

USDA CLIMATE HUBS STRATEGIC PLAN

2020 - 2025



PHOTO CAPTIONS AND CREDITS

- 1) Farm Manager of Cecarelli Farms, William DellaCamera, shows sap beetles that have moved into corn after corn earworm damage. Photo credit: Northeast Climate Hub.
- 2) Installation of a TSCAN for the Organized Village of Kassan in Alaska. Photo credit: NRCS-AK.
- 3) Southern Plains Hub Fellow Caitlin Rottler and an NRCS specialist take soil samples to study the effects of climate and different management types on soil health. Photo credit: Lisa French, Cheney Lake Watershed, Hutchinson, KS.
- 4) Wildfire workshop. Photo credit: Clay Pope, Southern Plains Climate Hub.
- 5) Farmer in Puerto Rico stands in front of a cleared watermelon field after Hurricane María caused major crop losses. Photo credit: Eva Holupchinski, Caribbean Climate Hub.
- 6) Annual harvest dinner where local farmers and restaurants partner to create deeper connections with people and their food system, to support local farmers, and to better our community. <https://local-first.org/initiatives/eat-local/>. Photo credit: Emile Elias, Southwest Climate Hub.
- 7) Canola and wheat fields in eastern Washington. Photo credit: Gabrielle Roesch-McNally, Northwest Climate Hub.
- 8) Located in the mountains of Toa Alta, Puerto Rico, El Josco Bravo Project was one of several farms highlighted in the USDA Caribbean Climate Hub ADAPTA project, an effort to promote the benefits and importance of climate change adaptation in Puerto Rican agriculture. Photo credit: Caribbean Climate Hub.
- 9) University of Rhode Island researchers are assessing the viability of a summer cover crop now that the growing season has lengthened. Japanese Millet is one cover crop being assessed. Photo credit: Northeast Climate Hub.
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- 21) During a workshop focused on sustainable forestry in socio-ecological systems, participants enter Alzamora Laboratory Farm, located at the University of Puerto Rico, Mayagüez Campus. Photo credit: Caribbean Climate Hub.
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- 24) Southern Plains Climate Hub Fellow Caitlin Rottler and NRCS specialists work with a landowner to take soil samples in order to study the effects of climate and different management types on soil health. Photo credit: Lisa French, Cheney Lake Watershed, Hutchinson, KS.
- 25) Workshop participant touches a mahogany that was felled during hurricane Maria in 2017, the first tree harvested from El Yunque National Forest in 50 years. Photo was taken at the Milling Techniques for Maximum Wood Utilization workshop which aimed to increase capacity of wood industry and support sustainable management of trees downed by hurricanes. Photo credit: Caribbean Climate Hub.
- 26) Southern Plains Hub Fellow, Caitlin Rottler, provides a rainfall simulator demonstration. Photo Credit: Clay Pope, Southern Plains Climate Hub.
- 27) Farm Manager of Cecarelli Farms, William DellaCamera, checks traps for corn ear worm moths to evaluate if spraying is needed for the farm's integrated pest management strategy. Photo credit: Northeast Climate Hub.

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I. Introduction

In February 2014, the U.S. Department of Agriculture (USDA) announced the launch of "Regional Hubs for Risk Adaptation and Mitigation to Climate Change." The "Climate Hubs" support USDA program agencies and partners by providing a regional focus on working lands within the rapidly evolving fields of climate science, adaptation, and mitigation. The Climate Hubs provide expertise in forestry, agriculture, climate services, carbon dynamics, ecology, and science communication to address the effects of climate change. The Climate Hubs work with a diverse network of partners to support science-based decision making and facilitate communication with partners about climate-related risks and vulnerabilities. The Hub network provides avenues for communication among field staff, program managers, researchers, planners, and decision makers. The Hubs offer practical, science-based information and tools that field staff and other partners can share with producers and natural resource managers to meet region-specific, climate-related needs. The Hubs use a three-pronged approach to accomplish their mission: 1) science and data syntheses, 2) technology/tool co-development and support, and 3) outreach, convening and training. With this approach, the Hubs leverage USDA investments to build regional responses to climate change and variability. In doing so, the Hubs advance the mission of USDA while amplifying the contributions of USDA agencies and offices, including the Agricultural Research Service (ARS), Natural Resources Conservation Service (NRCS), U.S. Forest Service Research & Development (FS R&D), National Institute of Food and Agriculture (NIFA), Animal and Plant Health Inspection Service (APHIS), Farm Service Agency (FSA), Risk Management Agency (RMA), Rural Development (RD), Economic Research Service (ERS), and the Office of the Chief Economist's (OCE) Climate Change Program Office (CCPO).

Vision

Robust and healthy forests, agricultural production, and natural resources under increasing climate variability and climate change.

Mission

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.



Figure 1: Climate Hub regions and headquarters locations. Five of the USDA Climate Hubs are housed at U.S. Forest Service Research Stations (Northeast, Northern Forests, Southeast, Caribbean, and Northwest), and five are hosted by Agricultural Research Service Laboratories (Midwest, Northern Plains, Southern Plains, Southwest, and California).

Narrative Statement

The Climate Hubs program developed the following narrative statement to encompass their challenge and approach to achieving their mission.

Natural and working lands are affected by climate change, and USDA has made substantial investments in research, data, and tools to maintain working lands' productivity. However, these resources are often in a format that is not easily transferred or understood by USDA staff or land managers. Therefore, by building regional partnerships, and serving as a convening, co-production body, the USDA Climate Hubs can develop, interpret, and provide compelling and accessible information, support, and tools to managers of working lands.

The Challenge

Climate change affects food, forest, and fiber production across the United States in ways that vary by region. The Climate Hubs were established to understand and respond to the unique needs of the USDA, its agencies, and their partners, ensuring relevant and timely information and resources are available to meet their needs. Some of the expected climate change effects, vulnerabilities, and solutions in agriculture, forestry, and rural communities were documented in the Fourth National Climate Assessment and are highlighted below.

Agriculture Vulnerabilities

- Food and forage production will decline in regions experiencing increased frequency and duration of drought. Shifting precipitation patterns and seasons, when associated with increasing temperatures, will accelerate the depletion of water supplies for irrigation, intensify wildfires that can reduce forage on rangelands and impact crops, and expand the distribution and incidence of pests and diseases for crops, livestock and forests. Alternate breeding approaches are being employed to develop higher-yielding, more stress-tolerant crops and livestock, improve soil conditions, and better prepare for extreme drought events.
- The degradation of critical soil and water resources may accelerate as more frequent extreme precipitation events occur across agricultural landscapes. Sustainable crop production is threatened by excess runoff, leaching, and flooding, which result in soil erosion, degraded water quality in lakes and streams, and negatively affects rural and urban communities and infrastructure. Management practices to restore soil structure and hydrologic function are essential for improving landscape and community resilience.
- Challenges to livestock health are growing due to the increased frequency and intensity of high-temperature extremes. Heat stress on livestock results in significant economic losses for producers. Improved design of confined animal housing expanded application of silvopasture, and more heat-tolerant livestock are all important advances to minimize these challenges.

