan
Drought Coordination	WAOB Meteorologists	USDA & interagency	<ul style="list-style-type: none"> Coordination with Climate Hubs on upcoming Cooperative Agreement with the National Drought Mitigation Center Actively partnering with Intergovernmental Council on Advancing Meteorological Services to produce a survey of Federal weather and climate networks Maintaining leadership roles in the National Drought Resilience Partnership and the National Integrated Drought Information System Rotating authorship of US Drought Monitor and North American Drought Monitor
Sustainability	OCE	USDA, State, USAID	<ul style="list-style-type: none"> The United States launched the Coalition on Sustainable Productivity Growth for Food Security and Resource Conservation (the SPG Coalition) in 2021 at the United Nation's Food Systems Summit to mobilize action to accelerate the transition to more sustainable food systems through productivity growth that optimizes agricultural sustainability across social, economic, and environmental dimensions The SPG Coalition has over 90 members, including 19 countries, the EU, the Food and Agriculture Organization of the UN and research and private sector organizations from around the world. The Coalition has finalized its Terms of Reference, hosted webinars to share best practices, and is planning its first global conference for October 8, 2022.
Food Loss & Waste	OCE	USDA, EPA, & interagency	
Risk Assessment and Regulatory Review	ORACBA	USDA & interagency	<ul style="list-style-type: none"> Reviewing environmental risk assessments for USDA regulations Coordinating risk assessment resources across USDA Advertising climate-related events in ORACBA News and Calendar
Climate-related pest management issues	OPMP	USDA & interagency	<ul style="list-style-type: none"> Investigating the specific impacts on grower adoption of climate-smart conservation practices (e.g., no-tillage and cover cropping) from regulatory changes for key herbicides.

			<ul style="list-style-type: none"> • Supporting the continued registration and proper stewardship of pesticide seed treatments products, which can be especially well-suited to the unique challenges of higher pest and disease pressure in no/low-till, cover-crop scenarios. • Support continued safe use of tools that are needed in crop protection, and which may become more important in the face of changing pest complexes.
Climate-related biotechnology issues	OPMP	USDA & interagency	<ul style="list-style-type: none"> • Coordination within USDA and across the Federal government to support domestic and global development, risk-proportionate regulation, and usage of biotechnology products that can help address the causes and consequences of climate change. • Coordination of USDA input into the draft executive order “Advancing Biomanufacturing and Biotechnology Innovation for a Sustainable, Safe, and Secure Bioeconomy”, which includes leveraging biotechnology to address climate change (expected finalization in June 2022). • Along with other USDA staff, published the peer-reviewed journal article “Advancing genome editing to improve the sustainability and resiliency of animal agriculture” which emphasized the role of biotechnology in climate change adaptation and mitigation in animal agriculture on April 21, 2022. • Worked with USDA Foreign Agricultural Service to host “The Role of Agricultural Biotechnology to Address Climate Change” workshop for APEC High Level Policy Dialogue for Agricultural Biotechnology on April 19-20, 2022. • Publication of the “Biotechnology and Climate Change” page on the USDA website in March 2022. • Coordination within USDA and with FDA on FDA’s March 2022 announcement of a regulatory decision for genome-edited SLICK cattle, which have increased heat tolerance. • Led a February 2-3, 2022, workshop for developers on regulation of genetically engineered microorganisms, many of which will enable climate change adaptation and mitigation in agriculture and industry.

TABLE 2: OBPA CLIMATE ADAPTATION ACTIONS

Action	Lead Office	Accomplishments to Date
Strategic Planning, Performance, and Evidence Building	OBPA Performance	The 2022 -2026 USDA Strategic Plan supports the Department-wide Climate Adaptation Plan and USDA leadership’s commitment to address the climate change crisis by setting its first strategic goal to “combat climate change to support America’s working lands, natural resources, and communities.”
Enterprise Risk Management	OBPA Performance	OBPA is currently developing the framework for USDA’s Enterprise Risk Management program, led by OBPA’s Director who is named as USDA’s Chief Risk Officer.
Budget Formulation Process	OBPA Budget Formulation	OBPA already began incorporating performance elements into the FY23 budget process at the agency estimate and department estimate stages and will continue working with Mission Areas to ensure that their performance metrics align with the Strategic Objectives laid out in the Strategic Plan. Additionally, OBPA will continue to feature climate change crosscutting activities in the annual budget summaries that are released with the President’s Budget and provide examples of climate change related increases in the Budget.
Budget Data Collection and Requests	OBPA Budget Formulation	OBPA works with OMB and USDA leadership to coordinate Department-wide budget data requests and crosscuts to report on funds spent on US Global Change Research Program, Clean Energy and Emission Mitigation, Climate Adaptation and Resilience, International Climate Assistance, etc. OBPA is also working closely with the Office of the Secretary to implement the Justice40 initiative, a response to section 223 of E.O. 14008, by providing support in developing a benefit calculation methodology and overall coordination and implementation.
Regulatory and Rulemaking	OBPA Regulatory	OBPA has been assisting Mission Areas in identifying any existing regulations, orders, guidance documents, and policies that are inconsistent with national objectives and by providing comprehensive support and review for regulatory actions that support those objectives.

TABLE 3: OHS CLIMATE ADAPTATION ACTIONS

Climate Vulnerability	Action Title/ Description	Type of Activity	Coordination
Increasing need for more intensive interagency coordination due to increased severity and duration of weather impacts	Ensure that we utilize our interagency coordination at meetings with as the Agency Emergency Coordinators, Continuity Coordinators, and Security Council to focus on the potential impacts of climate change on USDA emergency response and recovery, COOP planning and policy development.	Planned	USDA
Increasing workload for our 24/7/365 Operations Center due to longer and more intense fire, flood and hurricane seasons	Look at flexibilities with our current Operations Center contract to allow us to expand personnel as needed during fire, flood and hurricane seasons. Work with interagency partners on enhanced GIS products and share information in a timely manner.	Planned	USDA
Ensuring agency alternative sites have properly accounted for risks posed by climate change	Work closely with the Agency COOP Coordinators to ensure that they are accounting for the risks posed by climate change to their alternate sites.	Planned	USDA
Increasing vulnerability to flooding risk posed to USDA HQ Department's Emergency operations	Continue to exercise alternate work opportunities for watch officers so that they can perform the majority of their work from HQ and alternate locations.	Planned	USDA
Ensuring that intelligence briefings provided by the National Security Division (NSD) incorporate the latest information related to USDA's climate vulnerabilities	Incorporate I.C. Products into briefings related to the 5 climate vulnerabilities outlined in the USDA Action Plan for Climate and Adaptation. that can be shared with varying levels of USDA leadership.	Planned	USG

