

US Department of Agriculture Climate Change Adaptation Plan June 2014

I. Policy Framework

Role and Mission of USDA

The US Department of Agriculture (USDA) provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues through its evolving service role at the nexus of traditional rural American food, fiber and fuel production and the emerging economic opportunities in renewable energy, broadband, and recreation. The vision statement of the USDA Strategic Plan calls for the Department “to expand economic opportunity through innovation, helping rural America thrive; to promote agriculture production sustainability that better nourishes Americans while also helping to feed others throughout the world; and to preserve and conserve our Nation’s natural resources through restored forests, improved watersheds, and healthy private working lands.” Climate change has the potential to confound USDA efforts to meet these core obligations and responsibilities to the Nation.

Rural America is rapidly transitioning to a diverse and competitive business environment driven by an increasingly sophisticated consumer market here and abroad. The economic vitality and quality of life in rural America depends on a financially healthy agricultural system and access to agricultural and emerging markets. US farmers, ranchers and foresters ensure that all of America and many other parts of the world have nutritious and safe food, adequate energy sources, and fiber products sufficient for the needs of a rapidly increasing population. Climate change adaptation is essential to sustain these capabilities.

Background

Scientific evidence shows that US climate has changed substantially since 1900, that this rate of change is accelerating, and that even greater rates of change are likely to occur in the next 100 years. Climate change has the potential to disrupt USDA’s efforts to meet the core obligations and responsibilities articulated by its mission and goals. The vulnerability of USDA operations and programs to climate change will be highly dependent on the variability, magnitude, and pattern of climate changes, as well as on changes in climate extremes. Changing precipitation and temperature patterns as well as increasing atmospheric greenhouse gas concentrations affects forest- and agro-ecosystems at national, regional, and local scales. These changes may have significant implications for USDA program participation and associated costs. Such projections are accompanied by a great deal of uncertainty so policies will need to be flexible enough to adapt to this uncertainty.

USDA is unique among many Federal Departments in that the broad spectra of its sub-agency missions include research, applications and technology transfer, public land management, technical assistance, and communications and delivery, missions that revolve around people and the land; private and public, rural and urban. These broad areas provide a strong foundation to address the complexities of climate change, climate variability, and extreme events. The 2014

USDA Climate Change Adaptation Plan integrates input from 11 USDA sub-agencies and offices and updates their 2012 plans. The Adaptation Plan provides a vulnerability assessment, reviews the elements of USDA's mission that are at risk from climate change, and provides actions and steps being taken to build resilience to climate change specifically in response to EO 13653. In addition, the plan advances President Obama's efforts to integrate climate change adaptation planning into the actions of the Federal Government through the President's Climate Action Plan (PCAP), other executive orders, and the US Department of Agriculture departmental policies.

USDA is well-positioned to meet the requirements of the federal agency climate change adaptation guidance. The Department's Strategic Plan for 2014-2018 provides a powerful foundation for climate change adaptation planning.

All five goals of USDA's Strategic Plan have objectives that articulate opportunities and challenges associated with climate change adaptation. Strategic Goal 2 specifically addresses the challenges of climate change and opportunities "to ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change." The Strategic Plan calls for the Department to capitalize on opportunities presented by the Nation's efforts to develop markets for ecosystem services. The USDA Strategic Plan further calls on the Department to lead efforts to mitigate and adapt to climate change through Goals 1, 3, 4 and 5.

Strategic Goal 1: Assist Rural Communities to Create Prosperity so They are Self-Sustaining, Repopulating, and Economically Thriving

- Objective 1.1 – Enhance Rural Prosperity, Leveraging Capital Markets to increase Government's Investment in Rural America;
- Objective 1.2 – Increase Agricultural Opportunities by Ensuring a Robust Safety Net, Creating New Markets, and Supporting a Competitive Agricultural System;
- Objective 1.3 – Contribute to Expansion of the Bioeconomy by Supporting Development, Production, and Consumption of Renewable Energy and Bio-based Products.

Strategic Goal 2: Ensure our National Forests and Private Working Lands are Conserved, Restored, and Made More Resilient to Climate Change while Enhancing our Water Resources

- Objective 2.1 – Improve the Health of the Nation's Forests, Grasslands, and Working Lands by Managing Natural Resources;
- Objective 2.2 – Lead Efforts to Mitigate and Adapt to Climate Change, Drought and Extreme Weather in Agriculture and Forestry;
- Objective 2.3 – Contribute to Clean and Abundant Water by Protecting and Enhancing Water Resources on National Forests and Working Lands;
- Objective 2.4 – Reduce the Risk from Catastrophic Wildfire.

Strategic Goal 3: Help America Promote Agricultural Production and Biotechnology Exports as America Works to Increase Food Security

- Objective 3.1 – Ensure US Agricultural Resources Contribute to Enhanced Global Food Security;

Objective 3.2 – Enhance America’s Ability to Develop and Trade Agricultural Products Derived from New and Emerging Technologies;

Strategic Goal 4: Ensure that All of America’s Children Have Access to Safe, Nutritious, and Balanced Meals

Objective 4.4 – Protect Agricultural Health by Minimizing Major Diseases and Pests to Ensure Access to Safe, Plentiful, and Nutritious Food.

Strategic Goal 5: Create a USDA for the 21st Century that is High-Performing, Efficient, and Adaptable

Objective 5.2 – Build a Safe, Secure, Efficient Workplace by Leveraging Technology and Shared Solutions across Organizational Boundaries.

Executive Directives, Policies, and USDA’s Role

Climate change challenges the mission, operations, and programs of nearly every federal agency and USDA is no exception. Ensuring that the Federal Government has the capacity to execute its missions and maintain important services in the face of climate change is essential. Climate-specific strategies include and are based on:

Executive Order 13514 – Federal Leadership in Environmental, Energy, and Economic Performance (October 2009)

EO 13514 directed each agency to develop a sustainability strategy and reduce greenhouse gas emissions and to develop policies and practices to support the Federal Adaptation Strategy. This Executive Order challenged federal agencies to set sustainability goals for agency operations and directed agencies to improve their environmental, energy and economic performance. Each federal agency was asked to evaluate agency climate change risks and vulnerabilities to manage both the short- and long-term effects of climate change on the agency’s mission, programs, and operations.

US Department of Agriculture Departmental Regulation 1070-001 (June 2011) – The purpose of this regulation is to implement sections of EO 13514 and establish a USDA-wide directive to integrate climate change adaptation planning and actions into USDA programs, policies and operations. This policy statement stands today.

US Department of Agriculture Strategic Sustainability Performance Plan (June 2013) – On the 2013 plan, USDA identified climate change resilience as its sustainability practice Goal 9. Strategies included Sub-Agency plans to integrate climate change adaptation into agency and regional planning, establish 7 regional climate hubs, and report on progress in climate preparedness and resilience implementations. The previous year’s plan reported a risk analysis on how climate change might affect its functions and national agriculture production and included adaptation plans from eleven USDA sub-agencies.

The President's Climate Action Plan (June 2013)

This plan, consisting of a wide variety of executive actions, has three key pillars: a) Cut Carbon Pollution in America; b) Prepare the United States for Impacts of Climate Change; and c) Lead International Efforts to Combat Global Climate Change and Prepare for its Impacts. The President's plan identifies approximately 72 actions that the Federal Government should take. USDA is participating wholly or in coordination with other agencies in 19 actions including identifying vulnerabilities to climate change, maintaining agricultural sustainability, managing drought and leading efforts to address climate change through international negotiations. Those focused primarily on national USDA resilience strategies include:

President's Climate Action Plan		
Pillar 1: Cut Carbon Pollution in America		
Deploying Clean Energy	Cutting Energy Waste	Reducing Other Greenhouse Gas Emission
<ul style="list-style-type: none"> • Next Generation Biofuels • Transmission Project Siting and Permitting • Green Buildings and Energy Efficient Strategies • Biogas Roadmap 	<ul style="list-style-type: none"> • Energy Efficiency and Conservation Loan Program (reducing barrier to energy efficient investment) • Rural Energy for America Program 	<ul style="list-style-type: none"> • Interagency Methane Strategy • Reduced Emissions from Deforestation and Forest Degradation (REDD+) • NEPA Guidance Distinguishing Biogenic Carbon and Fossil Carbon • Voluntary Carbon Partnerships

President's Climate Action Plan		
Pillar 2: Prepare the United States for the Impacts of Climate Change		
Building Stronger and Safer Communities and Infrastructure	Protecting Our Economy and Natural Resources	Using Science to Manage Climate Impacts
<ul style="list-style-type: none"> • Direct Agencies to support Climate-resilient Investment • Support Communities Preparing for Climate Impacts • Rebuilding/Learning from Extreme events • Tribal Adaptation and Resiliency Project 	<ul style="list-style-type: none"> • Identify Vulnerabilities of Key Sectors • Promote Insurance leadership for Climate Safety • Conserve Land and Water Resources • Maintain Agricultural Sustainability • Manage Drought (National Drought Resilience Partnership) • Conserve Forests - Reduce Wildfire Risks • Prepare for Future Floods 	<ul style="list-style-type: none"> • Develop Actionable Climate Science • Assess Climate-Change Impacts in the US • Launch Climate Data Initiative • Provide Toolkits for Climate Resilience

President’s Climate Action Plan	
Pillar 3: Lead International Efforts to Combat Global Climate Change and Prepare for its Impact	
Work with Other Countries to Address Climate Change	Lead Efforts to Address Climate Change Through International Negotiation
<ul style="list-style-type: none"> • Expand Bilateral Cooperation with Major Emerging Economies • Combat Short-lived Climate Pollutants • Reduce Emissions from Deforestation and Forest Degradation • Expand Clean Energy Use and Cut Energy Waste • Negotiate Global Free Trade in Environmental Goods and Services • Strengthen Global Resilience to Climate Change • Climate Smart Agriculture • Global Research Agenda 	<ul style="list-style-type: none"> • Support the Department of State in Ongoing Negotiations on Climate Change • Prepare a major Interim Report for the National Climate Assessment entitled, <i>Global Climate Change, Food Security, and the US Food System</i>. • Work with partners in establishment of the Climate Smart Agricultural Alliance

Executive Order 13653 – Preparing the United States for the Impacts of Climate Change (November 2013)

EO 13653 directs agencies to develop or continue to develop, implement, and update comprehensive plans that integrate consideration of climate change risks and vulnerabilities into agency operations and overall mission objectives. This EO advances the focus of resilience strategy in the President’s Climate Action Plan.

II. Planning for Climate Change Related Risk

Section 5(a) of EO 13653 states “each agency shall develop or continue to develop, implement, and update comprehensive plans that integrate consideration of climate change into agency operations and overall mission objectives...” This portion of the USDA Adaptation Plan addresses the five subsections enumerated in EO 13653.

Section 5(a)(i): identification and assessment of climate change related impacts on and risks to the Agency’s ability to accomplish its missions, operations, and programs.

Vulnerability Assessment

A sampling of the risks grouped by the USDA Strategic Goals¹ and the Sub-Agencies' strategies follow:

Strategic Goal	Objective	Risks and vulnerabilities	Sub-Agencies Involved ²	Possible Response Strategies
1 Assist Rural Communities to Create Prosperity to be Self-Sustaining, Repopulating and Economically Thriving	1.1 Enhance rural prosperity Develop and support regional food systems	Some regions will face greater challenges in adapting to changes in extreme events such as droughts and storms	RD, ERS, FSA, RMA, ARS, NIFA	Better prepare farmers with adaptive responses to climate, encourage regional networks through USDA Climate Hubs. Develop new crop varieties to withstand changing climate conditions.
	Generate and retain green jobs and economic benefits through natural resource and recreation programs	Tourism activities and green jobs will be positively (warm-weather activities) and negatively (snow-related activities) impacted by climate change. Coastal tourism could be affected by sea-level rise.	FS, RD, NRCS, FSA	Work with rural communities to manage lands for tourism and outdoor recreation and find ways to use lands to enhance green employment opportunities.
	1.2 Increase agricultural opportunities; robust safety net Capitalize on opportunities presented by the nation's efforts to develop markets for ecosystem services and mitigate climate change	Ecosystem services will be stressed by climate extremes and natural disasters. Small producers may be impacted sooner than others; climate changes will stress some crops and potentially affect sustainability and competitiveness of agricultural systems.	ERS, FS, FAS, FSA, NRCS, RD, RMA	Work with producers to diversify agricultural practices and protect ecosystem services. Promote crops with mitigation potential and with greatest resilience to environmental changes. Establish more certified organic operations; Trade preserved through USDA staff resolution of market access issues; Improved crop insurance; Conduct research to improve seed and feed, improve agricultural practices, diversify, and develop ecosystem markets.
	1.3 Contribute to Expansion of Bioeconomy Facilitate sustainable	Energy crops subject to new and challenging growing conditions. Stressed	ARS, ERS, FS, FSA, NIFA, NRCS, RD	Renewable energy can offset greenhouse gas emissions. Develop new energy crop varieties that can withstand