Forestry

- More frequent extreme weather events are increasing the frequency and magnitude of severe ecological disturbances, driving rapid (months to years) and often persistent changes in forest structure and function across vast landscapes. The effects of gradually changing climate averages and extremes include altered forest productivity, health, and the distribution and abundance of species at longer timescales.

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- Climate change will decrease the ability of many forest ecosystems to provide essential ecosystem services to society. Tree growth and carbon storage are expected to decrease in many locations because of higher temperatures, more frequent drought, and increased disturbances. The onset and magnitude of climate change effects on water resources in forest ecosystems will vary, and are already occurring in some regions.
- Forest management activities that increase the resilience of U.S. forests to climate change and extreme weather events are being implemented, with a broad range of adaptation options available for different applications. This may include supporting climate adaptation planning that incorporates climate-adapted seedlings into reforestation efforts. The future pace of adaptation will depend on how effectively social, organizational, and economic conditions support implementation.

Rural Communities

- Residents in rural communities may encounter unique challenges to responding to climate change impacts due to higher rates of poverty and more limited access to community resources. Communication, transportation, water, energy, and sanitary infrastructure may be more vulnerable to disruption from climate stressors in rural areas. Achieving social resilience to these challenges may require increases in local access and capacity for making adaptive improvements to community resources and infrastructure.
- Challenges to human health are growing due to the increased frequency and intensity of high-temperature extremes. Extreme heat conditions contribute to heat exhaustion, heatstroke, and heart attacks. Expanded health services in rural areas and for farm labor, in collaboration with other federal climate networks (e.g., the NOAA RISAs (Regional Integrated Sciences Assessments)), could help to alleviate these challenges.
- Rural communities provide food and forest products to urban communities and to regional, national, and international markets. Climate change in one region can have direct and indirect effects on rural communities in other regions. Widely shared knowledge and informed planning can increase local adaptive capacity and reduce risks for individual farms, forests, and local communities.

II. USDA Strategic Alignment

The Hubs' strategic plan aligns with and contributes to the FY2018-2022 USDA Strategic Plan, including goals 1 through 7. Hub strategies also align with and contribute to Administration priorities including emerging Departmental priorities and initiatives.

FY2018-2022 USDA Strategic Plan Goals:

1. Ensure USDA programs are delivered efficiently, effectively, and with integrity and focus on customer service.
2. Maximize the ability of American agricultural producers to prosper by feeding and clothing the world.
3. Promote American forest and agricultural products and exports.
4. Facilitate rural prosperity and economic development.
5. Strengthen the stewardship of private lands through technology and research.
6. Ensure productive and sustainable use of our National Forest System lands.
7. Provide all Americans access to a safe, nutritious, and secure food supply.

Executive Order on Tackling the Climate Crisis at Home and Abroad

This Executive Order (EO 14008¹) establishes a government-wide approach to combat the climate crisis. The Climate Hubs can contribute positively to multiple provisions and initiatives in EO 14008. Specifically, the EO aims to empower workers by advancing conservation, agriculture, and reforestation efforts. The EO specifies a role for America's farmers, ranchers, and forest landowners in combating the climate crisis and reducing greenhouse gas emissions such as through carbon sequestration. A Civilian Climate Corps Initiative will help mobilize the next generation of conservation and resilience workers and maximize the creation of accessible training opportunities and good jobs. This initiative will aim to conserve and restore public lands and water, bolster community resilience, and address climate change. Other relevant sections of the EO include USDA encouraging voluntary adoption of climate-smart agricultural and forestry practices and submitting an action plan for adaptation and resilience.

Climate-smart Agriculture and Forestry Strategy

EO 14008 tasked the U.S. Secretary of Agriculture to deliver a report with recommendations for a climate-smart agriculture and forestry (CSAF) strategy². The Secretary was directed to consider CSAF practices that decrease wildfire risk fueled by climate change, source sustainable bioproducts and fuels, and result in conservation actions that provide measurable carbon reductions and sequestration. The Climate Hubs play a central role in recommendation #4: *Strengthen education, training, and technical assistance for CSAF practices*. USDA can leverage the Climate Hubs to continue to lower barriers and increase the rate of adoption of CSAF practices. The Climate Hubs can also help identify opportunities for collaboration with partners to develop necessary innovation or curate tools and technologies to moderate stressors. The Hubs can bring lessons-learned back to USDA agencies and their partners to complete a cycle of learning, enhancing resilience, and improving productivity.

USDA's Action Plan for Climate Adaptation and Resilience

EO 14008 also directed USDA to prepare an Action Plan for Climate Adaptation and Resilience (Adaptation Plan), which outlines the steps that USDA will take to integrate climate adaptation into its mission and operations. Due to their ability to work across organizational boundaries and their regional specificity, the Hubs have a role in each of the five Department-scale actions that were described in the Adaptation Plan:

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.

Actions #2 and #5 task the Hubs with expanding their outward-facing efforts while also working within USDA to support Mission Areas and agencies in delivering climate adaptation through their activities and programs.

The Adaptation Plan also describes the significant role the Climate Hubs can play in advancing climate literacy among USDA staff, by initially convening a climate literacy working group and ultimately

¹ <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/>

² <https://www.usda.gov/sites/default/files/documents/climate-smart-ag-forestry-strategy-90-day-progress-report.pdf>

working with agencies and staff offices to identify and deliver on climate literacy needs. The Hubs can also coordinate internal information dissemination within USDA, connecting climate science outcomes to Mission Areas and programs. These elements of the Adaptation Plan all align with the workstreams and strategic goals of the Climate Hubs described below. Through their activities, the Hubs will contribute to iterative and sustained adaptation planning by USDA to ensure that emerging needs of the Hubs' internal and external stakeholders are addressed as climate change continues.