TABLE 4: OPEM CLIMATE ADAPTATION ACTIONS

Climate Vulnerability	Action	Coordination	Progress Metrics	Accomplishments to Date
Climate change threats to facility operations as well as resources and infrastructure	Enhance workforce climate literacy	USDA		
	Develop climate smart policy and guidance			
USDA mission-related stresses, energy, water, and natural resources availability	Issue policy and guidance to increase facility energy and water efficiency	APHIS, ARS, FS, NRCS, OO	Decrease in energy and water use intensity	Issued Sustainable Practices DR in 2021.
	Develop and implement an Energy Management System	APHIS, ARS, FS, NRCS, OO	1. Percent completion of draft EnMS (By Dec 2022) 2. Number of USDA agencies and staff offices which have implemented an EnMS (initiate June 2023)	1. OPEM Facilities Energy Program Manager received training on developing and implementing an EnMS; and 2. OPEM initiated framework for developing an EnMS.
Environmental cleanup at remediation sites	Foster strategic planning for climate adaption and resilience in cleanup projects	USDA	Percentage of projects funded that have a response action that incorporates resiliency strategy.	1. Update to DR 56001-005 to consider climate adaptation and resiliency in environmental actions (Feb 2022); and 2. Establish requirements for incorporating use of resilient response actions for providing project funding from the HMMA (May 2022)
Stress on facility, fleet, infrastructure, and federal land operations	Build climate change resilience in USDA facilities and on USDA land	USDA	Percentage of portfolio constructed using sustainable resilient practices	Issued Sustainable Practices DR in 2021
	Enhance operational climate resilience in facilities, on sites, and in fleet	USDA	Percentage of portfolio and fleet operated using climate resilient practices	Issued Sustainable Practices DR in 2021

Stress on fleet operations	Transition to a low-emissions fleet and telematics rollout	USDA	Percentage of fleet vehicles with low-emissions, telematics	Acquiring vehicles with less petroleum per mile and using alternative fuels as available
Prepare for climate-ready supply of sustainable products and services	Sustainable acquisition actions for climate-ready supply of products and services	USDA		Topic discussed with USDA Green Purchasing Work Group.
Stress on vulnerable and underserved communities	Environmental Justice	USDA	Percentage of projects funded that have a response action in an area accessible to EJ communities	1. Update to DR 56001-005 that requires the integration of Environmental Justice in all actions (Feb 2022); and 2. Establish requirements for serving EJ communities for providing project funding from the HMMA (May 2022)





Food Safety and Inspection Service
U.S. DEPARTMENT OF AGRICULTURE

Climate Change Adaptation Plan

March 2024





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1.0 Executive Summary

The Food Safety and Inspection Service (FSIS) is the public health regulatory agency of the U.S. Department of Agriculture (USDA) responsible for ensuring that domestic and imported meat, poultry, and egg products are safe, wholesome, and properly labeled. This includes addressing impacts of climate change which may impact employee health, food safety and animal welfare. Strategies to address potential impacts are outlined in this report.

FSIS established a team of scientists, health professionals, veterinarians, risk assessors, an emergency response specialist, policy experts and communicators to develop this climate adaptation plan (Appendix 1). The team considered the impacts of climate change through the lens of an increase in extreme weather events, such as an increase in heat waves/severe cold and increased precipitation/flooding/snow. The United States is seeing an increase in days where the ambient temperature is greater than 90 °F, which may create conditions that affect employee health, welfare of animals presented for slaughter, and the safety of meat, poultry, and egg products. Increased drought severity may reduce water availability for drinking, sanitation, and meat processing. In addition, an increase in extreme weather events may lead to power outages, flooding, or more severe winter weather, including increased snowfall, which can harm FSIS employees and livestock/ birds.

The team identified the potential impacts (vulnerabilities) on FSIS employee health, animal welfare/ humane handling and food safety. Ten key vulnerabilities, in order of likelihood and potential impact, were identified:

- More frequent natural disasters/extreme weather events, e.g., wildfires, drought, floods, heat waves, extreme cold, which impact human health, animal welfare, and food safety.
- Changes in the geographical distribution of animal pests and diseases due to warmer temperatures, which can impact animal welfare and food safety.
- Heat stress on FSIS employees.
- Decreased animal welfare.
- Heat stress to animals during transport.
- Less water or contaminated water at processing plants.
- Less water availability in pre-slaughter/ante-mortem.
- Increased inspector workload due to greater numbers of sick or disabled animals.
- Increased processing, storage, and transport costs.
- Slower laboratory sample transportation and storage issues.

FSIS has strategies in place to address these impacts and will continue to monitor these to protect FSIS employee health, animal welfare and the food supply.

2.0 Introduction

FSIS is the public health regulatory agency of the USDA responsible for ensuring that domestic and imported meat, poultry, and egg products are safe, wholesome, and properly labeled. FSIS ensures food safety through the authorities of the Federal Meat Inspection Act (FMIA), the Poultry Products Inspection Act (PPIA), and the Egg Products Inspection Act, as well as humane animal handling



through the Humane Methods of Slaughter Act (HMSA). To carry out these congressional mandates, FSIS employs approximately 8,700 full-time employees, including a frontline workforce comprised of public health veterinarians, consumer safety inspectors, and food inspectors.

On January 27, 2021, the President issued Executive Order (EO) 14008 to help the United States prepare for a changing climate, which is resulting in an increase in extreme weather events, such as heatwaves and heavy precipitation. This EO laid out a vision to address the risks and opportunities posed by climate change and requires each federal agency to develop an action plan describing steps the agency can take to bolster adaptation and increase resilience to the impacts of climate change.

