



# NIFA CLIMATE ADAPTATION & RESILIENCE PLAN

MAY 04, 2022

REE-NIFA: Megan O'Rourke, Ari Caramanica, Jim Dobrowolski, Sheila  
Fleischhacker, Amy Ganguli, Linsey Haram, Lydia Kaume, Erica  
Kistner-Thomas, Summer LaRose, Patrick Martin, Hannah Moshay,  
Nurun Nahar, Suzanne Stluka, Adam Wilke

## 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.

Climate Adaptation Plan Leadership: Megan O'Rourke, Kevin Kephart

Climate Adaptation Plan Executive Writing Team: Megan O'Rourke (lead), Ari Caramanica, Linsey Haram, Hannah Moshay

Climate Adaptation Plan Writing Team: Megan O'Rourke (lead), Ari Caramanica, Jim Dobrowolski, Sheila Fleischhacker, Amy Ganguli, Linsey Haram, Lydia Kaume, Erica Kistner-Thomas, Summer LaRose, Patrick Martin, Hannah Moshay, Nurun Nahar, Suzanne Stluka, Adam Wilke

Internal NIFA Vulnerabilities and Actions Survey Team: Ari Caramanica (lead), Linsey Haram (lead), Derecka Alexander, Erika Kraus, Summer LaRose, Patrick Martin, Emma Moran, Adam Wilke

Climate Adaptation Plan Ideation Team: Megan O'Rourke (lead), Keesha Corbin (lead), Derecka Alexander, Ari Caramanica, Joel Caton, Prali Chitnis, James Dobrowolski, Sheila Fleischhacker, Amy Ganguli, Robert Godfrey, Rocio Gutierrez Garzon, Linsey Haram, Cassandra Huey, Lydia Kaume, Kevin Kephart, Erica Kistner-Thomas, Erika Kraus, Summer LaRose, Patrick Martin, Hannah Moshay, Nurun Nahar, Maurice Smith, Suzanne Stluka, Neerja Tyagi, Adam Wilke

Stakeholder Engagement Team: Megan O'Rourke (lead & panelist), Kevin Kephart (panelist), Derecka Alexander, Keesha Corbin, Linsey Haram, Summer LaRose, Hannah Moshay, LaRachelle Smith

Climate Change Priority Core Team: Megan O'Rourke (lead), Rubella Goswami (lead), Keesha Corbin, Kellie Burdette, Amber Campbell, Ari Caramanica, Joel Caton, Parag Chitnis, Andres Cibils, Sheila Fleischhacker, Amy Ganguli, Debora Hamernik, Lydia Kaume, Kevin Kephart, Erica Kistner-Thomas, Crystal Kyle, Patrick Martin, Eric Norland, Megan O'Rourke, Shafiqur Rahman, Maurice Smith, Ann Stapleton, Adam Wilke, Shoushan Zeng

Additional Internal NIFA Survey and Interview Help: Derecka Alexander, Ari Caramanica, Amber Campbell, Mark Carter, Daniel Cassidy, Prali Chitnis, Denis Ebodaghe, Brent Elrod, John Erickson, Danielle Farley, Matt Faulkner, Amber Gellert, Rocio Gutierrez Garzon, Debora Hamernik, Keith Harris, Cassandra Huey, Lisa Jahns, Venu Kalavacharla, Lydia Kaume, Bisoodat Macoon, Patrick Martin, Hannah Moshay, Vance Owens, Dorissel Resto, Susan Rice, Suzanne Stluka, Christian Tobias, Neerja Tyagi, Adam Wilke

## 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.<sup>i</sup> 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.

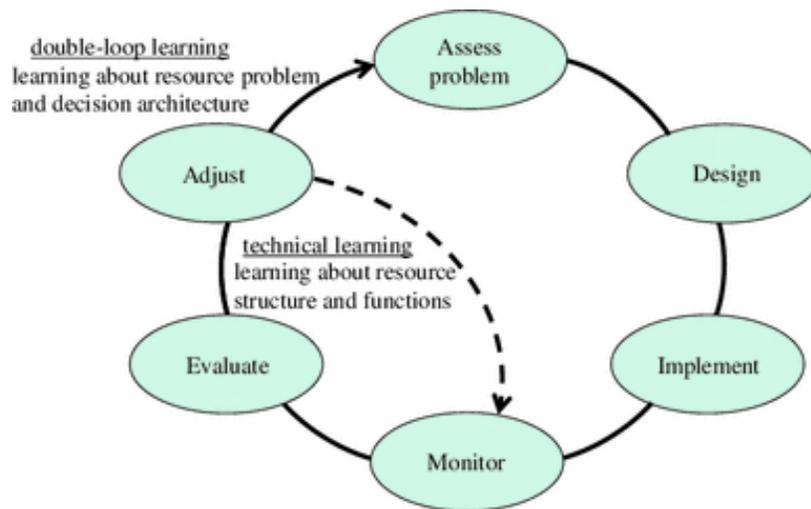


Figure 1. Diagram of the *adaptive management process*<sup>ii</sup>, which requires institutions to 1) assess the problem; 2) design solutions; 3) implement solutions; 4) monitor implementation; 5) evaluate success of solutions to address the problem; and 6) adjust solutions based on knowledge gained 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, OGF, 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, OGF	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
<b>CROSS-CUTTING</b> 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
<b>CROSS-CUTTING</b> 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
<b>CROSS-CUTTING</b> 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.

<sup>i</sup> Pardey, P.G., and Alston, J.M. 2021. The drivers of U.S. Agricultural Productivity Growth. *Federal Reserve Bank of Kansas City*.

<sup>ii</sup> Williams, B.K and Brown, E.D. 2014. Adaptive management: from more talk to real action. *Environmental Management*. 53, 465–479.