USDA Science Blueprint: A Roadmap for USDA Science from 2020 to 2025

Prepared in 2020, the USDA Science Blueprint lays out themes that provide a framework for USDA's science initiatives. There are five program themes: *Sustainable Ag Intensification*, *Ag Climate Adaptation*, *Food and Nutrition Translation*, *Value Added Innovations*, and *Ag Science Policy Leadership*. The Climate Hubs' strengths, objectives, and strategies align with several objectives articulated in the Blueprint and are well positioned to support the efforts of the Research, Education, and Economics (REE) and Forest Service (FS) mission areas. In particular, the goals of the *Ag Climate Adaptation* theme are to ensure that agricultural lands, national forests, and private working lands are managed, conserved, and restored to enhance productivity and resilience to climate change and other disturbances, such as drought, invasive species, and wildfire. Further, new science-based strategies and management practices will be developed and supported to promote systems that are fully leveraged to mitigate and adapt to changing climate and weather patterns and more intense heat, water, and other stress events to ensure food security and livelihoods.

Summary

The USDA Climate Hubs are well positioned to support the USDA Strategic Plan, EO 14008, the CSAF Strategy, the Adaptation Plan, and the USDA Science Blueprint. The goals of the Climate Hubs align with these initiatives in that the Hubs work across research and program agency boundaries to develop and deliver science and tools, curate and implement tools and technologies, and provide technical assistance and training in ways that reduce risk, enhance conservation, build resilience, store carbon, and promote the productivity and sustainability of working lands. Since 2014, the Climate Hubs have worked to ensure that farmers, ranchers, forest managers, and supporting businesses and agencies have the tools and information they need so that the Nation's farms and forests are more resilient to drought, hurricanes, floods, pests, and wildfire. The Hubs have achieved this by linking science and practice in agriculture and forest management.

III. How We Work

The Regional Climate Hubs are individually led through ARS and FS R&D, with support and guidance from a National Lead and Coordinator. Every two years, the National Lead position rotates between ARS, NRCS, and FS. The National Coordinator is hosted by the Office of the Chief Economist, Climate Change Program Office. Additional program oversight is provided by a multi-agency Executive Committee³. Several USDA agencies provide staff and operational funding, and actively engage in programmatic coordination. This intra-agency structure generates investment efficiencies, accelerated learning, and facilitates enterprise alignment.

³ The Executive Committee is led by a rotating chair (representing the same agency as is currently leading the Hubs program), and a permanent co-chair from the Office of the Chief Economist. The Executive Committee was established to guide, focus, and facilitate resources needed within the USDA to implement the Climate Hubs. The Executive Committee includes leadership from ARS, FS, NRCS, APHIS, RMA, NIFA, ERS, RD and FSA. See the Hubs charter here: https://www.climatehubs.usda.gov/sites/default/files/Regional_Hub_Charter.pdf.

Staffing

Each of the ten Regional Climate Hubs has a Director, and in some cases a Coordinator who is supported by the host research agency (ARS or FS R&D). From 2015 to 2020, each Hub also had a postdoctoral scientist supported by various USDA program agencies through the now-discontinued USDA Climate Hubs Fellows Program. Liaisons from RMA, FSA, APHIS, and NRCS have served one-year details with several Hubs between 2015 and 2019. Since 2019, however, only NRCS has continued to provide liaisons to the program, with three liaisons working with the Hubs in 2021. Additional staff, operations, and project funding are supported by various USDA research and program agencies, as well as through competitive funding to accomplish Regional Hub goals.

USDA Research Functions

The primary research agencies supporting the Climate Hubs are ARS and FS R&D, which provide facilities, employ staff, and support administrative functions such as contracting, grants, and agreements. Other USDA research agencies, including APHIS and ERS, collaborate and provide relevant research. NIFA funds extramural research that may support Climate Hub goals through competitive grants and capacity funding.

ARS, NRCS, and FS play key roles in supporting and governing the Climate Hubs. ARS focuses on conducting foundational and applied research, with efforts in the synthesis and development of decision-support tools. NRCS provides technical outreach through the administration of conservation programs and associated technical assistance in climate mitigation and adaptation. NRCS emphasis is on the conservation of soil, water, air, plants, animals, and energy. The FS R&D deputy area studies forest and rangeland ecosystem structure, function, and services, including the role of climate and the effects of climate change and climate variability. FS R&D also provides technical assistance in adaptation planning and implementation to land managers and works directly with them to co-develop appropriate tools and best practices for adaptation and mitigation.

USDA Program Functions

USDA program agencies provide risk management, incentives, and technical support of best management practices that align with the Climate Hubs mission. Program agencies include FSA, FS State and Private Forestry (S&PF), FS National Forest System (NFS), RMA, and RD.

USDA regional, state, and local programs provide support to the Hubs to help realize their vision and carry out their missions. Support may be project-specific and include interagency agreements or staff collaborations, as well as regional leadership commitments to steering committees or other planning and guidance activities. For example, USDA service agencies (e.g., FSA, RMA, and RD), and the Cooperative Extension System (a partnership of USDA and the land-grant university system) work with the Hubs to deliver knowledge, tools, and information to farmers, ranchers, and foresters through existing outreach, extension, and education capabilities. The FS State & Private Forestry deputy area is responsible for extension support and program delivery to non-federal forest owners, and works through State Foresters, municipalities, nongovernmental partners, and private landowners.

IV. Who We Serve

The Hubs’ partners include: 1) USDA agencies, 2) federal, state, university, tribal, nongovernmental, and private sector researchers and advisors to agriculture and forestry, and 3) farmers, ranchers, and forest managers. The Hubs work through USDA and other programs, networks, and initiatives across the country to connect with a wide variety of partners. Each of the ten Hubs serves as a regional resource of up-to-date climate information relevant to agriculture and forestry, and as a climate-focused conduit between USDA science and program agencies. Hub personnel frequently serve as climate consultants and facilitators, providing venues for two-way communication between practitioners and researchers. The Hubs use co-production to facilitate engagement among scientists and decision-makers to develop more relevant and useful products. The co-production cycle, highlighted in Figure 2, demonstrates a cyclic process of knowledge exchange, monitoring, and learning that takes place among the Hubs and partner groups.