USDA's [Departmental Regulation \(DR\) 1070-001: Policy Statement on Climate Change Adaptation](#) reflects the high priority that the Administration has placed on addressing climate change and affirms the necessity of integrating climate adaptation into USDA's work. [USDA's Action Plan for Climate Adaptation and Resilience](#) provides information, tools, and resources to increase resilience to climate impacts.

Our changing climate may create conditions that affect FSIS employees, the welfare of animals presented for slaughter, and the safety of meat, poultry, and egg products. FSIS considered the potential impacts of more frequent extreme weather events, such as heat waves and floods, as well as risks associated with a warming climate and drought. Climate change is also resulting in more severe winter weather, including increased snowfall, and very cold weather in locations where extreme cold does not typically occur. This is due to changes in the Arctic Polar Vortex, which allows extremely cold air to dip south, instead of staying in place over the North Pole. Extremely cold weather can result in harm to FSIS employees and livestock/ birds. This report outlines the policies, procedures, and programs that FSIS leverages to increase our resilience and reduce the impact of climate-driven conditions on human health, animal welfare, and food safety.

The FSIS Climate Change Adaptation Plan has been developed in accordance with [DR 1070-001](#), with guidance from USDA's Office of Energy and Environmental Policy within the Office of the Chief Economist. This Climate Adaptation Plan will help to ensure that FSIS employees have a deeper understanding of the potential impacts of climate change on FSIS employees, animal welfare, and food safety hazards and the actions FSIS can take to mitigate these impacts.

3.0 About FSIS

FSIS focus is to ensure food safety and proper labeling of meat, poultry, and egg products. FSIS inspection program personnel (IPP) verify industry compliance with applicable food safety and labeling regulatory requirements. This ensures that regulated establishments have sound food safety systems to protect public health. The "food safety system" can be defined as a systematic approach implemented to prevent foodborne illness. It includes developing and implementing a Hazard Analysis and Critical Control Point (HACCP) system in accordance with 9 CFR Part 417 and a Sanitation Standard Operating Procedure (SOP) in accordance with 9 CFR Part 416. It also includes any programs or procedures an establishment uses (e.g., prerequisite programs) to prevent food safety hazards from occurring and to support decisions in the hazard analysis.



FSIS has personnel skilled and trained in food science, public health, policy development, risk analysis, epidemiology, microbiology, toxicology, data analytics, bioinformatics, and related sciences. FSIS also employs personnel who perform a range of financial, human resources, administrative, investigative, technical, communications, and Equal Employment Opportunity functions, and other functions that support FSIS' food safety and public health mandates and policies.

The FSIS Vision and Mission—underpinned by FSIS' Core Values: *Accountable, Collaborative, Empowered, and Solutions-Oriented*—were designed to move the agency closer to accomplishing its goals and the associated outcomes and objectives presented in the next section.

FSIS Vision

Everyone's food is safe.

FSIS Mission

Protect public health by preventing illness from meat, poultry, and egg products.

Fiscal Year (FY) 2023–2026 Strategic Goals

Goal 1: Prevent Foodborne Illness and Protect Public Health

Outcome 1.1: Prevent Adulteration and Misbranding

Outcome 1.2: Limit Illness From FSIS-Regulated Products

Goal 2: Transform Inspection Strategies, Policies, and Scientific Approaches to Improve Public Health

Outcome 2.1: Improve Food Safety Through the Adoption of Innovative Approaches and Technologies

Outcome 2.2: Optimize Data Use at Every Level of Agency Decision Making

Goal 3: Achieve Operational Excellence

Outcome 3.1: Sustain and Advance an Adaptable, High-Performing and Engaged Workforce

Outcome 3.2: Optimize Service Delivery

4.0 Climate Change Vulnerabilities and Adaptation Actions

The USDA Department-Wide [action plan for climate adaptation and resilience](#) identified five potential climate change impacts (vulnerabilities) to agriculture, based on their vulnerability assessment.

These are:

- Decreased agricultural productivity
- Threats to water quantity and quality
- Disproportionate impacts on vulnerable communities
- Shocks due to extreme climate events
- Stress on Infrastructure and public lands

FSIS established a team of scientists, public health professionals, veterinarians, risk assessors, an emergency response specialist, policy experts and communicators to develop this climate adaptation

plan (Appendix 1). The team assessed vulnerabilities based on our mission, which align with those of the Department (Table 1). The strategic goals, outcomes, and objectives outlined in the FSIS [FY 2023–2026 Strategic Plan](#) provide an integrated framework for understanding how FSIS is fulfilling the agency’s mission to protect public health by preventing illness from meat, poultry, and egg products. All three agency goals may be impacted by a changing climate. The adaptation actions are tied to one or more of the agency’s strategic goals.

4.1 Identifying and Ranking Climate Change Vulnerabilities

To estimate the relative risk of climate change vulnerabilities to FSIS operations, FSIS team members reviewed the relevant literature and used their expert judgement to identify potential vulnerabilities to FSIS employees, food safety hazards, and animal welfare. This approach ensured that the FSIS’ adaptation plan addressed the vulnerabilities that pose the greatest risk, considering both their likelihood and potential impact.

The team began by compiling a list of over 40 potential vulnerabilities that could affect FSIS operations, derived from the scientific literature, review of other USDA agencies’ climate adaptation plans, and consultations with FSIS scientists and technical experts. We sought experts from within FSIS to advise on which of the vulnerabilities were most relevant to FSIS operations and which were similar enough to be combined. The final list included 10 vulnerabilities.

We then ranked the 10 climate change vulnerabilities, based on a scoring methodology that considered the likelihood of the event occurring, multiplied by the estimated consequences (potential impact to human health, animal welfare and/or food safety; Table 1). Impacts could be at the national, regional, or local (i.e., one or a small number of establishments) level.¹ The lowest likelihood (i.e., least likely) and consequence (i.e., minimal impact) outcome was defined as having a value of one and the highest outcome (i.e., most likely or most severe consequence) was defined as having a value of five. The expert panel then assigned values for likelihood and consequence for each vulnerability. The likelihood and consequence values were multiplied to give a measure of relative risk for each vulnerability, which were then ranked from 1 (most risky) to 10 (least risky) (Table 1).