¹ Source: US Department of Agriculture Strategic Plan FY 2014-2018: <http://www.ocfo.usda.gov/usdasp/sp2014/usda-strategic-plan-fy-2014-2018.pdf>

² Agency Abbreviations: ARS: Agricultural Research Service; APHIS: Animal and Plant Health Inspection Service; ERS: Economic Research Service; FS: Forest Service; FAS: Foreign Agriculture Service; FSA: Farm Service Agency; NASS: National Agricultural Statistics Service; NIFA: National Institute of Food and Agriculture; NRCS: Natural Resources Conservation Service; RD: Rural Development; RMA: Risk Management Agency.

	renewable energy development	environmental conditions with changing climate and weather patterns may increase market competition of crops used for food, fiber and fuel		climate extremes. Promote resource-efficient cropping. Develop advanced biomass crops and methods for sustainable biofuel production; Analysis and data from commodity markets for renewable energy sources; Integration of regional systems with sustainable agriculture, forestry and range management
2 Ensure Our National Forests and Private Working Lands are Conserved Restored and Made Resilient to Climate Change while Enhancing our Water Resources	2.1 Improve Health of Nation's Forests, Grasslands and Working Lands by Managing Natural Resources	Degradation of resources will lead to increased GHG emissions, and threaten wildlife, fish, plants, lands, water, recreation, community and prosperity, inability of USDA to assess or influence pollutant causes through its programs	FS, FSA, NRCS	Work with private and public land managers to improve health and protect lands through conservation methods. Provide additional incentives to improve soil health and water quality while maintaining working lands, preserve open space and restore public forests. Use environmental markets to establish ecosystem service benefits
	2.2 Lead Efforts to Mitigate and Adapt to Climate Change	Healthy soils and plants everywhere are challenged by a changing climate, extremes	ARS, FSA, FS, NRCS, NIFA, RD, RMA	Integrate research results into policies and conservation practices, disseminate information, and support land managers who use these practices; Implement USDA Hubs to facilitate integration of science-based practical information
	2.3 Contribute to Clean and Abundant Water by Protecting and Enhancing Water Resources in National Forests and on Working Lands	Drought and increased runoff, increased urban development, increased impervious surfaces pose problems for increasingly limited quantities and quality of water resources	FS, NRCS, RD, RMA	Encourage producers and forest managers to preserve wetlands, use sustainable farming practices that put minimal stress on water resources; deliver financial and technical assistance to landowners to implement conservation measures and management strategies to benefit water quality, availability and improve watershed health
	2.4 Reduce Risk of Catastrophic Wildfire	Parts of the country, particularly the west, are increasingly threatened by drought and longer fire seasons; Budgetary, legal, and regulatory constraints	FS, NRCS	Work with all communities to ensure they are fire-adapted, for prevention, preparedness and response; USDA will work with private and public partners to implement hazardous fuel reduction and ecosystem restoration projects

<p>3 Help America Promote Agricultural Production and Biotechnology Exports As America works to Increase Food Security</p>	<p>3.1 Ensure US Agricultural Resources Contribute to Enhanced Global Food Security</p>	<p>Ensuring global food security will become more challenging as countries address growing global population, land degradation, scarce water and climate change; Many nations may experience failing crops and food insecurity</p>	<p>APHIS, ARS, ERS, FAS, FSA, NASS, NIFA</p>	<p>Research should continue to improve and protect US staple crops to adapt to changing climate conditions, markets can be opened to send these resources abroad; Cooperator participation from developing countries participating in scientific exchange provide critical learning opportunities; Research into climate-resilient crops and agricultural practices can be disseminated globally to farmers to help them become self-sufficient</p>
	<p>3.2 Enhance America's Ability to Develop and Trade Agricultural Products derived from New and Emerging Technologies</p>	<p>Risks to food security and human health increase as shifts in distribution and nature of diseases, invasive species and agricultural pests increase; Public resistance to biotechnology-based food production; Global partnerships increase risk of natural and manmade events limiting success of programs.</p>	<p>APHIS, ARS, FAS, NIFA</p>	<p>Enhance protection of agriculture, natural resources through adaptive risk analysis models, engaging larger number of stakeholders; USDA will increase support of global adoption of science-based systems models and contributions of innovative technology to global food and energy security and environmental sustainability with US trading partners which should increase trade opportunities for US producers</p>
<p>4 Ensure All America's Children have Access to Safe, Nutritious and Balanced Meals</p>	<p>4.4 Protect Agricultural Health by Minimizing Major Disease and Pests to Ensure Access to Safe, Plentiful, and Nutritious Food</p>	<p>Exposure to diseases, including plant and animal pests and pathogens, is expected to change as the climate warms and precipitation patterns change; Volume of smuggled or improperly imported agricultural products entering the US grows</p>	<p>APHIS, ARS, FAS, NIFA</p>	<p>USDA has developed a 3-part strategy to: identify pests and diseases before they enter the US, and continue research into prevention and suppression of disease ; provide training and expertise to identify threats at ports of entry; and works to eradicate pests and diseases or manage limits of damage if they are already in the US</p>

5 Create a USDA for the 21st Century that is High-Performing Efficient and Adaptable	5.2 Build a Safe, Secure, and Efficient Workplace by Leveraging Technology and Shared Solutions across Organization Boundaries	Extreme events and rising sea level may impact facilities built decades ago near coastlines or along flood-prone river valleys; Aging infrastructure may not withstand severe storms, tornadoes and hurricanes	All agencies	To ensure the security of USDA facilities infrastructure and employee safety, increased implementation of technology solutions and workplace enhancements including telework will be used to improve program delivery safely and with greater flexibility for its customer base
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Climate Change Effects on USDA Functions

Climate change presents new challenges for regulatory and response agencies. Public safety is increasingly at risk due to fast-moving wildfires, unpredictable extreme weather events such as flash flooding and associated sudden appearance of disease vectors. Risks to food safety, ecosystem health, and challenges to human health associated with animal and plant diseases, invasive species, and pests may increase. The extent and greater range of endemic and exotic pests, weeds, and diseases are raising concerns for the agricultural and forestry sectors, with widely seen consequences to productivity and ecosystem health. Although the influence of these factors is increasingly recognized by scientists and policy makers, the role of climate change in their proliferation is often not well understood. USDA is conducting basic and applied research on the interacting effects of climate change on endemic and exotic pests, weeds and diseases, and their resistance to management actions designed to control these types of species.

USDA’s costs for administering services such as disaster assistance, crop insurance, conservation and energy programs, and technical assistance are likely to increase as a result of climate change. Severe weather and other climate-related events such as associated excess moisture, more persistent and prolonged drought, pest infestations, and heat stress place pressure on the capacity of USDA agencies to meet demands. Shifts in climate may also affect USDA structures and infrastructure, particularly in areas subject to rising sea level and in areas of increased recurrence of extreme damaging storms, tornadoes, and hurricanes. USDA facilities, lands, and operations may be increasingly and less predictably affected by these events. Rising temperatures influence the energy costs associated with aging structures constructed when energy costs were a less significant portion of agency budgets.

Climate Change Effects on Agricultural Production³

Agriculture is dependent on a wide range of ecosystem processes that support productivity including soil health and availability of adequate potable water supplies. Multiple stressors, including climate change, increasingly compromise the ability of ecosystems to provide these services. Key near-term climate change effects on agricultural soil and water resources include the potential for increased soil erosion through extreme precipitation events, as well as regional and seasonal changes in the availability of water resources for both rain-fed and irrigated

³ Source: *Climate Change and Agriculture in the United States: Effects and Adaptation* USDA Technical Bulletin 1935. Submitted as a USDA Technical Report for 2013 National Climate Assessment.

agriculture. The vulnerability of agriculture to climatic change is strongly dependent on the responses taken by humans to moderate the effects of climate change. Adaptive actions within agricultural sectors are driven by perceptions of risk, direct productivity effects of climate change, and by complex changes in domestic and international markets, policies, and other institutions as they respond to those effects within the United States and worldwide.

In the last 150 years, US agriculture has exhibited a sustained capacity to adapt to a diversity of growing conditions and associated dynamic social and economic changes. These adaptations occurred during a period of relative climatic stability and abundant technical, financial, and natural resources. During the next century, the predicted higher incidence of extreme weather events will have an increasing influence on agricultural productivity. Future agricultural adaptation will be undertaken in a decision environment characterized by uncertainty of the agricultural system response to increasing climatic variability, the complexity of interactions between the agricultural systems, non-climate stressors in the global climate system, and the increasing rate and intensity of climatic change. Climate change will exacerbate biotic stresses on agricultural plants and animals. Changing pressures associated with weeds, diseases, and insect pests, together with potential changes in timing and coincidence of pollinator lifecycles, will affect growth and yields. The potential magnitude of these effects is not yet well understood.

Crops: Plants are currently grown in areas in which they are exposed to temperatures that generally match their threshold values. As temperatures increase over the next century, shifts may occur in crop production areas because temperatures will no longer occur within the range, or during the critical time period for optimal growth and yield of grain or fruit. Many climate stressors are interrelated. Warming temperatures, for instance, will act to increase crop water-demand. An increase in winter temperatures also affects perennial cropping systems through interactions with plant chilling requirements. All perennial specialty crops have a winter chilling requirement (typically expressed as hours below 10°C and above 0°C) ranging from 200 to 2,000 cumulative hours. Yields will decline if the chilling requirement is not completely satisfied because flower emergence and viability will be low. Increasing carbon dioxide (CO₂) in the atmosphere is a positive for plant growth, and controlled experiments have documented that elevated CO₂ concentrations can increase plant growth while decreasing soil water-use rates.

The effects of elevated CO₂ on grain and fruit yield and quality are mixed. Because elevated CO₂ concentrations disproportionately stimulate growth of weed species, they are likely to contribute to increased risk of crop loss from weed pressure. Crops and forage plants will continue to be subjected to increasing temperatures, increasing CO₂, and more variable water availability caused by changing precipitation patterns. These factors interact in their effect on plant growth and yield. A balanced understanding of the consequences of management actions and genetic responses to these factors will form the basis for production systems more resilient to climate change.

Livestock: Changing climatic conditions affect animal agriculture in four primary ways: (1) feed-grain production, availability and price; (2) pastures and forage crop production and quality; (3) animal health, growth and reproduction; and (4) disease and pest distributions. Livestock production systems are vulnerable to temperature stresses. An animal's ability to adjust its metabolic rate to cope with temperature extremes can lead to reduced productivity, and in

extreme cases, death. Prolonged exposure to extreme temperatures will also further increase production costs and productivity losses associated with all animal products. Water is also a limiting factor. Extended water stress on any animal can eventually lead to death. Livestock operations are increasingly faced with the sale of many, if not all, of their stock during prolonged drought when water supplies are no longer readily and continuously available.

Climate Change Effects on Forests⁴

By the end of the 21st century, forest ecosystems in the US will differ from those of today. The most rapidly visible and most significant short-term effects on forest ecosystems will be caused by altered disturbance regimes. These include wildfires, insect infestations, pulses of erosion and flooding, and drought-induced tree mortality. These both direct and indirect climate-change effects are likely to cause losses of ecosystem services in some areas but may also improve and expand ecosystem services in others. The ability of communities with resource-based economies to adapt to climate change is linked to their direct exposure to these changes. Areas most vulnerable because of current infrastructure and resource production are based on past climate and steady-state conditions. Human communities that have diverse economies and are resilient to change today will also be better prepared for future climatic stresses. Building on practices compatible with adapting to climate change provides a good starting point for land managers who may want to begin the adaptation process. Establishing a foundation for managing forest ecosystems in the context of climate change as soon as possible will ensure that a broad range of options will be available for managing forest resources sustainably.

The effects of increased temperature and changes in moisture will alter the growing environment for many tree species in the US. Mortality may increase in older forests stressed by low soil moisture. The trend toward higher temperatures in recent decades has already decreased snow depth, duration and extent in the western US. Decreased snow cover increases long-term soil moisture deficit which in turn can decrease tree health and leave forests more susceptible to insect and pathogen damage. Regeneration may decrease for species affected by both low soil moisture and competition from other species at the seedling stage. Many models predict an upward elevation and northward latitude movement of species habitat as climate changes. The higher genetic diversity of most tree species aids tolerance of a broad range of environmental conditions including temperature variation. Therefore, extreme weather events may have a greater influence than gradual changes in temperature or precipitation on ecosystems and trigger multiple stressors and disturbances. These ‘pulses’ of biophysical disturbance have the potential to change ecosystem structure and function across millions of hectares in relatively short time spans. With increased atmospheric carbon dioxide (CO₂) and nitrogen deposition, the physiological function and productivity of forest ecosystems could be altered with significant variation in response among species and regions. Forest growth and afforestation in the United States currently account for a net gain in carbon storage, offsetting approximately 13 percent of the Nation’s fossil fuel CO₂ production. During the next few decades, Eastern forest ecosystems, where soil moisture is sufficient and disturbances are low, are expected to continue to sequester

⁴ Source: *Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the US Forest Service*, USDA FS General Technical Report PNW-GTR-870. Submitted as a USDA Technical Report for the 2013 National Climate Assessment

carbon through favorable response to elevated CO₂ and to higher temperatures. Retention of carbon will depend on maintaining or increasing the total area of Eastern forest. Western forest ecosystems may begin to emit carbon if wildfire and insect disturbance continue to increase at the rates that they have in recent years.