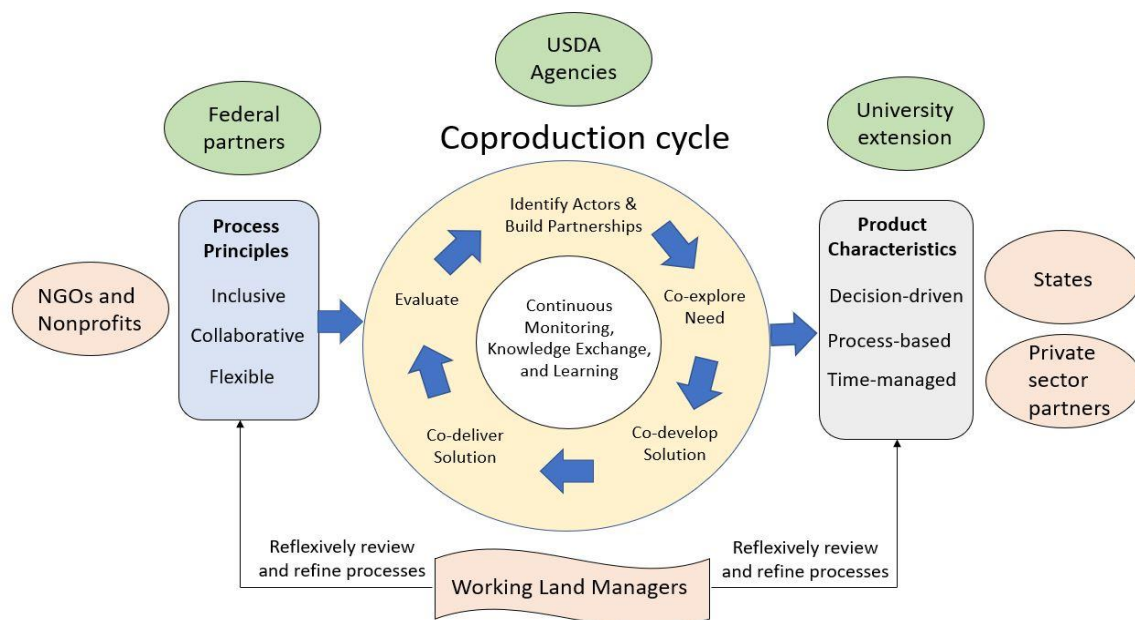


Figure 2: Hubs and partners co-production process. (Original co-production cycle source: Vincent, K., Daly, M., Scannell, C., & Leathes, B. (2018). What can climate services learn from theory and practice of co-production? *Climate Services*, 12, 48–58. doi: 10.1016/j.cliser.2018.11.001)

Climate Hubs Partners and Customers

- 1) **Internal partners:** USDA research agencies and program agencies.
- 2) **External partners:** Other federal agencies, universities and extension, states, tribes, local governments, non-governmental organizations, international organizations, and other technology-transfer providers, including but not limited to natural resource managers and service providers, and regional boundary organizations.
- 3) **USDA customers:** Farmers, ranchers, and forest managers, and the people and communities that depend on them.

Federal Research Agency Partners

Climate research is ongoing in many federal departments and agencies, especially those 13 that participate in the U.S. Global Change Research Program (USGCRP)⁴. Understanding and minimizing climate risk extends beyond the science capabilities of any one department or agency, and beyond the risk management practices of any one resource management community. Coordination is vital in ensuring that science capabilities and risk management practices developed by various partners support response and preparation in integrated ways.

The USDA Climate Hubs complement other networks of federal climate science and information centers (Figure 3). These networks include Climate Adaptation Science Centers (CASCs) (Department of Interior, U.S. Geological Survey), Regional Integrated Sciences and Assessments (RISA) teams (Department of Commerce, National Oceanic and Atmospheric Administration [NOAA]), Regional Climate Centers (NOAA), Regional Climate Service Directors (NOAA), the Sea Grant Program (NOAA), and other programs. Working with and across these other agency climate networks, the Hubs serve as a regional source of applied knowledge focused on adaptation and mitigation strategies for working lands.

Each network's specific mandate is targeted to the stakeholders associated with their respective agency's mission, yet overlapping geographies mean shared climate and weather events that affect multiple stakeholders, infrastructures, and landscapes simultaneously (see Figure 3). Designing agency programs to support mission-relevant partnerships ensures that decision makers obtain consistent information in the form and at the level of detail appropriate to their activities. The federal networks link their regional efforts to ensure that those affected by the same type of event benefit from more comprehensive and robust scientific expertise and innovative practices from across the federal government. Working together, the networks leverage knowledge and resources to address the growing demands for climate related support⁵.

University Partners

The Land Grant institutions in each state support climate change research and application, and provide outreach through Cooperative Extension. USDA provides funding to these institutions through NIFA formula funds and competitive grants. Land Grant institutions are crucial partners in the success of the Climate Hubs. They provide critical services, such as foundational and applied research, synthesizing and translating information, co-developing decision tools and management practices, and conducting outreach to land management partners. Key academic partners for the Hubs include:

- Cooperative Extension, which has been doing outreach and extension with land management partners for over 100 years. Cooperative Extension was engaged early in the process of establishing the Climate Hubs due to their existing network of trusted outreach professionals living in communities of working land managers.

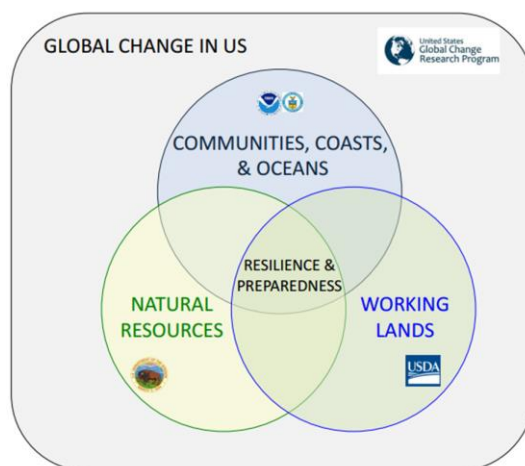


Figure 3: Collaboration of federal climate science and information centers.

⁴ Learn more about USGCRP here: <https://www.globalchange.gov/>

⁵ To learn more about federal climate network collaboration, visit <https://toolkit.climate.gov/content/federal-agency-coordination>

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- The Agricultural Experiment Stations, which provide applied science and syntheses—key deliverables for each Regional Climate Hub.
- The Association of Public and Land-grant Universities (APLU), which provides the Climate Hubs with access to many underserved communities. APLU includes eighteen 1890 Land Grant colleges/universities and represents six related higher education organizations, including the American Indian Higher Education Consortium. This consortium serves the interests of the nation's thirty-three 1994 Land Grant Universities. Hispanic Serving Institutions and Non-Land Grant Colleges of Agriculture are also represented by APLU.