¹ While we considered some climate vulnerabilities whose impacts may be localized to one or a limited number of establishments, we cannot account for the business decisions that individual establishments will make in response to these climate-driven conditions. This plan focuses on FSIS’ national-level authorities to ensure that statutory obligations are met in the face of these climate vulnerabilities.



Table 1. Risk Ranking of the Vulnerabilities (from Riskiest to Least Risky)

Rank	Brief Description of Vulnerability	FSIS Goal(s) Impacted	Impact on FSIS employees	Impact on animal welfare	Impact on food safety
1	More frequent natural disasters/extreme weather events, e.g., wildfires, drought, floods, heat waves, extreme cold (Shocks due to extreme climate events) *	Goal 1, 2, 3	X	X	X
2	Changes in the geographical distribution of animal pests and diseases due to warmer temperatures (Decreased agricultural productivity) *	Goal 1, 2		X	X
3	Heat stress on FSIS employees (Shocks due to extreme climate events) *	Goal 3	X		
4	Decreased animal welfare (Decreased agricultural productivity) *	Goal 1		X	X
5	Heat stress to animals during transport and lairage (Decreased agricultural productivity) *	Goal 1		X	X
6	Less water or contaminated water at processing plants (Threats to water quantity and quality) *	Goal 1			X
7	Less water availability in pre-slaughter/ante-mortem (Threats to water quantity/ quality) *	Goal 1		X	X
8	Increased inspector workload due to greater numbers of sick or disabled animals (Decreased agricultural productivity) *	Goal 1, 3	X		
9	Increased processing, storage, and transport costs (Decreased agricultural productivity) *	Goal 1			X
10	Slower laboratory sample transportation and storage issues (Decreased agricultural productivity) *	Goal 1, 2			X

*Link to USDA Department-wide vulnerability.

4.2 Climate Change Risks to FSIS Employees

4.2.1 Vulnerability

- ✓ More frequent natural disasters/extreme weather events
- ✓ Heat stress on FSIS employees
- ✓ Reduced FSIS employee availability

FSIS employs a frontline workforce comprised of approximately 8,700 employees, the majority of whom work in more than 6,800 Federally regulated establishments in the United States and its territories. FSIS employees may work outdoors, where the temperatures could be extremely high or extremely low, as they ensure the welfare of animals when they arrive for slaughter, or they may work inside establishments, where the ambient temperature may be very high, as air conditioning may not be available. Fans may be used for cooling in these areas (See Appendix 2).

Health hazards related to climate and heat or cold stress can result in injuries, disease, death, and reduced productivity.² Climate-related hazards for workers may include (1) increased ambient temperature, (2) air pollution, (3) ultraviolet light, (4) extreme cold weather leading to frostbite, and (5) vector-borne diseases.³ Of these hazards, FSIS employees are most likely to be exposed to increased ambient temperature and extreme weather events. Occupational exposure to hot environments and extreme heat can result in heat stroke, heat exhaustion, heat syncope, heat cramps, and heat rashes, or death. Heat also increases the risk of workplace injuries, such as those caused by sweaty palms, fogged-up safety glasses or face shields, and dizziness. This may make frontline jobs undesirable, if provisions are not in place to protect workers and give leave options, negatively impacting recruitment and retention goals.

FSIS is responsible for ensuring the safety of its employees. The Department of Labor's (DOL) Occupational Safety and Health Administration (OSHA) is responsible for setting and enforcing standards to ensure safe, healthy working conditions.⁴ Across the United States, heat is a growing workplace hazard, with climate change making extreme heat more frequent and severe. There is no current OSHA standard related to heat index and heat-related interventions; however, the Centers for Disease Control and Prevention's National Institute for Occupational Safety and Health (NIOSH) has recommended an occupational standard for workers exposed to heat and hot environments, which

² NIOSH [2016]. NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106. <https://www.cdc.gov/niosh/docs/2016-106/>

³ Schulte PA, Chun H [2009]. Climate change and occupational safety and health: establishing a preliminary framework. [J Occup Environ Hyg 6\(9\):542-554](#).

⁴ Fact sheet: Biden Administration Mobilizes to Protect Workers and Communities from Extreme Heat, <https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/20/fact-sheet-biden-administration-mobilizes-to-protect-workers-and-communities-from-extreme-heat/>, September 20, 2021

includes guidance on how to prevent adverse outcomes.³ In addition, in 2023, DOL issued the first-ever Hazard Alert for heat, reaffirming that workers have heat-related protections.^{5,6}

Extreme weather events can disrupt transportation networks which may affect the movement of people, animals, and products. Establishments may have to temporarily suspend operations due to fluctuations in the number of animals available for slaughter, power outages, flooding, or if establishment workers are unable to safely travel to work. Similarly, FSIS IPP may be unable to safely access establishments if roads, rails, bridges, waterways, and utilities are damaged or blocked.

4.2.2 Climate Change Adaptation Actions [FSIS Goal 2, 3]

FSIS is committed to the safety of our employees. We will continue to encourage safety and hazard reporting (FSIS Directives [4791.12](#) and [4791.13](#)) to ensure safe and healthful working conditions for all FSIS employees in all environments. Additionally, we ensure our employees are trained in workplace safety. IPP are required to complete training on Workplace Safety and Health Hazards every year. FSIS also issues policy guidance to IPP on preventing heat stress illness. The agency provides IPP with a range of items to protect them from heat stress and continually monitors the use of these and the selection of items available. Regulations require that safe drinking water is available to all FSIS employees.

[FSIS Directive 5500.2 Significant Incident Response](#) outlines the procedures for the FSIS Emergency Management Committee (EMC) and programs within FSIS to follow while managing significant incidents. A significant incident is one that presents a grave, or potentially grave, threat to public health, to the safety of FSIS-regulated products, or FSIS personnel (e.g., natural disasters). These procedures outline communication and coordination protocols, including program area reporting responsibilities, reporting system and email outage contingencies, and triggers for activating the EMC. Additionally, FSIS participates in locally led natural disaster planning in rural and urban settings to continuously assess response procedures and identify opportunities for further development and improvement.