One of the most visible short-term effects on forest ecosystems is caused by altered disturbance regimes that occur with increased frequency and severity. Interacting disturbances have the greatest effect on ecosystem responses and may simultaneously alter species composition, structure and function. The type and magnitude of disturbances will differ regionally and pose significant challenges for resource managers. These disturbances include wildfire, insect infestations, invasive species, increased flooding, erosion and movement of sediment into streams, increased drought and land use-change. Wilderness-urban interfaces and urban areas are projected to increase at the expense of rural forests. Land-use shifts in rural areas could involve conversion of forests to agricultural uses, depending on market conditions. While higher temperatures and population growth will increase the value of urban trees for mitigating climate change effects, these factors may also increase the difficulty of keeping trees healthy in more urban environments.

Economic Effects of Climate Change on US Agriculture and Forestry

The economic effects of climate change are shaped by an array of institutions from local to global scales ranging from commodity markets to systems of research, development, education, communication, and transportation. These institutions define opportunities and constraints in which stakeholders can modify or adapt their behavior to minimize losses and take advantage of new opportunities for gain associated with changing climatic conditions. The economic implications of climate change in the US are sensitive to yield effects and adaptation opportunities, as well as constraints in the US and abroad. US farmers' capacity to adapt, as well as to respond to shifting trade patterns, will mitigate potential effects on domestic producers and consumers. However, future climate scenarios with even the least extreme rates of warming may result in more severe implications for food security for the very poor and vulnerable populations worldwide.

Adaptive behavior can include a network of adaptive responses with changes in consumption, production, education, and research. The aggregate effects of a changing climate ultimately depend on the effectiveness of this network of adaptive responses -- from the local producer adjusting planting patterns in response to crop yield, to seedling producers investing in more drought-tolerant varieties, to nations changing trade restrictions in response to food, fiber, and fuel concerns at a global level. Producers' financial viability will be affected by change in management costs associated with changing biophysical stressors, the effects of variability and extreme weather events, and potential credit or resource constraints. Regional capacity for expanding agriculture, forestry, or irrigated production will depend heavily on the availability of land and water. Agricultural, forest, and natural ecosystems are complex; the manner in which adaptive behaviors in production and consumption systems respond to biophysical changes and incorporate lessons from research and education will determine the overall effects of a changing climate.

Adaptive behavior can mitigate the potential effects of climate change on food production, agricultural and forest-based income, and food security by moving production out of regions with newly reduced comparative advantages in specific production sectors and into areas with improved relative productivity. Early analyses found that with adaptation, the production effects of climate change are reduced to one-fifth to one-sixth of initial yield effect (Reilly et al., 2007⁵). More recent analysis has found that some regions can experience negative price effects from adaptation in other regions (Malcolm et al., 2012⁶). In addition, there is a growing concern that farms may need to adapt to much higher levels of production risk as climate change interacts with threshold effects in cropping production systems (Schlenker and Roberts, 2009⁷).

Attempts to quantify the economic effects of climate change are dependent on number of elements including climate and yield projections, treatment of adaptation constraints, and the methods and models used. For example, if global yields are generally lower, global prices rise regardless of domestic yield increases. The resulting price increases could benefit US producers but not necessarily the US consumer. Uncertainty in climate projections is also a critical element in assessing economic effects, in part because uncertainty about benefits of adaptation may impede the adaptive response of farmers.

Agency Assessments of Risk and Vulnerability

USDA is composed of many sub-agencies with differing missions. Sub-agencies were requested to assess their risk and vulnerability to climate change. The responses are broad and address risks and vulnerabilities at global, national, regional, and local scales as they relate directly to a particular mission. A few sub-agency impacts are outlined below. Individual Sub-Agency Adaptation Plans with more detail are attached in Section VI.

- *Physical and Biological Impacts:* Agriculture and forestry are impacted by shifts in temperature and precipitation patterns, amounts, intensities and extreme weather events and climate variability. Changes in key climate variables affect the seasonality of hydrologic regimes, reproduction cycles of pests and pathogens, and length of fire seasons. The changing climate is already altering species ranges and has the potential to alter ecosystem structure in the future. Management will require forward-looking approaches to novel ecosystems instead of depending on historical ranges of variability. These impacts pose challenges to sustaining agricultural lands, forest, grasslands and the supply of goods and services upon which society depends, such as clean drinking water, abundant food, forest products, outdoor recreation opportunities, and habitat.

⁵ Reilly, J. et. al., 2007. *Energy Policy*, 35(11): 5370-5383

⁶ Malcolm, S., E. Marshall, M. Aillery, P. Heisey, M. Livingston, and K. Day-Rubenstein. 2012. *Agricultural Adaptation to a Changing Climate: Economic and Environmental Implications Vary by U.S. Region*. Economic Research Report. USDA Economic Research Service (ERR-136) (<http://www.ers.usda.gov/publications/err-economic-research-report/err136>).

⁷ Schlenker, W. and M. Roberts. 2009. "Nonlinear temperature effects indicate severe damages to US crop yields under climate change." *Proceedings of the National Academy of Sciences*. 106(37): 15594-15598.

- **Wildfires - Increasing wildfire season length and extent of fire on the landscape.** Research estimates the potential for up to 100 percent increase in the number of acres burned annually by 2050. Increasing wildfire response requires increased funding. Forest Service (FS) - Fire suppression funding has grown from 16% of the FS budget in 1995 to 42% currently and funding is transferred from other agency programs in years when suppression funds are exhausted. Firefighting employees and contractors, and residents in the wild land-urban interface are increasingly at risk due to extreme wildfire behavior. National Forest System lands bordering tribal lands are increasingly at risk of fire. Tribes are particularly vulnerable to fires both on and off tribal lands which complicates coordination of firefighting across shared fire-prone landscapes with various jurisdictional controls. Lack of resources, poverty, remote access, and poor infrastructure exacerbate already high risks areas.

- **Heat Stress - Prolonged personnel exposure to the elements during extreme temperatures.** Human health and safety - Risk to employees and contractor/cooperators. Events that include atypical weather patterns experienced during the 2013-2014 winter season has result in extremely cold temperatures in most regions, especially unusual in the southern states. Higher summer temperatures may increase field personnel risk of heat exhaustion, heat stroke, and dehydration. Heat stress has the potential to impact operations at all levels. Higher temperatures during the early to middle portions of the row-crop growing season impact yields.

NRCS – Heat stress affects many aspects of NRCS’ mission: Changes in plant adaptability in specific locations, such as plant hardiness zone movements and shifts in crops, greater ground-level ozone concentrations due to slightly warmer temperatures, and expansion of ozone nonattainment areas, increased cooling-related energy demands in the warm months, including confined animal feeding operations, increased energy demands associated with greater irrigation requirements, increased melting of permafrost in transition zone regions in Alaska, decreased soil moisture due to increasing rates of evapotranspiration, decreased winter snowpack in the mountains due to a shift in the rain/snow transition zone and more rain-on-snow events

RMA - New Hardiness Zone Maps: RMA has been evaluating the new Hardiness Zone Map published by Agricultural Research Service. As it gets warmer, some of the zones may shift (mostly northward); therefore this could affect most of our plans of insurance products, particularly the Nursery Crop plan of insurance. RMA insures nursery plants based on county and hardiness zone; as a consequence of the changes in the climate, some nursery plants may no longer be insurable in some specific locations or higher insurance premiums may be necessary. RMA has been evaluating and having informed conversations on this issue.

RD - Increased temperatures will likely increase the need for energy efficient homes in low-income communities and an increased demand on power generation capacity. In turn, these demands will produce a rise in the number of applications for assistance from residential applicants, electric cooperatives, and rural businesses.

- **Surface Water Temperature - Increased water temperatures in rivers, lakes and streams, lower water levels in late summer, and drying of streams and ponds.**
FS - Forest Service and bordering tribal lands are increasingly at risk regarding watershed and fisheries maintenance. Tribes are particularly vulnerable to fluctuations in water temperatures and flow as many communities rely on aquatic species for subsistence and cultural purposes. These risks are frequently exacerbated by a lack of adaptive capacity due to lack of resources, poverty, ineffective or nonexistent infrastructure, and relative isolation. A further consideration is that failure to manage trust lands in a sustainable manner may result in abrogation of treaty rights, creating a risk position for federal natural resource agencies.
NRCS - increased stream and lake temperatures impacting fisheries and other biological processes, wildlife and fish species and habitat changes.

- **Insects and Disease - Increased exposure to and spread of damaging insects and disease, especially invasive species.** Affects natural resource management on all lands.
ARS - Greater uncertainties are associated with the effects on pests and pathogens. In general, the geographic distribution of pests is largely dependent upon climate, whereas the incidence and severity of outbreaks are largely dependent upon weather.
APHIS – Effects of climate change will likely require new regulations and policies as well as innovative, non-regulatory approaches to address new or shifting pest and disease scenarios worldwide. Impacts on ecosystem and habitat characteristics will result in shifts of animal and pest populations into new or expanded habitats. This movement can result in increased spread of diseases (such as citrus greening and hemorrhagic disease of ruminants) and other pests. Such movements can also lead to increased encounters with wildlife in populated areas, potentially increasing disease transmission among wildlife, livestock, and people.
FS - The changing climate is already altering species ranges and has the potential to alter ecosystem structure in the future as evidenced by the mountain pine beetle (a native insect) now epidemic in the West. FS implemented a National Insect and Disease Risk Assessment and completed an updated map, supporting data and information to identify areas at risk for catastrophic levels of forest insects, pathogens, and abiotic mortality agents.
NRCS – Climate change brings increased pest and disease pressures due to temperature changes in some regions including native and exotic pests, and changes in insect activity, including frequency, intensity, and location (including pollinators), increased competition from weed and invasive plants.
RMA - In 2004, RMA began monitoring soybean rust developments. The threat of soybean rust disease affecting US soybean growers in the near future is a serious concern. RMA participates on a soybean rust working group, hosted by the USDA Office of Pest Management Policy, and formed to prepare for the arrival of soybean rust by keeping State, commodity, and federal scientists informed of the recent activity related to soybean rust. Working group members include at least one Extension plant pathologist from each soybean state and any other representatives from state, federal, and commodity organizations with an interest in soybean rust. The working group meets as needed to discuss items such as management options, information resources, range of soybean rust, and recent research.

- **Effect on Food Safety, Food Security, and Food Research**
 - ARS - Flooding can have a major food safety impact. A Food and Drug Administration (FDA) rule now considers ready-to-eat crops that have been in contact with flood waters to be adulterated due to potential exposure to sewage, animal waste, heavy metals, pathogenic microorganisms, or other contaminants.
 - APHIS - Through enhanced coordination among the public and private sectors, APHIS expects to participate in more food-safety disaster relief because of the increased frequency of extreme weather events. For example, the risks of stored-product pest (e.g. khapra beetle) contamination increase during storage, deployment, and forward-staging of food-aid materials. Additionally, food security needs are increasing the demand for plants genetically engineered to resist pests as well as pests engineered to prevent the transmission of plant pathogens. Meeting these needs will lead to increased research and complexity of assessments (including requests for permits, field trials, inspections, compliance issues and deregulation petitions).
 - FAS – Climate change may lead to declines in agricultural productivity exacerbating vulnerabilities that lead to increased number of countries becoming food insecure and request FAS administered food assistance in times of limited resources.
 - GIPSA – Operations at both interior and US export locations may become more vulnerable to extreme weather events. Increased need for quality verification of USDA food assistance purchases may overwhelm existing capacities.

- **Rising Sea Levels - Tribal communities, National Forest System lands, Pacific Island communities, infrastructure most vulnerable.** Coastal lands and coastal Tribes are increasingly at risk of damage to their lands, including infrastructure, due to rising sea level. Tribes and islanders are particularly vulnerable to sea level rise as many tribal communities and islanders have limited or no opportunity to relocate without extreme cost and/or Congressional action. Tribes that rely on aquatic species for subsistence and cultural purposes affected by sea level are further at risk. These risks are frequently increased due to lack of resources, poverty, ineffective or nonexistent infrastructure, and relative isolation.
 - FS - Learn from and assist Tribes and other native peoples in managing our Nations' natural resources in the context of changing climate in collaboration with Department of the Interior's Landscape Conservation Cooperatives and Climate Science Centers.
 - NRCS - Increased salinization of near-coastal waters due to rises in sea level and greater storm activity impacts conservation planning.