State Government Partners

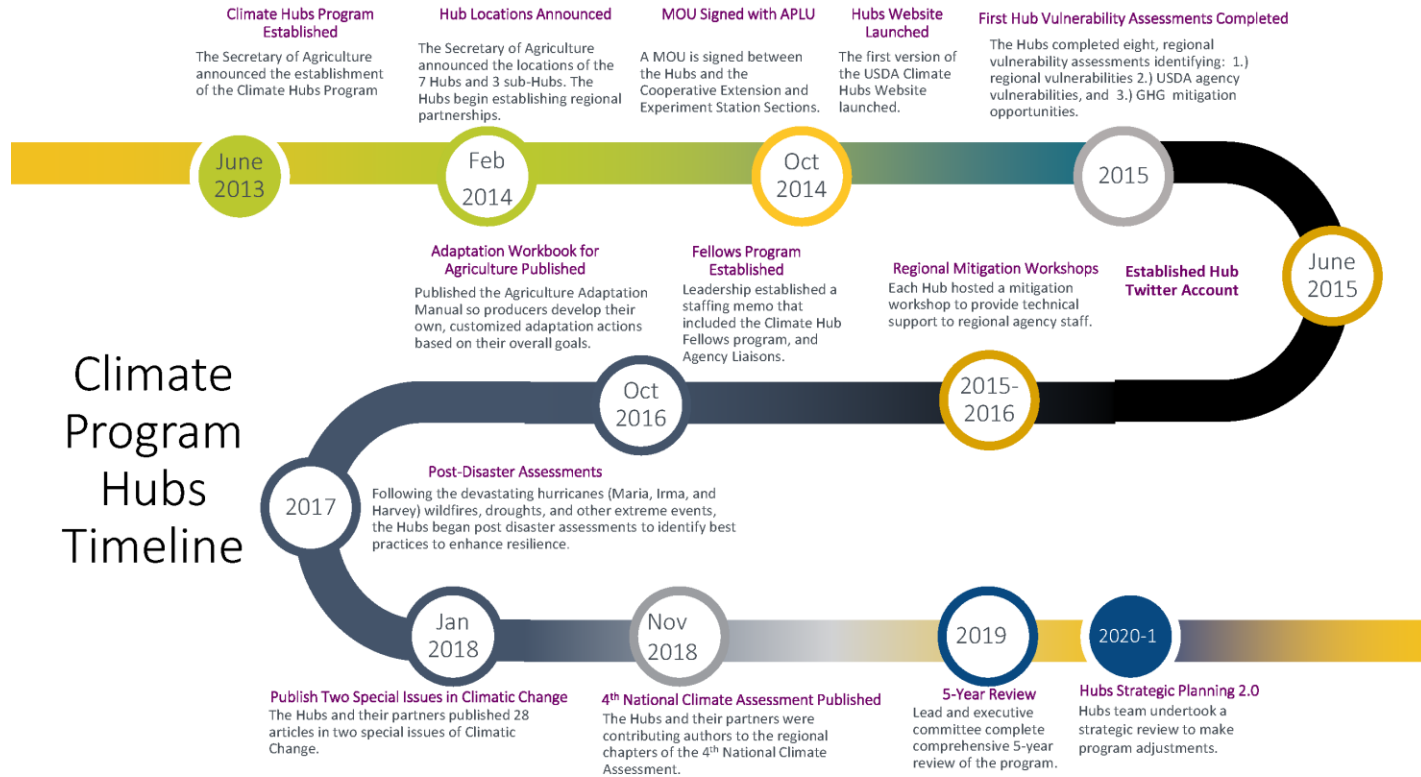
State Government agencies are critical to agricultural and forestry communities for the delivery of services, conservation of resources, planning, and management of public and private lands, interacting with federal agencies, communicating to the public to reduce the risk to life and property, and responding to changing climate. Therefore, state agencies involved in agriculture, forest management, planning, and climate-related communication are important partners of the Hubs.

- State climate advisors and climatologists help inform and develop agricultural and water policies, regulate water use, and plan for various hazards and emergencies.
- State Departments of Natural and Environmental Resources and Agriculture often eligible to receive and administer federal funds to understand and reduce the risks of climate change and lead relevant forest and agriculture advisory certification programs.
- State Departments of Planning and Statistics are key resources with which to share data and resources related to climate, agriculture, forestry, and related sectors.

Program Timeline

The Climate Hubs program was established in 2014, and some of the key program highlights are provided in the timeline below. The timeline starts with the program formation and goes through the key events that have occurred over the past six years, including completing regional vulnerability and post-disaster assessments, establishing the Climate Hubs Fellows program, publishing adaptation workbooks and regional special issues, contributing to the 4th National Climate Assessment, and carrying out the Five-Year Review.

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V. The Climate Hubs’ Five-Year Review (2019)

The USDA Climate Hubs Charter mandates that the Executive Committee conduct a performance review of the program every five years, and that the Climate Hubs’ National Lead chair the Five-Year Review process.

The *purpose* of the 2014-2019 review was to: (1) evaluate and assess the efforts of the Hubs relative to the Hubs' mission as stated in their charter, and (2) evaluate the Hubs' ability to adapt to the changing needs of USDA’s internal and external partners.

The *objectives* of the review were to: (1) provide an assessment of the Hubs' accomplishments and related impacts from 2014 to 2019, including their effectiveness in identifying and capitalizing on opportunities to provide meaningful information and tools to USDA’s internal and external partners, and (2) develop a set of recommendations based on identified opportunities to guide future direction.

The following sections highlight key findings of the Five-Year Review:

Climate Hubs’ Strengths

- The Climate Hubs excel at outreach, partnership building, and as convening bodies.** The Hubs have provided a platform for USDA agencies to meet and work on common issues and expand USDA’s outreach in collaboration with partners and working lands managers.
- Information produced by the Hubs, which is distributed in multiple formats, effectively expands working knowledge of climate and adaptation in the field.** The Hubs have synthesized regional climate impacts, identified how climate change and variability affects land management, and communicated this information in effective ways.
- The Hubs successfully work with partners to leverage funds to address pressing needs in their regions.** The Hubs have worked with an array of partners, including USDA agencies; universities and extension; a broad range of federal, state, and tribal agencies; conservation districts, conservancies,

lands trusts, and other non-governmental organizations; international organizations; and regional and national certification programs.

4. **The Hubs increasingly work with new audiences to help build climate resilience across the country.** The Hubs have helped new audiences identify regionally and culturally relevant climate adaptation opportunities. They have also helped the next-generation workforce become more climate-informed. These efforts have included reaching out to underserved communities including Tribes, tribal and inter-tribal organizations, veteran farmers, women farmers, small-scale farms, Spanish speakers, 4-H, and K-12 schools.
5. **Science development capacity and the role of the Climate Hub Fellows have been a critical resource for the Hub teams.** Ten Fellows, one per Hub, were recruited in a national search and supported as ARS or FS postdoctoral scientists through interagency agreements with FSA, RMA, NRCS, and APHIS. This cohort provided significant levels of research, training, and outreach support to the activities of the Hubs.