As per [FSIS Directive 4630.2](#), weather and safety leave may be granted when it is determined that an [FSIS] employee or group of employees cannot safely travel to or from, or perform work at, their normal worksite, a telework site, or other approved location (i.e., remote) due to severe weather events. This form of administrative leave is used in conjunction with operating status announcements issued by the U.S. Office of Personnel Management or Federal Executive Boards. There is no limit to the number of hours that may be recorded as weather and safety leave.

⁵ FACT SHEET: President Biden Announces New Actions to Protect Workers and Communities from Extreme Heat, <https://www.whitehouse.gov/briefing-room/statements-releases/2023/07/27/fact-sheet-president-biden-to-announce-new-actions-to-protect-workers-and-communities-from-extreme-heat/>, July 27, 2023

⁶ Hazard Alert, Extreme Heat Can Be Deadly to Workers, Occupational Safety and Health Administration, issued July, 2023, https://www.osha.gov/sites/default/files/publications/OSHA_HA-4279.pdf

4.3 Climate Change Risks to Animal Welfare

4.3.1 Vulnerabilities

- ✓ More frequent natural disasters/extreme weather events
- ✓ Changes in the geographical distribution of animal pests and diseases
- ✓ Decreased animal welfare
- ✓ Heat stress during transport and lairage
- ✓ Less water or contaminated water at processing plants
- ✓ Less water availability in pre-slaughter/ante-mortem

Livestock and poultry production systems may be impacted by changes in environmental conditions, such as air temperature, relative humidity, precipitation, and frequency and magnitude of extreme events (i.e., heat waves, severe droughts, extreme precipitation events, and coastal floods). Extreme weather events are impacted by climate change, either being more frequent or more severe. Some animal welfare conditions, such as frostbite or heat stress, are the direct results of environmental conditions. Climate change can also indirectly affect animal welfare when it leads to changes in the geographical distribution of animal pests and diseases. This section will focus on the direct effects of climate change on animal welfare in the context of ensuring humane handling of livestock and poultry.

As temperatures rise, animals are more likely to experience heat stress. Acute heat stress can lead to death during transportation or lairage. Extreme heat conditions can also increase stress that livestock and poultry experience during transportation to slaughter. Stressed livestock can have difficulty unloading from the trailer and walking to holding pens. Animals that become overheated in the trailer and during lairage may become disabled. Livestock that are sick or disabled will need to be protected, separated from healthy animals, and evaluated by a veterinarian. Establishments are required to humanely move disabled animals with appropriate implements and equipment.

Extreme weather events can affect an establishment's ability to humanely handle animals.⁷ Floods can introduce contaminated water (e.g., human and animal waste, pesticides, and industrial wastes) into processing plants. Establishments need to modify animal handling practices if water sources become contaminated and if there is limited or no access to water for drinking or cooling of animals. Furthermore, loss of electricity could prevent the use of fans or other cooling systems. Trucks already in transit would either need to delay their arrival or keep moving to provide air flow to animals prior to unloading.

4.3.2 Climate Change Adaptation Actions [FSIS Goal 1, 2]

Once a truck transporting livestock and poultry for slaughter enters the premises of an official establishment, the establishment must comply with the FMIA, PPIA, and HMSA. The Directives that describe the procedures FSIS uses to verify compliance with the Acts are summarized in Table 2.

⁷ Duchenne-Moutien, R and Neetoo, Hudaa. Climate Change and Emerging Food Safety Issues: A review. Journal of Food Protection, Vol. 84, No. 11, 2021, Pages 1884–1897 <https://doi.org/10.4315/JFP-21-141>.



On September 9, 2004, FSIS announced that livestock slaughter establishments should implement and maintain a systematic approach to humane handling and slaughter to best assure compliance with the regulations ([69 Federal Register 54625](#)). A systematic approach is a comprehensive way of evaluating how livestock enter and move through an establishment. Establishments should (1) assess the ability of their livestock handling and slaughter practices to minimize distress and injury to livestock; (2) design facilities and implement handling practices that minimize distress and injury to livestock; (3) periodically evaluate facilities and handling methods to ensure that they continue to minimize distress and injury to livestock; and (4) when necessary, modify facilities and handling methods to ensure that they continue to minimize distress and injury to livestock. For FSIS to consider a systematic approach to be robust, the agency expects that the systematic approach will include a written animal handling program and program records. The records need to be available for FSIS review.

When FSIS IPP perform FSIS verification tasks, the amount of time focused on a specific humane handling or slaughter of livestock regulation is entered into the Humane Handling Activities Tracking System (HATS). IPP verify the specific facility, handling, and slaughter requirements for each of the categories, which are described in Table 3. Specifically, HATS Category I and Category III address identified climate vulnerabilities of inclement weather and water and feed availability. HATS violations are monitored to ensure trends are responded to with appropriate outreach to establishments. FSIS will continue its outreach efforts to help ensure that slaughter facilities have sound commercial practices and livestock humane handling programs resulting in compliance with the regulations ([9 CFR 381.90](#) and [313](#)) and improved animal welfare. To assist with outreach, FSIS has developed the [Compliance Guide for a Systematic Approach to the Humane Handling of Livestock](#) so that all slaughter establishments may apply the recommendations in these guidelines, as appropriate, such as conducting assessments of their facility, adapting its facilities to inclement weather, and handling of disabled animals humanely. Those establishments exposed to blizzards or extreme freezing conditions need to evaluate their facilities to prevent water and carbon dioxide lines from freezing, slips and falls due to the formation of ice in walkways, and frostbite if the temperature in their holding area is not maintained.