- **Extreme Weather Events - Prolonged personnel exposure to the elements during extreme flooding, tornadoes, hurricanes, etc.** Human health and safety risk to employees and contractor/cooperators. Events that include atypical weather patterns experienced during the 2013-2014 winter season have resulted in extremely cold temperatures in most regions, especially unusual in the southern states. Higher summer temperatures may increase field personnel risk of heat exhaustion, heat stroke, and dehydration. Extreme events have the potential to impact operations at all levels. While the hurricane season this past year was not significant, hurricanes cause significant risk to human health and safety. In 2013, significant tornadoes in the Great Plains and Midwest

caused significant damage to USDA facilities and severe and sustained stress to families that lost homes. Other extremes include:

- Increasing or Intensified Precipitation

ARS - To reduce the effect of seasonal extreme weather events, a significant amount of land susceptible to flooding has been taken out of production. This has affected ARS' ability to continue some of its important produce-related research.

NRCS – Changes in precipitation will result in increased soil erosion potential due to increased precipitation intensity and amount, greater flood potential from increased precipitation frequency, duration, amount and intensity, especially in the East and Midwest, and greater potential for water quality impairments in some areas due to increased sedimentation and nutrient loading. Landslides may increase in saturated sediments disrupting transportation systems, burying residences and harming people. Saturated clay sediments near the Potomac River in 2014 caused residences to buckle, crack and slide following heavy rains and displaced homeowners indefinitely.

- Increasing and Prolonged Drought

ARS - *Implications for natural resources in research:* Short and long-term water shortages (drought) and excesses (too much, too fast) are expected to increase in frequency with changing climate. Research that has always been based on rain-fed plots may thus require irrigation for the first time. Even among field plots that have been irrigated all along, greater amounts of water may be required, which can alter or compromise research objectives and/or progress. Water shortages may result in the loss of experimental material (plants, soil, animals), delay planting dates, suppress yield quantity and/or quality, and increase the threat of fire on grazing lands research locations. Water shortages will affect research priorities, especially when reduced water availability for research and industry alters what, where and how a crop or livestock can be grown.

NRCS - Water supply is challenged in areas already water-stressed, including the Southern Plains and the Southwest where drought is likely to become more frequent and longer lasting. There are water management challenges in the irrigated West, including amount and timing of water due to changes in snowpack and snowmelt, with consequent impacts on water rights, fisheries, hydroelectricity, and other water stakeholders.

RD - Climatic changes will disturb crop yields and modify growing locations, drought conditions may also lead to increased requirements for infrastructure to deliver water to areas that no longer have viable water sources as well as to power generation facilities, which may lead to a greater volume of applications for assistance from RD programs. This increased demand would divert resources from normal program operations, impacting RD's ability to achieve its mission and goals.

- *Marketing and Trade Impacts*
 - APHIS - Associated shifts in disease and pest prevalence may overwhelm the current ability of off-shore programs to provide real-time information regarding pest and disease potential and may increase risk to US agriculture. Existing surveillance and diagnostic networks for animal and plant health diseases (e.g., avian influenza, foot and mouth disease, citrus greening, Asian long-horned beetle, fruit flies, etc.)

could be overwhelmed. Increased requirements for commodity and pathway risk analyses may overwhelm existing capacities. Moreover, APHIS may need to modify animal and plant health import requirements to protect the health of US agriculture.

- FAS - Increased frequency of extreme weather events may destabilize import and export markets and increase market volatility. Long-term strategies to build markets for US products could become difficult. Climate change may lead to production shortfalls and export bans abroad, undermining FAS efforts to promote free trade. Warmer average temperatures may increase the range and severity of disease outbreaks in the US raising Technical Barriers to Trade (TBT) and Sanitary/Phyto-Sanitary (SPS) concerns abroad. Climate change may disrupt or slow agricultural development and trade in some countries and accelerate the demand for adaptation and mitigation strategies.

- *Infrastructure Concerns*

- APHIS has established animal and plant health emergency frameworks to facilitate coordinated, timely responses to disease and pest emergencies. APHIS also has established frameworks to address all hazards (e.g. hurricanes, floods, wildfires) for impacts on plant and animal health and the needs of individuals with service animals and household pets, in addition to providing technical assistance for animal and agriculture emergency management. Climate change has the potential to overwhelm existing frameworks as a result of increases in extreme weather events, wildfires, and pest and disease outbreaks. In the event of wide-ranging climate disruption events, capacity could be overwhelmed. APHIS is working with assistance from other USDA and Department of Homeland Security (DHS) emergency response resources to develop procedures for requesting support and coordinating activities. State, local, Tribal, industry, and other stakeholders with key roles in threat mitigation also may be overwhelmed. Changes in pest and disease biology will require APHIS to ensure that its emergency response strategies (including new pest and disease response guidelines) and capabilities are updated and coordinated with the DHS National Response Framework.
- FSA - FSA will conduct “continuity of operations” exercises to better understand the administrative implications of and prepare headquarters, state, and field office staff for large-scale crop failure, which will be increasingly likely with climate change.
- FS - With increasing heavy rain events, the extensive road system on National Forest System lands will require increased maintenance and/or modification of infrastructure (e.g. larger culverts or replacement of culverts with bridges). Ski areas, reservoirs, and campgrounds are strongly influenced by past and current climate. Preserving high-quality outdoor recreation experiences will depend not only on the condition of the land, facilities, and transportation infrastructure but also on where such opportunities can be accommodated safely and managed under a changing climate. The projected increase in US population and the continual decline of public access to privately-owned undeveloped land will increase demand for recreation opportunities on public land.
- NIFA - A changing climate can result in more frequent, severe and longer term

weather related disasters in the national capital region. There will be a future need to increase the agency's resiliency to short and medium term weather events. NIFA should strive toward improvements in employee notification, increased productivity of unscheduled telecommute workdays, as well as decreased panel impacts of weather related travel delays. Impacts of a variable and changing climate will require an adaptation plan assessment that focuses on the ability to maintain primary operations when personnel are unable to report to the primary duty station. This also includes impacts to panels who are invited to DC to conduct reviews of proposals.

Transportation and building infrastructure will also be impacted by climate and the safety of personnel travelling to and from the primary work site will need to be addressed. Climate will also impact the technological infrastructure where information systems are housed and require a controlled temperature and humidity environment. This also applies to NIFA's back-up systems located outside Washington D.C.

- NRCS - NRCS recognizes that impacts from climate change will influence NRCS's ability to deliver its programs. Shifts in weather patterns may also diminish the performance of past and current conservation efforts unless steps are identified and implemented to modify these legacy federal investments. NRCS has offices in every State, the Pacific Islands Area, and the Caribbean Area. As of January 2014, NRCS employed about 10,150 full time staff. While nearly 400 employees are based in the four offices in the Washington, DC metropolitan area, more than 95% of NRCS staff is located outside of the DC area. Those staff are distributed among more than 2,600 offices across the Nation and across the organization. Field offices include Centers, State Offices, Service Centers, and Support Offices. NRCS has the benefit of an inherent resilience to local or regional disaster or disruption because staff is widely geographically distributed. Only a national-scale event (total or near-total electric grid failure, for example) is likely to incapacitate NRCS.
- RD - RD supports rural communities through loans, loan guarantees, and grants. For some of RD's programs, the agency holds liens or other security interests in facilities and related infrastructure in areas that could be affected by hydrological changes and sea-level rises resulting from impacts such as inundation and erosion. Additionally, many climate change models predict increased frequency and severity of weather events such as tornados and hurricanes, which can damage utility facilities and infrastructure. Climate change therefore represents a risk to these agency assets and the communities they serve. Damage that may occur to such infrastructure and facilities would create an increased demand on RD to respond to requests for financial assistance to repair, replace, relocate or otherwise improve these assets. The potential for increased demands on financial resources could divert those resources from normal program operations, impacting RD's ability to achieve its mission and goals. An increase in financial assistance requests could burden all aspects of RD operations, including but not limited to underwriting, engineering, and environmental review activities. Extreme weather events could also have devastating effects on rural communities as well as RD offices and their personnel stationed throughout the Nation. Events that could damage or destroy facilities and utility infrastructure needed to supply water, electricity, and telecommunications to communities and field offices could create significant health and safety problems for the public and for RD employees. Additionally, emergency response can be affected by telecommunications

failure, including failure of the Federal Communications Commission’s Enhanced 911 (E911) system, which is supported by towers and infrastructure financed by RD programs.

Section 5(a)(ii) – a description of programs, policies, and plans the agency has already put in place, as well as additional actions the agency will take, to manage climate risks in the near term and build resilience in the short and long term

A number of ongoing actions to build resilience and address climate change impacts and risks are addressed through plans and activities already in place. Recently initiated activities include the USDA Regional Climate Hubs and the passage of the Agricultural Act of 2014.

- *USDA Regional Climate Hubs* – Seven regional climate hubs, now established across the US, deliver science-based tools, strategies and practical information to farmers, ranchers and forest landowners within each region of the United States to support decision-making related to climate change. These Hubs will maintain and strengthen agricultural production, natural resource management, and rural economic development under increasing climate variability. The Hubs will build capacity within USDA to deliver information and guidance on technologies and risk management practices at regional and local scales. The three primary goals of the USDA Regional Climate Hubs are: 1) **Technical Support**: The Hubs will provide support to USDA agriculture and land management program delivery by offering tools and strategies for climate change response. These approaches will help producers cope with challenges associated with drought, heat stress, excessive moisture, longer growing seasons, and changes in pest pressure. The Hubs will support applied research and develop partnerships to facilitate this process; 2) **Assessments and Regional Forecasts**: The Hubs will provide periodic regional assessments of risk and vulnerability in the production sector to contribute to the sustained National Climate Assessment process, and provide accessible regional data and interpret climate change forecasts for hazard and adaptation planning; 3) **Outreach and Education**: The Hubs will provide outreach and extension to farmers, ranchers, forest landowners, and rural communities on science-based risk management through the land grant universities, the Cooperative Extension System, USDA Sub-Agency Service Centers, and public/private partnerships and educate producers about the effects of climate change on agriculture and forests. They will also link a broad network of partners participating in climate risk adaptation and mitigation, including universities; non-governmental organizations; federal agencies such as the Department of Interior (DOI) and the National Oceanic and Atmospheric Administration (NOAA); Native Nations and organizations; State departments of environment and agriculture; research centers; producer groups and more.
- *Capacity Building*: USDA sub-agencies are developing plans to educate their employees and their stakeholders and accommodate expected changes associated with climate change. Partnerships between scientists and land managers are being strengthened to improve the focus of research and technology to address current and emerging science and information needs. Identifying challenges, vulnerabilities, and further implications are key.

- Economic Research Service (ERS) - ERS efforts to address mission challenges related to climate change center around building research capacity in the area of climate change effects and adaptation. ERS is working closely with NASS and other USDA and federal agencies to develop a solid, spatially detailed baseline of current and past conditions related to land resources, climate, and land use and farmer decision-making. Such a baseline will be necessary to support robust analyses of how changes in the climate, and associated changes in the resource base, will affect farmer decision-making and how farmers interact with USDA programs. This effort involves a comprehensive integration into ERS analyses of key data sets from FSA, NRCS and NASS as well as close collaboration with other Federal agencies such as U.S. Department of Energy and U.S. Environmental Protection Agency. ERS researchers are participating in the Agricultural Model Inter-comparison and Improvement Project (AgMIP) to compare and refine methods for both international and domestic economic modeling of the impacts of climate change. Development and enhancement of integrated economic, crop, climate and environmental process models expand ERS' capacity to meet expected increases in demands for information about impacts and adaptation strategies in both the crop and livestock sectors. In addition to ongoing research on the role of USDA programs in farmer adaptation to drought risk, ERS is collaborating with the Forest Service to explore potential water shortages in the United States under changing climate conditions and the implications of such shortages for regional agricultural resilience to climate change. Specific research priorities are established based on formal and informal strategic planning efforts that incorporate input from customers, stakeholders, and USDA and external partners.
- FSA - FSA programs will affect the climate change adaptation process to varying degrees and in various ways. FSA Farm loans: Because adaptation is likely to involve significant investment in new technologies and infrastructure, producers least able to cope with climate change may be those with limited access to credit, such as beginning and disadvantaged farmers. These populations are also more likely to be farming marginal lands that are more susceptible to climate change impacts. FSA Disaster programs: This assistance can be a lifeline to farmers who suffer losses from extreme weather events. The short term support offers farmers the opportunity to adapt.
- FS - Partnerships between scientists and land managers are being strengthened to improve the focus of research and technology to address current and emerging science and information needs. Resource inventory, monitoring, and assessment activities and decision support tools are being better aligned and coordinated across FS programs and with partner agencies at multiple scales. Examples of ongoing and newly initiated capacity-building efforts are: Climate Change Resource Center, Environmental Threat Assessment Centers, Conservation Education Programs, and participation in the new USDA Regional Climate Hubs.
- NASS – Program changes and expansion in statistics sampling surveys due to climate change are being examined.
- NIFA - will need to balance the increasing demand for scientific research, modeling, educational programs, and extension activities to address climate change issues with other research, education, and extension needs. For example, investigations of climate stressors and tipping points will become more essential to climate adaptation science research and will need to be balanced with vulnerable areas of crop and livestock

production research and formal and informal state educational programs. There will also be a need to establish more long-term collaborations with federal funding agencies to provide research support to understand complex climate issues and develop the models and decision-making products essential for the sustainability of economic and natural resource systems.