Opportunities for Program Growth

1. **Demands for programs and products from the Hubs are exceeding current capacity.** With commitment from departmental leadership, the Hubs can expand engagement between USDA science and program agencies at regional and national levels.
2. **The Hubs can play a greater role in preparing for and learning from climate-related disasters such as fire, flood, drought, extreme temperatures, and hurricanes.** Climate projections and recent observations indicate increasing frequency and intensity of climate-related disasters, in which the USDA plays a role in preparation, response, and recovery. The Hubs are uniquely positioned to work across agency boundaries to both assess vulnerabilities and strengths in the agriculture and forestry sectors in post-disaster scenarios, and to use that learning to develop information that can be provided to agencies and practitioners to reduce the cost and risk of future events.
3. **The Hubs can develop additional resources to prepare a climate-informed workforce nationwide.** This would be a more purposeful and strategic approach to sharing information and training the agriculture and forestry advisory communities, including USDA and extension agents, as well as university forestry and agronomy program planners.
4. **The Hubs can produce additional tools relevant to USDA agencies and partners that capitalize on existing technologies and data.** This would capitalize on the regional expertise of the Hubs and awareness of what is or is not being accepted and implemented in regionally important sectors.
5. **Co-developing Hub products with a broader range of USDA program agencies and partners will increase tool utility and uptake.** This entails building on regional success stories to expand capacity of specific tools, programs, studies, or activities.

The Five-Year Review provided important insights into the challenges and opportunities available to the Climate Hubs program. Feedback from staff and partners enables leadership to identify areas where additional resources could bolster the program, and where additional focus and refinement are needed. The logic model below provides updated inputs, activities, outputs, outcomes, and assumptions. The Climate Hubs team worked together to develop the updated components of the logic model as well as the assumptions and metrics that will ensure the program stays on track.

VI. Goals, Strategies, and Metrics

Since their initiation in 2014, the Hubs have developed extensive networks, built trust as an information provider, developed a broad range of projects and products, provided input to regional and national climate assessments, managed variable funding and staffing scenarios, and developed a cohesive strategy to accomplish their mission. Hub activities to accomplishing their mission can be characterized by a

three-pronged approach: 1) science and data syntheses, 2) technology/tool co-development and support, and 3) outreach, convening, and training. These categories facilitate program tracking as well as reporting and communicating to the Executive Committee and partners. These themes are not mutually exclusive and have continued to evolve to help summarize the work of the Hubs:

- **Science and data syntheses.** A key role of the Hubs is understanding what the best science indicates about current and future climate scenarios; how current and projected conditions affect agriculture, forestry, and the communities that depend on them; how to best adapt to new conditions; and mitigate greenhouse gases, and what roadblocks exist to implementing best practices. Therefore, the Hubs continuously identify specific needs for assessments and syntheses of information at many scales. The science capacity and science perspective of the Hubs are critical to carry out this function effectively as they conduct, request, inform, review, and guide the development of relevant research.
- **Technology/tool co-development and support.** Tools and technology for agriculture and forest management are rapidly evolving, as is the knowledge about climate change, and the approaches to climate change mitigation and adaptation. Hubs engage in tool development and curation to address regional partner needs, support existing USDA and partner tools and capacities, and reduce obstacles to implementing best practices. These efforts improve access to climate change projections other usable regional data in support of risk management and climate adaptation planning. The Hubs also provide coordinated technical support in adaptation planning to supplement USDA agriculture and land management program delivery.
- **Outreach, convening, and training.** A major role of the Hubs is developing and communicating science-based information with a diverse set of partners. This theme covers a broad range of activities, from factsheets and trainings to podcasts and media interviews. It includes developing relevant information about, and providing exposure to, the latest climate science and its implications for working lands, as well as information regarding tools, practices, resources, and benefits to implementing climate mitigation and adaptation actions. The Hubs convene and engage with partners and communities in innovative and interactive ways to help increase climate literacy and lower the barriers to climate adaptation and mitigation, climate-related risk management, and rural productivity enhancement.

The Climate Hubs' Guiding Principles

Four values guide the Hubs' activities:

1. **Science-driven**—We generate and use science and technology and maintain a high standard of quality and objectivity.
2. **Partner-centered**—We engage with land management partners to listen, identify gaps, co-produce knowledge, and provide feedback to science and technology providers. We support our public, private, and tribal partners by developing relevant, timely, and usable information and tools that meet their current and future needs.
3. **Cooperative**—We cooperate within USDA, across the federal government, and among networks to effectively provide land management partners with information, management practices, and decision-support tools that reduce the risks of climate change and improve well-being.
4. **Efficient**—We recognize and work with inherent strengths within the Hub network and find the right person, team, or organization to do the work that needs to be done.

Hubs Value Added

The Hubs add value in the following ways:

1. The Hubs are connectors and **link the latest science to programs and managers.**

2. The Hubs **build mutual literacy in climate science and working lands**, using social science insights to encourage knowledge co-production.
3. The Hubs **assess climate vulnerabilities** pre- and post-disaster and make recommendations to increase landscape and community resilience.
4. The Hubs **provide tested and effective processes for adaptation** planning and implementation, helping managers gain the confidence to adapt.
5. The Hubs **build relationships and networks** to foster collective, nimble, science-informed weather and climate responses.

Based on this approach, the Hub guiding principles and value added, the Hubs team and Executive Committee have identified three overarching goals and strategies as well as metrics and outcomes to strive toward over the next five years: 1) enhance working lands resilience and productivity, 2) build climate awareness, and 3) increase program effectiveness. Strategies and actions to achieve these goals support Hub outputs and outcomes which are included below in a logic model. Indicators of success are also included to ensure the Hubs efforts stay “on track” as the program undertakes its diverse portfolio of activities.

Underpinning and woven throughout these goals are the cross-cutting themes of equity and environmental justice⁶⁷. By integrating environmental justice and equity concerns across its three themes and strategic goals, the USDA Climate Hubs can support historically marginalized, overburdened, and under-resourced communities. The Climate Hubs must ensure that environmental and economic justice are key considerations in order to address the disproportionately high and adverse human health, environmental, and climate-related impacts on disadvantaged communities.

Goal 1: Enhance Working Lands Resilience and Productivity

Ensure that agricultural lands, national forests, and private working lands are managed, conserved, and restored to enhance productivity and resilience to climate change.

Strategies

To enhance resilience to climate change and support productivity on working lands, the Hubs carry out their three-pronged approach identified above at the regional scale: 1) science and data syntheses, 2) technology/tool co-development and support, and 3) outreach, convening, and training.