Table 2. Selected Directives and Verification Tasks used by FSIS to Ensure Compliance with the FMIA, PPIA and HMSA

FSIS Directive Number	FSIS Directive Title	FSIS Verification Task
6100.1	Ante-Mortem Livestock Inspection	FSIS examine and inspect all livestock before slaughter to determine whether the animals are fit for slaughter for food.
6100.3	Ante-Mortem and Post-Mortem Poultry Inspection	IPP inspect poultry prior to slaughter.
6110.1	Verification of Poultry Good Commercial Practices	IPP verify the implementation of Good Commercial Practices. Poultry are to be handled in a manner that prevents needless injury and suffering. Water must be available for drinking.
6900.2	Humane Handling and Slaughter of Livestock	Lists requirements, verification activities, and enforcement actions for ensuring that the handling and slaughter of livestock is always done humanely.

Table 3. HATS Categories Used by FSIS to Verify Compliance With the FMIA and HMSA

HATS Category	Description ¹
<u>Category I: Inclement Weather</u>	The establishment needs to adapt its facilities and handling practices to inclement weather to ensure the humane handling of animals. Inclement weather (e.g., rain, heat, snow, or ice) may cause adverse effects on facilities and animal handling.
<u>Category II: Truck Unloading</u>	Livestock handling and facilities should facilitate humane handling procedures during livestock unloading activities. Animals prone to heat stress or that are injured can be difficult to unload.
<u>Category III: Water and Feed Availability</u>	Water is required to be accessible to livestock in all holding pens. Animals held longer than 24 hours must have access to feed.
<u>Category IV: Ante-mortem Inspection</u>	Livestock facilities and handling practices are to be maintained in a humane manner to prevent stress or injury to the animal.
<u>Category V: Suspect and Disabled</u>	U.S. suspect and disabled livestock* are required to be handled humanely and provided or placed in a covered pen.
<u>Category VI: Electric Prod/Alternative Object Use</u>	Establishment's procedures for humanely and effectively moving livestock do not involve excessive prodding or use of objects in a manner that cause injury.
<u>Category VII: Slips and Falls</u>	Establishments must provide adequate footing in livestock facilities to prevent animals from slipping and falling as they are handled and moved through livestock facilities.
<u>Category VIII: Stunning Effectiveness</u>	Stunning methods are required to be appropriate and effectively administered, producing immediate unconsciousness of the animal. Ante-mortem condemned animals are to be humanely euthanized.
<u>Category IX: Conscious Animals on the Rail</u>	Establishments are required to produce, at a minimum, unconsciousness, or surgical anesthesia after application of the stunning method and remain in this state until death.

* Animals showing signs of abnormalities, injuries, or diseases that require further examination by the PHV.

4.4 Climate Change Risks to Food Safety

4.4.1 Vulnerabilities

- ✓ More frequent natural disasters/extreme weather events
- ✓ Changes in the geographical distribution of animal pests and diseases
- ✓ Less water or contaminated water at processing plants
- ✓ Slower laboratory sample transportation and storage issues
- ✓ Increased processing, storage, and transport costs

Microbiological, chemical, and physical hazards can contaminate food at various points along the production chain. Contamination of food is highly influenced by environmental conditions such as climate, which impacts the prevalence, distribution, and transmission of many foodborne diseases.⁸ As the climate warms, higher ambient temperatures may result in chronic heat stress in animals, leading to reduced immunity to disease and increased susceptibility to parasites and pathogens. Warming temperatures are causing disease vectors such as mosquitos and ticks to move northward. This may change the distribution of zoonotic diseases and result in conditions not commonly seen at slaughter.

Salmonella and *Campylobacter* are common causes of foodborne illness, and a changing climate could potentially impact their prevalence in meat, poultry, and egg products.⁸ Past research has documented that *Salmonella* and *Campylobacter* infections in humans are influenced by temperature. Warming temperatures favor the growth of *Salmonella* in broiler flocks.⁹ In addition, milder winters will increase the survival of microbiological vectors such as flies, resulting in an increase in illnesses in food production animals. The higher incidence of illness in production animals may require increased verification activities by FSIS IPP to protect the food supply.

High ambient temperatures can also influence the growth of *Salmonella* during food production, transport, and storage.¹⁰ Increasing ambient temperatures will increase the heat load on refrigerated production, storage, and distribution facilities, making it more costly and difficult to hold products at appropriate temperatures. A 2-to-3-degree Celsius rise in temperature could reduce the chilled storage life of food products and lead to increased food spoilage and foodborne illness, unless technology

⁸ Lancet. The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. Published online October 25, 2022 [https://doi.org/10.1016/S0140-6736\(22\)01540-9](https://doi.org/10.1016/S0140-6736(22)01540-9)

⁹ Jiang, C., K. Shaw, C. R. Upperman, D. Blythe, C. Mitchell, R. Murtugudde, A. R. Sapkota, and A. Sapkota. 2015. Climate change, extreme events and increased risk of salmonellosis in Maryland, USA: evidence for coastal vulnerability. *Environ. Int.* 83:58–62.

¹⁰ Dietrich J, Hammerl JA, Johne A, Kappenstein O, Loeffler C, Nöckler K, Rosner B, Spielmeyer A, Szabo I, Richter MH. Impact of climate change on foodborne infections and intoxications. *Journal of Health Monitoring* · 2023 8(S3) [DOI 10.25646/11403](https://doi.org/10.25646/11403)

improves to maintain the required low-temperature range.¹¹ Higher temperatures may also result in slower post-mortem carcass cooling, which could potentially lead to increases in pathogens on meat and poultry.

Natural disasters, such as hurricanes, tornadoes, floods or wildfires, negatively impact FSIS-regulated establishments' ability to produce safe and wholesome products. A review of FSIS data and published research indicates that there is a potential for an increase in *Salmonella* and other pathogens in regulated food products following flood events.¹² A review of noncompliance records (NR) showed an increase in NR for sanitation and HACCP within 1–90 days after heavy rain periods ([FSIS Directive 5000.7](#)). The introduction of contaminated water can cause flood-related diseases in animals in the pre-harvest environment (e.g., clostridial diseases, mastitis, and tetanus), and some of these diseases may present food safety hazards not commonly seen by IPP.

Droughts can reduce water availability, which may cause insanitary conditions in food processing plants if there is a decreased ability to clean and sanitize equipment. This may result in increased transmission of foodborne pathogens. Reuse of water during water shortages may create food safety issues unless it has been appropriately treated.