- **RMA** - RMA's principle vulnerability to climate change is through the insurance coverage offered through its crop insurance policies. RMA provides coverage to farmers and ranchers for flood, drought, hurricanes, and other natural disasters. Climate change can affect these agronomic risks. Some of the risks, and opportunities, associated with changing climate that RMA will face will likely come from farmers changing their farming practices and approach growing crops differently by adapting to earlier growing seasons, planting new varieties or shifting locations of their farming operations to adapt to climate change. Risk to farmers will be higher, if they decide to plant earlier due to warmer spring weather and the crop insurance program parameters have not been updated. For example, if grower's plant earlier than the crop insurance policy allows, they will be required to carry more risk, as the crop insurance policies will not cover replanting payments.⁸ RMA is educating and providing outreach to growers through interviews with news and other organizations to explain to farmers how planting early would affect their crop insurance coverage. The establishment of USDA Regional Climate Hubs should also facilitate these efforts. Citrus: RMA revised the Florida Citrus Fruit Crop Policy for the 2014 and succeeding crop years to allow the Florida Automated Weather Network (FAWN) reporting stations to be used as verification for excess wind. RMA also now allows excess wind to be an insurable cause of loss for both citrus fruit insured as fresh citrus and juice.
- *USDA Departmental Regulation* - has been in place since 2011 that addresses implementation of EO 13514 and climate change adaptation planning. This directive established a USDA-wide effort to integrate climate change adaptation planning and actions into USDA programs, policies and operations. It provides for the Climate Change Program Office (CCPO) located within the Office of the Chief Economist to support and help coordinate activities among the USDA agencies and offices. With the issuance of EO 13653 and the President's Climate Action Plan, the departmental regulation is well-placed to track progress.
- *Global Change Task Force* – A monthly meeting of all USDA agencies and offices with climate change responsibilities is convened by the Climate Change Program Office Director. Department and agency activities are reported, issues discussed, and recommendations on actionable activities coordinated. The Task Force also includes members from the Office of the Chief Financial Officer as well as Legislative Affairs and General Counsel

⁸ A grower signed up for crop insurance on March 15 and planted before the earliest planting date is still covered for the crop year. However, if they suffer a loss from freeze or any other cause of loss, they would have to cover the cost to "replant" the crop --as replanting payments would not be covered since the farmer chose to plant before the established earliest planting date http://mrcc.isws.illinois.edu/news/releases/2012/20120326_EarlyWarmth2012.pdf

- *2013 Strategic Sustainability Performance Plan: Goal 9* – The resilience strategies outlined in Goal 9 are in progress and being integrated into regional planning. Additional representation of tribal governments, other vulnerable communities, and stakeholder engagement has been expedited by the inception of both a Task Force and Council outlined by the President’s Climate Action Plan and the establishment of the USDA Regional Hubs for Risk Adaptation and Mitigation to Climate Change (USDA Climate Hubs). The passage of the Agricultural Act of 2014 (2014 Farm Bill) will allow agency updates of programs and policies including grants, loans, and additional technical assistance to assist in addressing the impacts of climate change.

Section 5(a)(iii) - a description of how any climate change related risk identified pursuant to paragraph (i) of this subsection that is deemed so significant that it impairs an agency’s statutory mission or operation will be addressed, including through the agency’s existing reporting requirements

Significant risk includes those operations identified as an ongoing impact to the USDA or USDA Sub-Agency that have the potential to impair or prevent the success of agency mission activities, particularly in the long term. These are:

- **Wildfires:** Increasing wildfire season length, size and severity of large fires, coupled with an expanding wild land-urban interface, have been multiplying wildfire suppression costs and reducing the capacity to provide other services including ecosystem services. Personnel, the public, communities, and infrastructure are also at higher risk. Within the Forest Service, wildfire suppression expenditures are now a significant percentage of the agency’s budget, reducing capabilities to provide other critical services, including our capacity to manage forests for increased resilience, to protect their capacity to sequester and store carbon, and provide other ecosystem services. Fire suppression funding has grown from 16% of the Forest Service (FS) budget in 1995 to 42%. Increasingly large and severe wildfires will result in increased restoration needs as well as decreased capacity to manage for other services. In order to protect funding of programs and activities that restore fire-adapted ecosystems, address resilience, and accomplish other adaptation priorities, a change in funding mechanism for wildfire suppression is needed. However, Congressional action is required to change funding structure. Some progress has been achieved through the FLAME Act of 2009 which established a separate account for funding emergency wildfire suppression activities undertaken on federal lands managed by Department of Interior and the Forest Service. Additional legislation is being considered (Wildfire Disaster Funding Act (S 1875/HR 3992)).
- **Invasive Insects and Pathogens:** Climate change impacts on ecosystems and habitat characteristics will result in shifts of animal and pest populations into new and expanded habitats. This movement can increase the rapid spread of diseases and pests in regions already under stress from climate extremes. Pine bark beetle damage on thousands of acres of pine forest in the western US has forced the Forest Service alone to spend more than \$300 million to remove standing and dead hazardous trees for safety, establish new planting projects to restore healthy forests, treat over 850,000 acres, and dispose of over

410,000 tons of biomass because of limited dead-tree markets. Particular emphasis needs to be placed on global entry invasive species. The collaborative efforts and effectiveness of USDA sub-agencies and other federal agencies to identify unlawful entry and distribution of prohibited agricultural products, insects, and pathogens are increasingly stressed each year. Through increased trade, the volume of smuggled and improperly imported agricultural products as well as biological stowaways entering the US has the potential to grow. Escape of these pests and pathogens into US ecosystems can decimate cropping systems, livestock production, and ecosystem habitats. USDA detects and responds to new invasive species and emerging agricultural and public health threats using a three-pronged approach 1) identify pests and pathogens abroad and prevent their entry into the US; 2) provide training and expertise to identify threats at ports-of-entry; 3) work to eradicate pests and pathogens or manage them to limit damage if already in the US. The effectiveness of these and other programs to protect the food supply depends on all cooperating organizations working jointly to report infractions, prevent gaps in record-keeping, and provide sufficiently trained staff to identify and counter the increasing volume of unlawful or inadvertent infestations and the management of these invasive species. These needs are placing greater demands on limited resources.

- **Drought:** Drought is a very serious extreme that has occurred more frequently and for greater lengths of time in the last decade. Consequently, portions of the central and southern US, and more recently California, have experienced significant periods of widespread drought since 2010. While USDA and its sub-agencies and other federal agencies have jointly instituted new program incentives, a web-based clearinghouse for public access to federal disaster assistance, and improved tools for more reliable weekly analyses, critical western water supplies are in jeopardy and the impacts of the complexities associated with western water rights, hydroelectricity, fisheries and agriculture continue. USDA is partnering with NOAA, DOI and several other federal agencies to establish a National Soil Moisture Network with an emphasis on expansion into underserved regions and vulnerable populations. The framework would improve capabilities to monitor and plan for drought and support risk management strategies. Early collaboration to identify existing soil moisture networks, gaps and data compatibility is in progress. New approaches and resources to expand and fill network gaps will be needed to implement a strong framework for future drought monitoring.

Section 5(a)(iv) - a description of how the agency will consider the need to improve climate adaptation and resilience, including the costs and benefits of such improvement, with respect to agency suppliers, supply chain, real property investments, and capital equipment purchases such as updating agency policies for leasing, building upgrades, relocation of existing facilities and equipment, and construction of new facilities:

The USDA will focus ongoing efforts in improving climate adaptation and resilience on a number of current investments. Currently USDA supports climate adaptation and resilience in multiple initiatives in the areas of Energy Management and Greenhouse Gas (GHG), Sustainable Buildings, Sustainable Locations, Fleet Management, Sustainable Procurement and Bio-Preferred Products. Many of these initiatives are also detailed in Section IV.

Energy and Greenhouse Gas (GHG) Management

Energy: The Department is increasingly investing in energy and water efficiency, net zero energy facilities, and renewable energy projects. USDA is transitioning from traditional sources of electrical energy generation to those originating from agricultural products and other renewable sources. In each new construction and major renovation project, USDA validates the building's performance as 30 percent more energy efficient than the industry standard. For energy-efficiency and water conservation projects, the Department is developing guidelines to incorporate design review into new construction and major renovation projects. From 2009 to 2012, USDA investments assisting thousands of rural small business, farmers and ranchers have resulted in more than 6600 projects to install renewable energy systems and energy efficiency solutions and saved enough energy to power more than 680,000 homes annually. Additionally, USDA has initiated a \$250 million loan program to assist rural utilities in financing energy efficiency and renewable generation. Projects are slated to generate more than 5.1 Megawatts of on-site renewable energy for multifamily properties.

GHGs: In 2014, USDA has developed a comprehensive report on science-based methods for estimating greenhouse gas fluxes related to local agriculture and forest management. From 2010 to 2012, annual greenhouse gas mitigation benefits associated with USDA conservation programs totaled more than 11 million metric tons of CO₂ equivalent. USDA participates in an Interagency Methane Strategy to develop a measurement approach and entered into a partnership with the Innovation Dairy Center to voluntarily reduce the industry's methane emissions. Under PCAP, USDA and the dairy industry are working to develop a Biogas Roadmap to broaden greenhouse gas reductions incentives. USDA continues to issue updated USDA National Greenhouse Gas Inventory Reports to track changes in emissions and carbon sequestration in the US agricultural and forestry sectors. The next edition is due for release in October, 2014.

USDA Sustainable Buildings and Sustainable Location Policies

USDA measures sustainability in new construction and major renovations through third party certification systems such as LEED and Green Globes. In FY13, the Department increased its quantity of sustainable existing buildings to eleven percent of those larger than 5,000 gross square feet, using energy, water, and natural resources conservation criteria and plans to assess additional existing buildings in the future. USDA guidelines for new office sites include access to public transit, use existing transportation infrastructure, reduce parking demand, and avoid developing agricultural or other green space. USDA plans to initiate a policy consistent with the "Sustainable Locations for Federal Facilities," to strive to select sites in diverse and economically stratified communities served by mass transit, consistent with mission accomplishment requirements. In the future, USDA plans to continue climate adaptation and resilience practices. In order to prepare for natural hazards events such as storms, earthquakes, and wildfires, the Department will incorporate federal guidance on structural integrity and on coastal and floodplain locations.

USDA Fleet Management

The USDA Fleet Management program, in operating slightly over 40,000 vehicles nationwide, is taking action with respect to alternative fuel use and consumption levels, as well as fleet

composition. The Department currently is reducing FY13 annual petroleum use by over 2 million gallon equivalents, and surpassing the FY13 target to increase annual alternative fuel by 1.2 million gallon equivalents. To facilitate this shift, USDA is implementing a close-loop fleet charge card program to better track and monitor vehicle alternative fuel use. In the future, USDA plans to promote GHG emission reduction by alerting drivers to E85 locations for fueling, revising current fleet card policy. The Department continues to reduce the number of conventional fuel vehicles and to increase the percentage of low greenhouse gas-emission sub-compact and compact sedans and mid-size SUVs to reduce atmospheric emissions.

USDA Bio-Preferred Products and Sustainable Procurement

USDA's Bio-Preferred program designates industrial products made from sustainable, renewable feed stocks like corn, vegetable oils, and other agricultural commodities, forest, and marine resources, for preferred federal procurement to leverage the purchasing power of the Federal Government for finished products like, paints, coatings, dyes, inks, cleaners, lubricants, and bio-plastic. These bio-based products may replace products derived from petroleum. Some 97 categories, representing over 10,000 individual products, are designated. To date, the Bio-Preferred program has issued over 1,600 voluntary USDA Certified Product labels to help create consumer demand for bio-based products. Labels indicate the amount of new carbon each product contains. For the agency supply chain, USDA is reducing GHG emissions by procuring EPEAT (Electronic Product Environmental Assessment Tool⁹) equipment and specifying Energy Star and FEMP (Federal Energy Management Program¹⁰) equipment and appliances in buildings.

Section 5(a)(v) - a description of how the agency will contribute to coordinated interagency efforts to support climate preparedness and resilience at all levels of government, including collaborative work across agencies' regional offices and hubs, and through coordinated development of information, data, and tools, consistent with section 4 of this order;

USDA contributes to and participates in many interagency efforts related to climate preparedness and resilience. USDA sub-agencies contribute extensively to many collaborative efforts, some of which are also described below.