The Hubs collaboratively work with partners to **identify** regional climate vulnerabilities then prioritize, plan, and implement projects or practices to adapt to climate stressors. The Hubs **connect** research to practice **reducing the vulnerability** of productive working lands to long-term climate change and extreme weather events⁸. The Hubs help to **lower barriers** and increase the rate of adoption of climate-smart agriculture and forestry practices. They also identify opportunities to collaborate with partners to develop needed innovations or curate tools and technologies to moderate stressors. With their focus on knowledge sharing, the Hubs are also poised to bring lessons learned back to USDA agencies and their partners and complete a cycle of learning and improved preparedness which can **enhance resilience and productivity**.

Additional actions when appropriate opportunities arise include: (a) developing economic assessments that inform and empower management planning and climate-informed decision making; (b) expanding the

⁶ [Executive Order on Tackling the Climate Crisis at Home and Abroad](#), January 27, 2021.

⁷ [Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government](#), January 20, 2021.

⁸ Climate-Smart Agriculture and Forestry Strategy: 90-Day Progress Report. May 2021. USDA.

<https://www.usda.gov/sites/default/files/documents/climate-smart-ag-forestry-strategy-90-day-progress-report.pdf>

reach or applicability of existing tools or technologies that build climate resilience and mitigate climate change; (c) collaborating on regional or national working groups to provide relevant information for national-level program or policy development; (d) coordinating input on adaptation strategies that promote productive and sustainable use of our NFS lands; (e) conducting pre- and post-disaster assessments; and (f) developing and conducting training and capacity building to increase sustainability and production on working lands.

Goal 2: Build Climate Awareness

To build shared climate awareness among USDA agency personnel, the agriculture and forestry advisory community, practitioners in agriculture and forestry, policy makers and planners, and the public.

Strategies

The Hubs serve as a trusted source of climate-related knowledge and can deliver information on climate projections and current weather and climate-related stressors and impacts to partners, ensuring science-based, data-driven, and customer-focused information. The Hub partner network cuts across traditional agency and program boundaries, providing a unique opportunity to build a shared awareness of the risks, vulnerabilities, challenges, best practices, and opportunities presented by climate change. Addressing this goal with an intention to reach diverse partners involves a strategy of diverse communication mechanisms grounded in traceable scientific documentation.

Key components of this strategy involve leveraging the co-production model to assemble, synthesize, interpret, and communicate relevant information in effective ways. Building a shared awareness involves integrating the best science into messaging tools like research publications, gray literature, social and other media communications, and video and podcast products. This includes developing educational modules, webinars, workshops, trainings, and demonstration projects. The Hubs participate in and lead regional and national working groups and initiatives, customer-focused workshops, science syntheses and interpretation to improve the common climate awareness.

Goal 3: Increase Program Effectiveness

To continually evaluate and refine program metrics and procedures to ensure program effectiveness and communicate success.

Strategies

The Hubs operate in a dynamic environment of competing priorities within their agencies, the federal government, and among their partners. Therefore, it is important that the Hubs have metrics and processes in place to evaluate their effectiveness and communicate success.

The Hub Directors and staff work with the National Office and Executive Committee to develop and implement efficient mechanisms to assess Hub resources, actions, outputs, and outcomes in qualitative and quantitative ways. The Hubs also seek to continuously improve their communication, consistency, adherence to science, and reach with underserved populations through quantitative and qualitative assessments of partner awareness and Hub communication effectiveness.

The Hubs program uses an adaptive management approach to evaluate and fine-tune its work as represented by the adaptive management cycle found in the Open Standards for Conservation manual (see Figure 4). Since the program began, the Hubs team has conceptualized, planned actions and monitoring, implemented their actions, analyzed the results, and captured and shared their learning. The program has evolved and will continue to do so to help land managers meet the challenges of a changing climate.

Climate Hubs' Logic Model and Metrics

The logic model that follows includes the inputs, partners, activities (outputs) and anticipated outcomes over time. The content of the logic model is by no means exclusive or comprehensive; however, it provides an overview of the kinds of work, partnerships, and inputs (resources) required to accomplish the established outcomes for the program. Indicators and output metrics are included to ensure the program is on track and accountable.

Outcome measurements are an important part of the management of any program; however, they require longer-term strategies that comply with the Paperwork Reduction Act (approved through the Office of Management and Budget) and compliance with the Federal Advisory Committee Act (FACA). For that reason, they are not included in this strategic plan, but are encouraged in future versions.

VII. Conclusion

The process of strategic planning allows the program to look back as well as forward. By undertaking this process, the staff and Executive Committee evaluated their experiences over the last five years (e.g., through the Five-Year Review), and identified ways to better manage and communicate their success to leadership. Adaptive management and co-production are key tenets of the Hubs' success and this plan has resulted from the implementation of those tenets. We look forward to many more years of successful implementation of the Climate Hubs program and working with partners to co-develop and implement many more climate-resilient strategies.

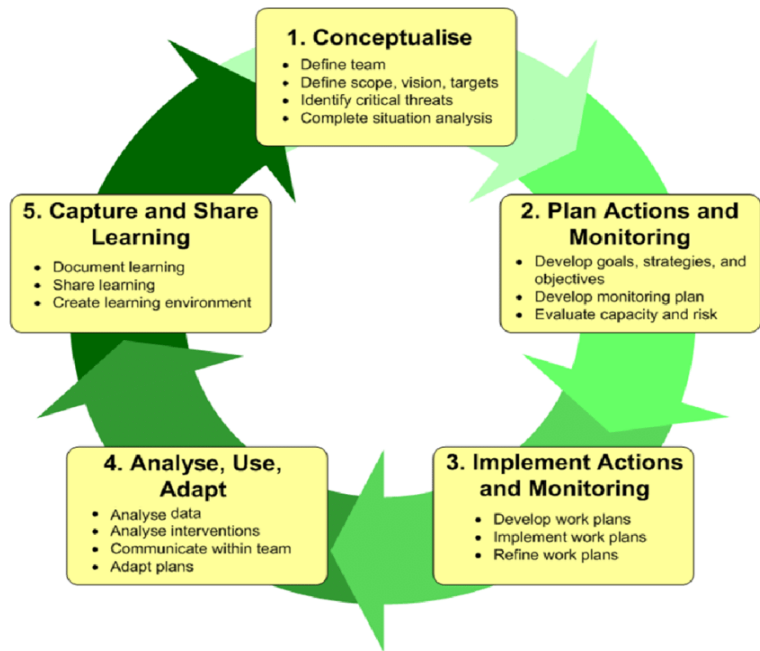


Figure 4: The Open Standards adaptive management cycle (www.conservationmeasures.org). Reference: Capitalizing on conservation knowledge: Using Conservation Action Planning, Healthy Country Planning, and the Open Standards in Australia - Scientific Figure on ResearchGate. Available from: <https://www.researchgate.net/figure/The-Open-Standards-adaptive-management-cycle-from->