IPP collect samples to send to one of FSIS' three analytical laboratories (located in Athens, GA, St. Louis, MO, and Albany, CA) for testing for foodborne pathogens and contaminants. FSIS laboratories could be impacted by extreme weather which could lead to power outages. FSIS employees may be unable to travel to the laboratories during extreme weather events. In addition, disruptions in courier services may delay the pickup and transportation of samples to the FSIS laboratories. Samples may need to be stored frozen or under refrigeration to prevent excess microbial growth and delays in receipt of samples by the laboratory may render them compromised and unable to be analyzed.

4.4.2 Climate Change Adaptation Actions [FSIS Goal 1, 2]

[FSIS Directive 5000.1](#), *Verifying an Establishment's Food Safety System*, provides comprehensive instructions to IPP in meat, poultry, and egg products establishments on how to protect public health by properly verifying an establishment's compliance with the pathogen reduction, sanitation, and HACCP regulations. Establishments are to implement a food safety system that includes assessing which food safety hazards are reasonably likely to occur in the establishment's production process, and to maintain controls necessary to prevent contamination by microbiological, chemical, or physical hazards. The regulations also require that the establishment maintain Sanitation SOPs. FSIS Directive 5000.1 also provides instructions to IPP on how to protect public health by properly verifying an establishment's compliance with the Sanitation Performance Standard requirements.

¹¹ James, S. J. and C. James 2010. The food cold-chain and climate change. *Food Research International* 43 (2010) 1944–1956. <https://doi.org/10.1016/j.foodres.2010.02.001>

¹² Linville JW, Schumann D, Aston C, Defibaugh-Chavez S, Seebohm S, Touhey L. Using a Six Sigma Fishbone Analysis Approach to Evaluate the Effect of Extreme Weather Events on Salmonella Positives in Young Chicken Slaughter Establishments. *J Food Prot.* 2016 Dec;79(12):2048-2057.



Regulatory requirements ([9 CFR 416](#)) state that a supply of running water that complies with the National Primary Drinking Water regulations ([40 CFR Part 141](#)), must be provided in all areas where products are processed, and for cleaning rooms and equipment, utensils, and packaging materials. IPP are also to determine whether the establishment is reusing water, ice, or solutions (such as brine, liquid smoke, or propylene glycol) to chill or cook ready-to-eat product and verify that the reuse meets regulatory requirements. Any establishment that reuses water, ice, or solutions in their process needs to consider that reuse in the hazard analysis and support any resulting decision regarding chemical, physical, or microbiological hazards.

FSIS collects data, analyzes data for trends, and takes data-driven actions to mitigate hazards and ensure food safety. FSIS routinely collects samples at establishments for regulatory testing. These samples are used to assess and categorize each establishment's performance to a standard and to prevent foodborne illness. FSIS evaluates data and develops strategies to address food safety concerns, including those exacerbated by climate change.

Under the current FSIS regulations, every establishment is to reassess the adequacy of its HACCP plan whenever changes occur that could affect the hazard analysis or alter the HACCP plan ([9 CFR 417.4](#)). Climate change is increasing the risks associated with natural disasters, such as hurricanes, floods, or wildfires. Natural disasters are a "change" that could affect the hazard analysis or alter the HACCP plan. If an establishment's HACCP plan documents that a hazard is not reasonably likely to occur based on a prerequisite program, the impact of a natural disaster on the prerequisite program must be evaluated to determine whether the program needs to be modified, to mitigate any effects caused by the natural disaster. This would require the HACCP plan to be updated.

[FSIS Directive 5000.7](#) provides instructions to IPP assigned to establishments in areas affected by a natural disaster. IPP are to inform affected establishments that they are required to reassess their HACCP plans and are to verify that establishments take appropriate actions to produce wholesome and unadulterated products. FSIS remains committed to implementing initiatives that will have a positive impact on the safety of regulated products and lead to illness reduction.

FSIS currently has procedures in place to help mitigate the impacts of extreme weather on FSIS laboratory operations and processes. FSIS Continuity of Operation plans are reviewed annually to ensure that they are working as intended. These plans include options to divert samples from an impacted FSIS laboratory to one of the other two laboratories and promote the use of backup generators. Contingency plans also exist in the event FSIS leadership is not able to operate from primary work sites to ensure no interruption to the FSIS mission.

The laboratories test samples on receipt for temperature and will discard samples that arrive above 15 °C, to prevent the growth of microorganisms in the sample during shipment. While 15 °C is the upper allowable limit, samples received at the laboratory are typically much lower. FSIS monitors the rates of sample discards and can respond by adjusting sampling schedules or supplies as needed in response to sample quality issues.

5.0 Data and Research Needs

FSIS maintains a list of [research needs](#) on its website. Each year, the Research Priority Review Panel identifies new research priorities and studies, based on outbreaks, laboratory data and findings in the field. FSIS does not do research, nor do we fund research, but we provide the list to encourage researchers to undertake projects relevant to food safety. The current list contains one relevant project:

- Determine the impact of climate and weather conditions on microbial pathogens in FSIS regulated products.

FSIS collaborates with other federal agencies and trusted partners and uses their climate data and resources to guide short- and long-term decision making. For example, weather data can be obtained from the National Oceanic and Atmospheric Administration and air quality data from [AirNow](#).

FSIS Significant Incidence Preparedness and Response Staff (SIPRS) compile and track data on significant incidents impacting FSIS regulated facilities, product, consumers, and personnel. SIPRS collects information related to regulated facilities that are at reduced operations or non-operational for reasons related to climate change, such as power outages, hazardous weather, and insufficient facility personnel or building damage/destruction related to extreme weather. Additionally, information is collected if FSIS employees are on leave or reassigned due to incidents related to extreme weather or displacement from their home. The data collected by SIPRS are utilized to develop situation reports that are provided to FSIS leadership, the Office of Food Safety, and the USDA Operations Center.

Some data specific to FSIS operations can be generated as needed. The following data and research may be useful to FSIS to inform decision making concerning climate change.