USDA Interagency Efforts

USDA Regional Climate Hubs – USDA is coordinating closely with both the Department of Interior (DOI) Climate Science Centers (CSCs) and Landscape Conservation Cooperatives (LCCs), and National Oceanic and Atmospheric Administration (NOAA) Regional Integrated Sciences and Assessments Program (RISAs) and Regional Climate Centers (RCCs); Native Nations and organizations, and a broad network of state and local departments of the environment and agriculture, university partners, and non-governmental organizations. FS hosts five and ARS hosts two of the seven USDA regional hubs recently established. These provide outreach and information to producers (farmers, ranchers, and forest land owners) on ways to mitigate risks; public education about the risks climate change poses to agriculture, ranchlands

⁹ EPEAT is a method for consumers to evaluate the effect of a product on the environment.

¹⁰ FEMP helps federal purchasers comply with requirements by identifying energy- and water-efficient products.

and forests; regional climate risk and vulnerability assessments; and centers of climate forecast data and information.

Council on Climate Preparedness and Resilience – This interagency Council, established by EO 13653 is co-chaired by the Chair of Council of Environmental Quality, the Director of Office of Science Technology Policy and the Assistant to the President for Homeland Security and Counterterrorism. Senior officials from various White House offices including the USDA are members. The Council works across agencies and offices in partnership with the newly established State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience, to coordinate and expand the Federal Government’s work to support communities in building climate change preparedness.

US Global Change Research Program – USDA and its agencies play an important role in federal climate change research, mitigation and adaptation activities. USDA is one of the 13 federal departments and agencies comprising the US Global Change Research Program (USGCRP) mandated by Congress in the Global Change Research Act (GCRA) of 1990. The USGCRP was tasked with improving the understanding of uncertainties in climate science research, expanding global observing systems, developing science-based resources to support policymaking and resource management and communicating findings broadly among scientific and stakeholder communities. USDA agency research scientists and program managers participate by serving on a variety of interagency working groups and strategic planning and program report committees to promote cooperative and collaborative research among federal agencies and their stakeholders. The USGCRP recently restructured and is re-evaluating the types of working groups and their charges. USDA is playing an active role in the new strategy and structure. The USGCRP provides an annual report entitled *Our Changing Planet* as a supplement to the President’s Budget. Relevant USDA research activities and plans are included in these annual reports.

National Climate Assessment – The GCRA also requires that USGCRP agencies produce periodic (not less than every four years) National Climate Assessments (NCA) that integrate, evaluate, and interpret findings of the USGCRP and discuss associated uncertainties. The assessments also provide analysis of the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity. Finally, the assessments analyze current trends in global change, both human-induced and natural, and project major trends for the subsequent 25 to 100 years. USDA scientists led in organizing and writing several technical reports for the 2013 NCA: *Climate Change and Agriculture in the US: Effects and Adaptation* (USDA Technical Bulletin 1935, November 2012); *Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the US Forest Sector* (USDA General Technical Report PNW-GTR-870, December 2012); *Biogenic greenhouse gases in North American terrestrial ecosystems* (Frontiers in Ecology and Environment, Special Issue n. 10, v. 10, December 2012) and supported the process through participation in the Interagency National Climate Assessment Task Force and the National Climate Assessment and Development Advisory Committee. A NCA process broadly supporting the benefits of reframing the NCA as a sustained function of the Federal Government is in progress. The first USDA-supported technical report in progress for this interim period is entitled *Global Climate Change, Food Security, and the U.S. Food System*.

National Fish, Wildlife and Plants Climate Adaptation Strategy (NFWPCAS) Implementation Team – This team, managed by DOI-US Fish and Wildlife Service, NOAA, and the Association of Fish and Wildlife Agencies is composed of federal natural resource agencies, State, and local agencies and Tribal representatives and tasked with implementing the NFWPCAS Strategy. The Strategy was developed through a similar partnership of federal, state, and local entities in response to a Congressional request to coordinate a nationwide fish, wildlife and plant climate adaptation plan. USDA APHIS, FS, FSA, and NRCS Sub-Agencies participated in the original strategy published in 2012. FS is the primary USDA Sub-Agency for the Implementation Team with input from FSA, APHIS, and NRCS. Provisions in the proposed Senate bill titled *Safeguarding America’s Future and Environment (SAFE) Act (S.1202)* have been introduced in part to support long-term activities associated with this effort.

USDA and NOAA Memorandum of Understanding (MOU) – the umbrella MOU is focused on improving cooperation to advance climate services and delivery to agriculture, forestry, and other environmental resource areas. Subsidiary Agreements (SAs) are providing frameworks for specific projects of mutual interest. A National Integrated Drought Information System (NIDIS) Subsidiary Agreement has been initiated to establish a framework to cooperate on improving capabilities to monitor and plan for drought and support risk management strategies with respect to agriculture. Deliverables, at least 4 of which directly respond to the President’s Climate Action Plan, include:

- Improved access to data and products allowing greater exposure and access of NOAA products while potentially lowering costs for those agencies already obtaining data;
- Coordination of research to focus USDA’s drought research activities
- More products to support US Drought Monitor (used as a trigger for USDA programs);
- Improved public outreach through release of information using Drought.gov;
- Integration of new USDA Regional Climate Hubs in existing programs;
- Input into the development of forecast products to improve utility to agriculture and
- Establishment of a National Soil Moisture Monitoring Network

USDA Agricultural Air Quality Task Force (AAQTF) - This task force was established in accordance with Section 391 of the Federal Agriculture Improvement and Reform (FAIR) Act of 1996 to better coordinate air quality activities and resources among USDA sub-agencies and other federal partners particularly the Environmental Protection Agency. The AAQTF chaired by NRCS, comprised of USDA employees, industry representatives, and other experts in the fields of agriculture and air quality, advises the Secretary on matters related to agricultural air quality, promotes USDA research efforts and identifies cost-effective ways the agricultural industry can improve air quality.

Joint Fire Science Program (JFSP) - Provides research tailored to the needs of fire and fuel managers and develops focused lines of research responsive to those needs. The focus is on science delivery with a suite of communication tools to ensure that managers are aware of, understand, and can use the information to make sound decisions and implement projects. This Program is tailored to wild land fire research in response to the emerging needs of policymakers and fire managers. More than 90 colleges and universities have also collaborated on and partnered with JFSP-sponsored research projects. This collaboration extends to private, non-

profit organizations and tribal, state, county, and local governments as well. In all, nearly 200 organizations have become partners in JFSP-sponsored research.

National Interagency Fire Center (NIFC) - The NIFC, located in Boise, Idaho, is the nation's support center for wild land firefighting. Eight different agencies and organizations are part of NIFC. Decisions are made using the interagency cooperation concept because NIFC has no single director or manager. The eight partner agencies are USDA-Forest Service, Department of Interior (DOI) Bureau of Land Management (BLM), National Weather Service, DOI-National Park Service, DOI-Bureau of Indian Affairs, DOI-US Fish and Wildlife Service, National Business Center, U S Fire Administration-FEMA, and National Association of State Foresters. Thirteen cooperating institutions including the American Red Cross and National Volunteer Fire Council are also members.

III. Providing Information, Data, and Tools for Climate Change Preparedness and Resilience (EO 13653 Section 4)

- a) Supported by USGCRP, and in support of federal, regional, state, local, tribal, private-sector and nonprofit-sector efforts to prepare for the impacts of climate change, USDA “shall work together to develop and provide authoritative, easily accessible, usable, and timely data, information, and decision-support tools on climate preparedness and resilience.” A partial listing of USDA accomplishments and ongoing activities in support of preparedness and resilience are:

Type of Information	USDA Sub-Agencies ¹¹	Description
Decision Support Tools	ARS, FS, NRCS, RD (RUS), RMA	COMET-Farm – Whole-farm greenhouse gas and carbon sequestration assessment http://cometfarm.nrel.colostate.edu/ ; NTT - Nutrient Tracking Tool for field-scale nutrient and sediment runoff http://nn.tarleton.edu/NTTWebARS/ ; PRISM climate mapping system and web portal; Cover Crop Termination and Zones – regionally appropriate cover crop management using local climate and cropping systems; Plant Hardiness Zone Map (also state and regional maps http://planthardiness.ars.usda.gov/PHZMWeb/); RUS program Energy Tool for energy efficiency programs
Conservation Education Courses	FS, NRCS	Climate change-related introductory and advanced curricula to enhance environmental

¹¹ Agency and Sub-Agency abbreviations: ARS: Agricultural Research Service, CCPO: Climate Change Program Office, FS: Forest Service, NASS: National Agricultural Statistics Service, NRCS: Natural Resources Conservation Service; RMS: Risk Management Agency

		literacy for agencies and interested stakeholders
Plant Materials Centers	NRCS	Geographically placed Plant Materials Centers provide information on regionally-adapted plants
Climate Change Websites	CCPO, FS, NRCS, ERS	Central data and information portals linking climate change information; FS - Climate Change Resource Center: Web-based technical information for forestry professionals
Databases, Inventories and Monitoring Systems	FS, NASS, NRCS, ERS	FS: FIA – Forest Inventory and Analysis; NASS: agricultural surveys and census ; FS: Forest and Rangeland Renewable Resources Planning Act (RPA) Assessments; NRCS: National Resources Inventory (NRI); NRCS: Soil and Water Resources Conservation Act Appraisal (RCA); NRCS: Conservation Effects Assessment Project (CEAP); NRCS: PLANTS; NRCS: Rapid Carbon Assessment (RaCA); NRCS: Ecological Site Inventory; NRCS: Web Soil Survey – soil maps of the US and its territories; NRCS: Snow Survey and Water Supply Forecasting, SNOTEL – automated snow survey network in western US, SCAN – automated continuously monitoring soil moisture network throughout US concentrated in cropland areas;
USDA Greenhouse Gas Inventory	ARS, CCPO	Annual emissions reports available electronically and in hard copy
Greenhouse Gas Protocols	CCPO, NRCS, FS	Comprehensive review of the best available methods for estimating greenhouse gas agricultural emissions available electronically and hard copy
Greenhouse Mitigation Options/Costs	CCPO	Cost-benefit analysis of technologies and practices on US agricultural lands
USDA Regional Climate Hubs	All USDA agencies	Regional centers to provide outreach and education, regional climate risk and vulnerability assessments and centers for climate data and information

- b) Agencies will work with CEQ and OSTP, overseers of a web-based portal on Data.gov to establish, identify, develop, and integrate data and tools relevant to climate issues and decision-making. Agencies will coordinate their work on these data and tools with relevant interagency councils and committees that support the implementation of Presidential Policy Directive 21 (Critical Infrastructure Security and Resilience) and EO 13642 (Making Open and Machine Readable the New Default for Government Information). USDA will lead the Food Resilience theme within the Climate Data Initiative (CDAT).

IV. Modernizing Federal Programs to Support Climate Resilient Investment (EO 13653 Section 2)

To support the efforts of regions, States, local communities, and tribes, all agencies, consistent with their missions and in coordination with the Council on Climate Preparedness and Resilience that was established in Section 6 of the EO 13653 will:

Section 2 (a)(i): identify and seek to remove or reform barriers that discourage investments or other actions to increase the Nation’s resilience to climate change while ensuring continued protection of public health and the environment. (ii) reform policies and federal funding programs (iii) identify opportunities to support and encourage climate-resilient investments (iv) report on their progress in achieving actions identified in (i-iii) including milestones.