Inputs	Outputs		Outcomes -- Impact		
	Participants	Activities	Short	Medium	Long
<ul style="list-style-type: none"> ▪ USDA scientists and staff ▪ USDA intra-agency coordination ▪ US federal government interagency coordination ▪ Coordination with States (Land Grant Institutions, Cooperative Extension, Agricultural Experiment Stations) and other non-federal partners (e.g., NGOs) ▪ International coordination ▪ Hub Executive Committee ▪ Hub Directors and Co-leaders ▪ Hub Steering committee members ▪ Partner and customer comments 	<ul style="list-style-type: none"> ▪ USDA Service Centers ▪ NOAA and DOI regional climate change institutions ▪ Agricultural producers, and forest landowners ▪ Commodity and producer groups ▪ General public ▪ Tribal governments and communities ▪ University scientists ▪ Cooperative Extension specialists and educators ▪ Sea Grant Extension specialists and educators ▪ State agencies ▪ Federal agencies ▪ Non -Government Organizations ▪ Agricultural and natural resource agencies of Canada, Mexico, Latin America, and the Caribbean 	<p>Goal 1: Enhance Working Lands Resilience and Productivity</p> <ul style="list-style-type: none"> ▪ Science and data syntheses ▪ Tool/technology curation and implementation support ▪ Technical assistance and training ▪ Develop economic assessments that inform and empower management planning and climate-informed decision making ▪ Expand the reach or applicability of existing tools or technologies that build climate resilience and mitigate climate change ▪ Collaborate on regional or national working groups to provide relevant information for national-level program or policy development ▪ Coordinate input to adaptation strategies that promote productive and sustainable use of our National Forest Systems lands ▪ Develop and conducting training and capacity building to increase sustainability and production on working lands. <p>Goal 2: Build Climate Awareness</p> <ul style="list-style-type: none"> ▪ Assemble, synthesize, interpret, and communicate relevant information in effective ways. ▪ Integrate the best science into messaging tools like research publications, gray literature, social and other media communications, 	<ul style="list-style-type: none"> ▪ USDA climate research is strengthened by collaboration across agencies and regions ▪ Extension climate capacity is established and strengthened ▪ Climate awareness is increased for producers, USDA service agencies, other regional USDA Agencies and Extension professionals ▪ Assessments of climate change risk to production systems and regions are published ▪ Climate resilient production strategies are developed ▪ Ongoing curation of decision-support tools and technology applications to support adaptation and mitigation on working lands ▪ The program runs efficiently and meets the needs of its 	<ul style="list-style-type: none"> ▪ Climate Hub partners (internal/external) and customers make climate-informed decisions due to their interactions with the Climate Hubs. ▪ A more climate-informed USDA workforce ▪ Increased production resilience to climate variability and extreme events ▪ Regional climate change impacts are understood at an appropriate level of granularity (time/space) that resonates with partners and customers. ▪ A well-managed, effective program that meets the needs of the partners and customers we serve. 	<ul style="list-style-type: none"> ▪ US agriculture and natural resources are made more resilient to or adapted to climate change ▪ Significant and measured mitigation of agricultural greenhouse gas production ▪ Agricultural producers continue to ensure global food security ▪ Climate - informed conservation of US agriculture and natural resources ▪ Continued production of safe, affordable, and high-quality US commodities ▪ U.S. agricultural producers remain competitive globally ▪ U.S. rural economy remains environmentally

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	<ul style="list-style-type: none"> ▪ Environmental groups ▪ Private Sector ▪ Traditionally underserved communities 	<p>and video and podcast products.</p> <ul style="list-style-type: none"> ▪ Develop educational modules, webinars, workshops, trainings, and demonstration projects ▪ Participate in and lead regional and national working groups and initiatives, customer-focused workshops, science syntheses and interpretation to improve the common climate awareness. <p>Goal 3: Increase Program Effectiveness</p> <ul style="list-style-type: none"> ▪ Work with the National Office and Executive Committee to develop and implement efficient mechanisms to assess Hub resources, actions, outputs, and outcomes in qualitative and quantitative ways. ▪ Continuously improve communication, consistency, adherence to science, and reaching underserved populations through quantitative and qualitative assessments of partner awareness and Hub communication effectiveness. 	<p>partners/customers</p>		<p>strong and sustainable</p> <ul style="list-style-type: none"> ▪ Lower costs in planning and response to extreme climate events ▪ Sustainable rural economies
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<p><u>Key Factors to Generating Change</u></p> <ul style="list-style-type: none"> ▪ Demonstrated value from partnerships and coalition building both within and outside the USDA. ▪ Defined outcomes and metrics that show connections between desired changes and our services. ▪ Increased climate literacy and ease in discussing climate for our partners through our key activities. ▪ Enhanced awareness of the Climate Hubs and buy-in to the program and approach. ▪ Demonstrated cost savings from adaptation/mitigation strategies and value foregone if the program did NOT exist. 	<p><u>External Factors affecting the program</u></p> <ul style="list-style-type: none"> ▪ Administrative support: Consistent, timely hiring process and fast turnaround Grants and Agreements support. ▪ Political will for the program (measured by funding, mentions and requests). ▪ Catalyzing event affecting perceived need or lack of need for the program (i.e. COVID-19, drought, hurricane). ▪ Mobility: Ability to meet in-person (vs. remotely) and associated travel. ▪ Turnover in agency staff and loss of institutional knowledge, access and support.
<p><u>Output/Activities Metrics</u></p> <ol style="list-style-type: none"> 1. Number of vulnerability or other significant climate assessments completed. 2. Number of peer-reviewed publications or general technical bulletins completed. 3. Number of curated or customized tools or technologies developed or supported. 4. Number of trainings or capacity building workshops (in-person or virtual) completed. 5. Number of developed demonstration projects, education modules or curricula. 	<p><u>Outcome Indicators to Demonstrate Impact</u></p> <ul style="list-style-type: none"> ▪ Request for hub services/products increase; including mutual interest in longer-term collaborations. ▪ Participants perceive science and the process as credible and useful - (near term). ▪ Findings/outputs meet the standard the agency applies to "usable" information for action. ▪ Novel development of new tools, resources, and research for partner and end user needs. ▪ Increased adoption of processes and practices promoted by the Climate Hub program.