5.1 Data Needs on Risks to FSIS Employees

- Wet bulb temperatures inside establishments when there is an extreme heat event
- Local data on extreme weather events to determine impacts on FSIS employee safety and health

5.2 Data Needs on Risks to Animal Welfare

- Local data on extreme weather events to determine impacts on animal welfare
- Research on impact of increasing ambient temperatures on animal welfare (e.g., heat stress)

5.3 Data Needs on Risks to Food Safety

- Data on temperatures inside establishments to determine likelihood of increased carcass cooling times that could permit microbial growth
- Data on extreme weather events to determine whether there is an increase in power outages and whether this leads to microbial contamination
- Data on pathogen contamination over time to determine whether it can be correlated with extreme weather events
- Research on impact of extreme weather events/ climate change on food safety

The impacts on small establishments, very small establishments, establishments in rural areas, and establishments in underserved communities should be considered when addressing data and research needs.

6.0 Crosscutting Topics

6.1 Equity Issues – Small Business Support

FSIS has implemented several efforts in support of small and very small establishments in underserved or rural communities.¹³ By supporting small and very small establishments, FSIS contributes to strengthening regional and local supply chains and to the USDA Food System Transformation framework's goal of building a more resilient food supply chain while reducing carbon pollution.¹⁴

Some of the actions FSIS has taken in support of small and very small establishments include:

- New and updated guidelines and translations into several languages: FSIS continually publishes guidance materials to support small and very small establishments and to help them understand and comply with regulatory requirements. FSIS has translated several guidance documents into Chinese, Vietnamese, Spanish, and Arabic.
- Integrated Small Plant Help Desk with askFSIS: FSIS operates the Small Plant Help Desk to allow industry stakeholders to get their questions addressed by technical experts. FSIS personnel are available via email and phone, or via electronic submission, which is integrated with the askFSIS application. FSIS uses askFSIS, a web-based computer application and phone system to receive and respond to technical and policy-related questions from stakeholders.
- Small Plant Roundtables: FSIS holds Small Plant Roundtables between agency leaders and establishment owners and operators throughout the country in a hybrid format (i.e., in person and virtual attendance) several times a year. The agency shares updates and information with attendees and invites representatives from USDA agencies to share information relevant to small and very small establishments. Interpreter services are available on request.
- FSIS leadership holds monthly establishment town hall meetings to provide information on FSIS initiatives and requirements and to answer questions from participants. FSIS posts recordings of the monthly calls to the agency's website.
- Direct outreach by FSIS personnel: Enforcement, Investigation and Analysis Officers dedicate up to 25 percent of their time to conducting outreach activities at small and very small establishments as part of their regular duties, to promote food safety, animal welfare and understanding of regulatory requirements. District Veterinary Medical Specialists visit new establishments during the initial 90 calendar days of operation to provide outreach on handling livestock humanely at slaughter establishments and handling poultry in a manner consistent with poultry good commercial practices.

¹³ Small establishments are defined as those with between 10 and 499 employees and very small establishments have less than 10 employees or \$2.5 million in annual sales ([61 FR 38806](#)). Combined, these represent over 90 percent of the total FSIS-regulated establishments.

¹⁴ <https://www.usda.gov/media/press-releases/2022/06/01/usda-announces-framework-shoring-food-supply-chain-and-transforming>

- FSIS created a monthly newsletter for small and very small establishments, which includes relevant information for these establishments such as announcements for the FSIS Roundtables.

6.2 FSIS Employee Climate Literacy

Currently, FSIS provides training to employees on the specific aspects related to climate change that directly impact its workforce, such as training on how to avoid heat stress illness. This Climate Adaptation Plan will help to ensure that FSIS employees have a deeper understanding of the potential impacts of climate change on the FSIS workforce, animal welfare, and food safety hazards and the actions FSIS can take to mitigate these impacts. FSIS leadership and subject matter experts can introduce the plan to FSIS staff through employee town halls, seminars, and the employee newsletter.

7.0 Appendices

7.1 Team Members

This report was written by a team of FSIS employees, representing most offices within the agency:

Elizabeth Van Dyne, Office of Management, co-lead
Isabel Walls, Office of Public Health Science, co-lead
Heather Bopes, Office of Field Operations
Christy Chanin, Office of Planning, Analysis and Risk Management
Stephanie Defibaugh-Chavez, Office of Policy and Program Development
Sarah Edwards, Office of Public Health Science
Gamola Fortenberry, Office of Public Health Science
Sally Ann Iverson, Office of Food Safety
Sunil Kumar, Office of Public Health Science
John Linville, Office of Policy and Program Development
Scott Malcolm, Office of Public Health Science
Lucy Touhey, Office of Management
Ted Toussaint, Office of Management

7.2 Case Study

An FSIS supervisory employee works at a poultry slaughter facility where the outside temperature was over 90 °F for 83 days during June, July, and August 2023. This establishment does not have air conditioning on the kill floor, but fans are available to circulate air. Air conditioning is available in the FSIS break room. Temperatures on the kill floor inside the establishment were higher than outside.

The supervisor reviewed the annual FSIS summer communications campaign on tips to avoid heat stress and available cooling items available to employees. The supervisor shared this information with employees prior to the increase in temperatures.



On this day, the supervisor used her best judgment to determine that it was hot enough to potentially affect the health of FSIS employees. The FSIS supervisor ensured that water, hydration fluids with electrolytes, and cooling items such as cooling neck scarfs were accessible. She provided personnel so that on-line employees could take breaks to rest in the air-conditioned break room and rehydrate with hydration drinks provided by FSIS. Staff were rotated on and off the line regularly to give breaks from the heat of the environment.

To ensure animal welfare, as there can be a risk to live animals on a hot day, the supervisor verified good commercial practices (GCP) for the incoming poultry. When the poultry arrived for slaughter, she communicated with the establishment staff to minimize the time the animals spent sitting in a still, parked truck without air flow. She verified that the establishment followed the procedures listed in their live poultry receiving program, which included the use of misters in the receiving area. She documented that the misting stations were on and being used. She observed the poultry and noted that they were not displaying any major signs of heat stress. She verified that the animals were being handled according to GCP and reported no concerns.