USDA Program or Action	Barrier Identified/Removed	USDA Sub-Agency ¹²	Milestones
Energy Efficiency and Conservation Loan Program Update	Enhanced authority to make loans targeted to energy efficiency and renewable generation	RUS	Final rule published; Resources available to targeted end-user stakeholders; Loan program initiated
Vulnerability and Food Security	‘Global Climate Change, Food Security and the US Food System’ report	CCPO	Report in preparation that examines effect of changing climate on global food security
Regional Hubs for Risk Adaptation and Mitigation	Regional scaling of climate-related needs	REE, NRE, CCPO, ARS, FS, NRCS, RD, RMA	7 Hubs announced; Work plans to establish enhanced interagency networking and collaboration in progress
FS Engineering and Watershed Program, Flood Response Guidance and team development	Updating national guidance for flood emergencies, recommendations for rebuilding infrastructure to be more flood-resilient	FS, NRCS, DOI-BLM, ACE, State	FS manual and handbooks updates, development of command procedures; implementation in response to flood emergencies
Rule 7 CFR 1970	Streamlined program administration and reissue Environmental Policy Rule CFR 1970 to address environmental impacts	RD	Proposed rule and comments; Final rule publication
Rural Energy for America Programs	Single and multi-farming housing issues, new and	RD	Program rules, proposed and final to improve

¹² Agency and Sub-Agency abbreviations: ACE: Army Corps of Engineers, AMS: Agricultural Marketing Service, ARS: Agricultural Research Service, APHIS: Animal, Plant Health Inspection Service, CCPO: Climate Change Program Office, CEQ: Council on Environmental Quality, DOI-BLM: Department of Interior Bureau of Land Management, DOJ: Department of Justice, EPA: Environmental Protection Agency, ERS: Economic Research Service, FS: Forest Service, FAS: Foreign Agriculture Service, FSA: Farm Service Agency, FWS: DOI Fish and Wildlife Service) NASS: National Agricultural Statistics Service, NIFA: National Institute of Food and Agriculture, NOAA: National Oceanic and Atmospheric Administration, NRCS: Natural Resources Conservation Service, NRE: Natural Resources and the Environment Mission Area, REE: Research, Education and Economics Mission Area; RD: Rural Development, RMA: Risk Management Agency

	existing		renewable energy, increased energy efficiency upgrades
National Drought Resilience Partnership	Technical support for drought challenges Financial assistance enhancements in targeted regions with reduced water	NRE, OCE	National Soil Moisture Network Plan; Form partnerships with emergency services at State and Federal levels; Action register within USDA
Climate Smart Agriculture Alliance	Lack of international alliances on climate change	FAS/CCPO	Initiating and signing charter
Next Generation Biofuels	Few resources available for biofuel mass production	RD	Commercial quantities of advanced biofuels R&D reducing production costs
Ecological Restoration and Resilience Policy (FSM 2020)	Provides foundation policy for sustainable management of FS lands	FS with other Federal land management agencies	Interim directives issued and reissued; Proposed directive published and finalized in 2014
USDA-FS Forest Planning Rule Directives (FSM 1920 and FSH 1909.12)	Revise forest land management planning and policy procedures to include climate change in planning rule	FS, CEQ, OMB, DOJ, EPA, FWS, NOAA Fisheries	Finish public comments; Number of land management plans revised under finalized rule when issued in 2014
Interagency Methane Strategy	Methane Emissions Reductions	CCPO, RD	Bio-Gas Roadmap Initiative; Establish Methane Measurement Workgroup
Agricultural Act of 2014 (2014 Farm Bill)	Technical assistance less than needed by agencies to assist client stakeholders	Multiple	Additional funding released for technical assistance at field level
Reducing Emission from Deforestation and Forest Degradation (REDD)	More interaction with developing countries in international negotiations	CCPO, FS	Technical assistance on carbon inventories and forests in developing countries
Reducing Wild Fire Risks	No 'National Risk Map' for underserved and other stakeholders	FS	Wild Fire Potential Map with values at risk
Voluntary Carbon Partnerships	Few public-private Partnerships focused to augments USDA environmental markets	NRCS, FS, OEM	Pilot programs with partners, e.g. Conservation Innovation Grants to establish public-partnerships
Climate Data Initiative	Stimulate innovation and private-sector involvement in climate change preparedness through open data and tools; vulnerability	REE	Virtual food resilience data portal and toolkit for new climate portal in Data.gov; First cut will focus on identifying food production

	of food production and supply to climate and weather events		and supply data sets and tools.
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V. USDA Adaptation Actions Table

This section is attached in a separate file.

VI. USDA Individual Agency Climate Change Adaptation Plans

In the next section, USDA Agencies have provided their Agency Climate Change Adaptation Plans. These agencies are: Agricultural Research Service (ARS), Animal and Plant Health Inspection Service (APHIS), Foreign Agricultural Service (FAS), Farm Service Agency (FSA), Forest Service (FS), Grain Inspection Packers and Stockyards Administration (GIPSA), National Agricultural Statistics Service (NASS), National Institute of Food and Agriculture (NIFA), Natural Resources Conservation Service (NRCS), Rural Development (RD), and Risk Management Agency (RMA).

V. USDA Adaptation Actions Table Highlights

Action Description	Action Goal	Agency Lead ¹	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination ¹	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
USDA Regional Climate Hubs	Technical support to deliver tools and strategies for climate change response; Regional assessments of risk and vulnerability; Outreach and Education on science-based risk management	USDA with DOI and NOAA as primaries	Provide tighter coordination among USDA agencies to translate and deliver climate adaptation and resilience information to USDA partners and stakeholders	Regional	Ongoing	Established 7 centers in the US working through established USDA facilities and programs.	Development of Work Plans, prepare regional vulnerabilities, develop partnerships, establish web presence	DOI Climate Science Centers and Landscape Conservation Cooperatives; NOAA RISAs; Cooperative Extension System; State Agricultural Experiment Stations	Existing support from USDA Sub-Agencies and USDA. Budget limitations may slow pace of hub effectiveness	Need to develop scorecard guidance; integrate completely with partners at regional level; Limited resources	New action – Hub announced in February 2014. Websites activated. Work plans in development
National Climate Assessment (NCA)	Assemble science to inform policy	USDA	Publication of scientific assessments and technical reports available on agriculture, forests, biogeochemistry, and food security	National and Regional	Ongoing sustained process	Assessments and distributed publications	Assessment publications	Federal, State and local entities	Periodic publication costs must be factored into Agency budgets	Continuing assessment process in 4 years between NCA publications	USDA-supported NCA technical report on 'Global Climate Change, Food Security and the US Food System FY 2014

¹ Agency Abbreviations: USDA – US Department of Agriculture; ARS – Agricultural Research Service; APHIS – Animal Plant Health Inspection Service; CCPO – Climate Change Program Office; FSA – Farm Service Agency; FAS – Foreign Agricultural Service; FS – Forest Service; NRCS – Natural Resources Conservation Service; NRE – Natural Resources and Environment Area DOI - Department of Interior; FWS – Fish and Wildlife Service; NOAA – National Oceanic and Atmospheric Administration; UACE – Army Corps of Engineers; EPA – Environmental Protection Agency; FEMA – Federal Emergency Management Agency; DOE – Department of Energy

5/29/2014 USDA Adaptation Actions Table

Global Research Alliance (GRA)	Collaboration to determine the role agriculture plays in mitigating GHGs through improved management practices	USDA-FAS, ARS, CCPO	Opportunity to participate globally with nations fully engaged in greenhouse gas emissions mitigation	International National	Ongoing	Regular meetings and workshops to ensure and update countries on research advances	Improved models, database access, management practices and technologies; enhanced science exchange through GRA Fellows program	US Leadership Team in coordination with appropriate international representatives		New resources made available for meetings and workshops will add momentum to the GRA	Research published to fill critical knowledge gaps in mitigating agricultural greenhouse gas emissions; FAS has delivered 25 GRA Fellows from 10 countries
Feed the Future (FtF)	To increase the food security of partner countries to become more resilient to climate change impacts	USDA-FAS	Opportunity to assess prevailing conditions, define priorities and align US resources to develop food and agricultural sectors of food insecure countries	FtF countries	Ongoing	FAS priorities candidates eligible to participate in capacity-building and scientific exchange activities	Participation in FtF working groups with a target of 100% attendance; Increase percentage of FtF countries recruited for capacity-building fellowship and scientific exchange programs	USAID Bureau of Food Security leads interagency FtF working group		Climate change adaptation may not be the most pressing concern of FtF countries to strengthen their food security measures	FAS has attended Working Group meetings and engaged FtF countries on food security initiatives for climate change
Climate Smart Agriculture Alliance	Working toward launch of a voluntary International Climate Smart Alliance	USDA-FAS, CCPO, FS	Opportunity for private-public partnership for smart agricultural practices in relation to climate change adaptation	International	Ongoing	Statement of Intent to Work on Alliance; Informal land sector dialogue to discuss post 20-20 climate regimes linked to the CEQ adaptation process and the US National Forest Carbon project.	Completion of initial collaboration documents and securing signatories	State Department, Treasury, USAID, USDA, World Bank, Netherlands and South Africa		Negotiating terms of agreements	Announcement of Initiative; Charter development and high-level rollout planned for Fall 2014

5/29/2014 USDA Adaptation Actions Table

Implement National Fish, Wildlife, Plants, Climate Adaptation Strategy (NFWPCAS)	Federal lands that are more resilient and able to sustain functions and productivity	USDA-FS, APHIS, FSA and NRCS; DOI - FWS;NOAA; Assoc. Fish Wildlife Agencies; Tribal nations	Opportunity to improve efficiency and effectiveness of strategic actions aligned with NFWPCAS	National	2014	Review agency programs and strategic plans and NFWPCAS	Crosswalk established USDA-FS and other goals and strategic actions with NFWPCAS goals, strategies and actions	Joint Implementation Working Group (JIWG) of NFWPCAS composed of multiple federal, state and local jurisdictional entities		Effective integration among USDA Sub-agencies with federal land management missions and those with missions to assist private landowners	NFWPCAS published and JIWG established
National Drought Resilience Partnership	Establish a framework to improve capabilities to monitor and plan for drought and support risk management strategies	USDA-NRE; OCE	Opportunity to collaborate on development and implementation of tools and products, improve accessibility and compatibility of sharing data, and establish a National Soil Moisture Network (NSMN) with emphasis on expansion into underserved regions and vulnerable populations	National	Ongoing	Identify existing soil moisture networks, gaps and data compatibility	Develop unified approach to NSMN	USDA, NOAA, DOI, UACE, FEMA, EPA and DOE		Data compatibility	Held workshop with principle federal agencies in Kansa City, MO. White paper in progress detailing next steps

5/29/2014 USDA Adaptation Actions Table

Climate Change and Tribal Projects	Learn and assist Tribes and other native peoples in managing natural resources in context of climate change	USDA-NRE; FS in Northern Stations coordinating; Expect USDA Hubs to increase coordination nationally	Opportunity to engage underserved and culturally diverse groups	National, Regional	Ongoing	Plan and facilitate workshops, support networks developing studies that highlight particular local challenges or adaptation options	Number of Tribal Nations and organizations engaged effectively	Collaboration with DOI-LCCs and CSCs		Highlights needs for funding to monitor with and for culturally diverse groups	USDA-FS works with over 80 tribes and 20 intertribal and native organizations. Active networks established in Pacific Northwest and Southwest US. More than 60 tribal experts and students supported to attend climate-related workshops and conferences.
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VI. USDA Individual Agency Climate Change Adaptation Plans

- 1. Animal and Plant Health Inspection Service**
- 2. Agricultural Research Service**
- 3. Farm Service Agency**
- 4. Foreign Agricultural Service**
- 5. Forest Service**
- 6. Grain Inspection Packers and Stockyards Administration**
- 7. National Agricultural Statistics Service**
- 8. National Institute of Food and Agriculture**
- 9. Natural Resources Conservation Service**
- 10. Risk Management Agency**
- 11. Rural Development**

USDA Animal and Plant Health Inspection Service
Climate Change Adaptation Plan 2014

**Animal and Plant Health Inspection Service
Climate Adaptation Plan
January 28, 2014**

APHIS Vision Statement

Advance the well-being of U.S. consumers by ensuring the health and availability of affordable food products and protecting forests and private working lands against devastating pests and diseases so that U.S. farmers, ranchers, and other citizens of our rural communities thrive and prosper.

APHIS Mission Statement

Protect the health and value of U.S. agricultural, natural, and other resources.

APHIS' Strategic Goals

Goal 1: Support rural communities

- Objective 1.1 – Implement agricultural pest and disease management programs, including those affected in rural areas
- Objective 1.2 – Protect and promote animal welfare

Goal 2: Protect forests, rangelands, and private lands

- Objective 2.1 – Reduce threats to forests and private working lands

Goal 3: Expand opportunities to develop and trade safe agricultural products, including biotechnology-derived agricultural products

- Objective 3.1 – Enhance the regulatory framework that allows for the safe development of genetically engineered organisms
- Objective 3.2 – Facilitate safe agricultural trade through international standard setting and effective management of sanitary and phytosanitary (SPS) issues

Goal 4: Minimize and prevent damage to the U.S. food supply caused by plant and animal pests and diseases

- Objective 4.1 – Monitor the health status of U.S. agricultural resources
- Objective 4.2 – Develop and implement programs to address plant and animal pests and diseases of concern
- Objective 4.3 – Provide diagnostics and technical support to enhance pest and disease programs, including emergency response capabilities for these pests and diseases.

APHIS' strategic goals listed above, and APHIS' approaches to climate change, are identified in the APHIS Strategic Plan FY 2010-2015¹. APHIS recognizes that climate change presents a threat to its ability to advance its strategic goals. The strategic plan describes activities that acknowledge climate change factors and incorporate response and adaptation strategies.

The APHIS Strategic Plan identifies climate change as a key external threat to its ability to meet its mission critical goals. Climate change will influence the level of risk to food security and human health associated with a suite of animal and plant diseases, invasive species, and agricultural pests. Changes in environmental conditions will increase the likelihood of shifts in the distribution and nature of current domestic diseases, invasive species, and agricultural pests. These changes will influence the dynamics of invasion and establishment of exotic diseases and agricultural pests. They will require that APHIS develop appropriate predictive risk and epidemiological models, domestic and offshore surveillance, and mitigation strategies to respond to changing climatic conditions that may affect disease and pest biology. Appropriate diagnostic tools and response strategies will afford APHIS' ability to maintain situational

¹ http://www.aphis.usda.gov/about_aphis/downloads/APHIS_Strategic_Plan_2015.pdf

awareness to support regulatory responses and sound decision-making. Tools that have been developed or are in consideration for development are described in more detail in [Appendix A](#).

APHIS, in coordination with other federal agencies and cooperators, monitors weather, pest trends, and pest outbreaks worldwide to develop pest exclusion activities whenever needed to enhance protection at air, land, and sea ports of entry, and inland areas where trade and other pathways expose the environment and agriculture to foreign pests and diseases. Empirical evidence has demonstrated that short term climate disruptions (e.g. drought, heat, and hurricanes) can strongly influence pest and disease incursion. These disruptions sometimes exacerbate pest pressure; however, pest pressure also can be minimized. Climate change is already starting to influence invasion biology, pest/disease epidemiology, and ecosystem dynamics, which can influence not only the likelihood of arrival, but also the potential for establishment and spread. Therefore, APHIS is developing analytic systems and predictive models to protect agriculture, natural resources, commerce, and trade. More information about these tools is available in [Appendix A](#).

APHIS does not anticipate that climate change will require a modification of its regulatory authority; however, climate change will likely require new regulations and policies as well as innovative, non-regulatory approaches to address new or shifting pest and disease scenarios.

Planning for Climate Change Related Risk

Section 5(a) of Executive Order 13653 (the “EO”) states that “each agency shall develop or continue to develop, implement, and update comprehensive plans that integrate consideration of climate change into agency operations and overall mission objectives...” This plan is organized according to the structure of Section 5 of the EO. Information requested in other sections of the EO is also presented. Actions related to each of these sections are summarized in a series of tables in the Appendices.

- 5.a.i. Identification and assessment of climate change related impacts on and risks to the agency’s ability to accomplish its missions, operations, and programs

Vulnerability Assessment

Risks associated with changing climate include:

Food Distribution and Aid

- APHIS regulations prohibit the importation of agricultural and food products that pose risk to plant, animal, and human health. Disaster relief (including food distribution) efforts associated with increased frequency of extreme weather events resulting from climate change will require enhanced coordination with other Federal, State, and local agencies to protect public and agricultural resources.
- Novel patterns in the distribution and movement of regulated agricultural products may create new or increased risk for introduction of pests and diseases. APHIS will work with Federal and State partners to enhance capacity to meet the challenges encountered with export and import requirements related to food distribution and aid.
- The storage, deployment, and forward-staging of food aid materials may be compromised as climate change and associated extreme weather events hamper the distribution of aid, impacting its local availability and potentially increasing the risks of stored product pests (e.g., khapra beetle).

U.S. Agricultural Production and Trade

Animal and Plant Health Inspection Service

- Climate change and associated shifts in disease and pest prevalence may overwhelm the current ability of off-shore programs to provide real-time information regarding pest and disease potential and may increase risk to U.S. agriculture.
- Existing surveillance and diagnostic networks for animal and plant health diseases (e.g., avian influenza, foot and mouth disease, citrus greening, Asian long-horned beetle, fruit flies, etc.) could be overwhelmed.
- Increased requirements for commodity and pathway risk analyses may overwhelm existing capacities.

Emergency Response Systems

- APHIS has established animal and plant health emergency frameworks to facilitate coordinated, timely responses to disease and pest emergencies. APHIS also has established frameworks to address all hazards (e.g., hurricanes, floods, wildfires) for impacts on plant and animal health and the needs of individuals with service animals and household pets, in addition to providing technical assistance for animal and agriculture emergency management. Climate change has the potential to overwhelm existing frameworks as a result of increases in extreme weather events, wildfires, and pest and disease outbreaks.
- In the event of wide-ranging climate disruption events, capacity could be overwhelmed and assistance from other USDA and Department of Homeland Security (DHS) emergency response resources would be required. State, local, Tribal, industry, and other stakeholders with key roles in threat mitigation also may be overwhelmed.
- Changes in pest and disease biology will require APHIS to ensure that its emergency response strategies (including new pest and disease response guidelines) and capabilities are updated and coordinated with the DHS National Response Framework.

Shifts in Geographic Distribution of Wildlife, Weeds, Pests, and Diseases

Climate change impacts on ecosystem and habitat characteristics will result in shifts of animal and pest populations into new or expanded habitats. This movement can result in increased spread of diseases (such as citrus greening) and other pests and increased encounters with wildlife in populated areas potentially increasing disease transmission among wildlife, livestock, and people. APHIS will direct and coordinate its surveillance, reporting, and mitigation initiatives with Federal, State, and Tribal stakeholders to maintain human, animal, and plant health. Partnering with others, such as the Department of Commerce's National Oceanic and Atmospheric Administration on the development of predictive models related to climate change would afford APHIS increased capacity to protect U.S. agriculture and natural resources while maintaining the flow of trade. Increased coordination and collaboration with international partners developing predictive models will enhance APHIS' ability to prepare for pest and disease incursions and other changes driven by climate change.

Increase in Demand for Genetically Engineered (GE) Crops and Related APHIS Services

APHIS expects an increase in the demand for GE crops that are modified to adapt to the effects of climate change and a commensurate increase in the numbers of permit and notification applications, risk assessments, field trials, inspections, compliance issues, and petitions for deregulation, thereby increasing demands on APHIS resources.

- Adapting to climate change will likely require innovations in agricultural technology,

Animal and Plant Health Inspection Service

including the introduction of novel traits. These innovations may create the need to revise and update protocols and approaches to risk assessments.

- Response to pest and disease outbreaks may require the increased use of treatment combinations and could therefore increase the complexity of environmental and risk analyses such as those required under the National Environmental Policy Act (NEPA).
- The increased desire for genetically engineered plants to resist pests or pests engineered to prevent the transmission of plant pathogens is expected to result in increased complexity of assessments.

The vulnerabilities listed above identify the climate change related impacts and associated risk that APHIS has determined may affect its ability to accomplish agency policies and programs and continue agency operations. To ensure that APHIS is best situated to handle these impacts and associated risks, APHIS is incorporating climate change modeling into risk assessments. To do so, pest and disease forecasting systems must be updated to shift from climatological-based forecasts (based on historical data) to systematically consider General Circulation Model outputs and Intergovernmental Panel on Climate Change scenarios. This shift requires development of enhanced capacity to establish links to these resources and maintain updated modeling approaches that best capture forecasts and associated uncertainty. In order to make these enhancements, as well as to achieve other climate-related objectives, APHIS is developing partnerships to leverage resources and minimize impacts of changing pest, disease, and vector distribution throughout the United States (see action items in [Appendix A, Table 1](#)).

In addition to understanding pest risks associated with climate change, APHIS also is working to understand climate-related environmental risks from and to its own actions to control pests, diseases, and vectors. An APHIS team comprised of multiple program areas developed a general draft APHIS-wide introductory NEPA climate change guidance document that lays the foundation for the various analytical approaches that programs may employ. These approaches, along with illustrative examples, will be provided in a supplemental document ([Appendix A, Table 1](#)).

To better understand risk and opportunities and thus be better able to plan for them, APHIS will:

- Adapt risk analysis models (both epidemiological and forecasting) to incorporate changes in the distribution of environmental and biological attributes predicted under different climate change scenarios. APHIS will use the output from these models to prioritize the likelihood and severity of threats and to focus subsequent activities on specific high-likelihood, high-impact diseases, agricultural pests or pest categories².
- Develop proposals in collaboration with other partners to adapt risk analysis models (both epidemiological and forecasting) to incorporate changes in the distribution of environmental and biological attributes predicted under different climate change scenarios³.

² This corresponds to the second element in USDA's Climate Change Science Plan (http://www.usda.gov/oce/climate_change/science_plan2010/USDA_CCSPPlan_112910.pdf): "to develop knowledge, institutional models, and tools to enable adaptation..."

³ This corresponds to the second and third element in USDA's Climate Change Science Plan: "to develop knowledge and tools to ..."

Animal and Plant Health Inspection Service

- 5.a.ii. Description of programs, policies, and plans the agency has already put in place, as well as additional actions the agency will take, to manage climate risks in the near term and build resilience in the short and long term.

Opportunities to minimize APHIS' vulnerability include:

Predictive Modeling Important to Preparedness

Regulatory Strategies

- Develop regulatory strategies that focus on risk pathways in lieu of specific pests.
- Ensure that climate change adaptation is incorporated into the APHIS decisionmaking framework.
- Ensure that regulatory considerations regarding adaptation approaches are consistent with the APHIS mission of safeguarding the health of plants, animals, and ecosystems and ensuring safe trade.

Leverage Resources

- APHIS will partner with Federal, State, local, and Tribal agencies, academic institutions, industries and other stakeholders to ensure a well-informed understanding and coordinated response to climate change.
- APHIS will leverage its research capabilities and program and response resources to enhance preparedness and the ability to mitigate and adapt to impacts related to climate change. The Agency will do so by adopting an infrastructure that enables rapid modification of policy and standard operating procedures.
- APHIS will seek to leverage trading partners to harmonize efforts and ensure that sanitary and phytosanitary measures are consistent with the goals of adaptation to climate change and the APHIS mission.

Ensure Continuity of Operations

- APHIS will maintain a workforce that is resilient to weather and other climate change-related disruptions so that the work of the Agency can continue as seamlessly as possible.
- APHIS will employ flexible management policies to assist employees impacted by disasters related to climate change (e.g., floods, hurricanes, wildfires) so that they may return to work as quickly as possible.

By using predictive modeling, assessing regulatory strategies, and leveraging resources, APHIS will mitigate the risks discovered during the vulnerability assessment. In addition, APHIS will examine its cooperative agreement process to ensure that it is responsive to increased demand to enter into agreements and partnerships associated with climate change.

[Appendix A, Table 2](#) shows several of the programs, policies, and plans involving APHIS' management of climate risks in the near-term and anticipated actions in the short and long term.

Animal and Plant Health Inspection Service plant health emergency response systems.

Emergency Response Systems

- As stated in APHIS' 2012 Climate Change Adaptation Plan, the Agency has established animal and plant health emergency frameworks to facilitate coordinated timely responses to disease and pest emergencies.
 - In 2013, the Emergency Support Function #11 (ESF#11) Annex to the *National Response Framework* was revised and changed the scope of ESF#11 activities. Particularly, ESF#11 now includes technical assistance for animal and agricultural emergency management. As the delegated national coordinator for ESF#11, APHIS works with multiple Federal Departments and Agencies, and non-governmental organizations to coordinate Federal support for disasters exceeding the response capability and resources of the local, State, territorial, and Tribal governments.
 - APHIS works with the National and Regional Response Teams under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 CFR 300) to support wildlife response for oil and hazardous substances releases.
 - In 2013, APHIS completed training eight Type 3 Incident Management Teams to respond to animal and plant health emergencies. These Incident Management Teams may be activated, if available, to support all-hazard emergencies, including those related to climate change.
 - APHIS has continuity plans to sustain Essential Functions in multiple geographic locations, during and after a catastrophic incident.
- As described in the section on vulnerabilities, wide-ranging climate disruption events could overwhelm capacity and assistance from other USDA and DHS emergency response resources would be required. State, local, Tribal, industry and other stakeholders with key roles in threat mitigation also may be overwhelmed. In response to this vulnerability, APHIS has several actions underway:
 - APHIS is working with USDA and DHS to develop procedures for requesting support and coordinating activities for large-scale responses.
 - As part of the development of incident-specific response annexes to the National Response Framework, APHIS is working with local, State, Tribal, and territorial governments, and non-governmental organizations to develop Food and Agriculture Incident specific annexes for each of the 10 Federal Emergency Management Agency Regions and at the national level.
 - APHIS maintains continuity plans to ensure that when disruptions occur, APHIS maintains redundancies to continue to perform its missions in other non-impacted operational locations. APHIS is expanding its Continuity of Operations plans to address business continuity and property protection issues.
 - APHIS has prepared for climate risks in the short and long term by implementing the USDA Telework Directive. Approximately 63 percent of APHIS employees have telework agreements in place, which allows for continuity in operations even during inclement weather such as a snowstorm.
 - For more severe weather outbreaks, such as Hurricane Sandy, APHIS developed a document outlining flexibilities available to employees that will allow them to maintain or return quickly to work productivity. During Hurricane Sandy, APHIS employed the use of the emergency leave transfer program. This program provided six employees with a total of 1,720 hours of donated leave to help them in the recovery process and maintain their expertise within the Agency.

Natural disasters also present a risk to animals and their owners. In FY 13, APHIS published a final rule (now under review) requiring all dealers, exhibitors, intermediate handlers, carriers,

research facilities, and other entities regulated by APHIS under the Animal Welfare Act to develop contingency plans for responding to and recovering from emergencies most likely to impact their facility and animals. APHIS also has co-sponsored exercises and training in animal disaster response and has developed best practices for animal emergency planning and response.

In addition to preparing for the impacts of climate change, APHIS also is examining its own actions that may contribute to climate change. APHIS uses methyl bromide to control regulated plant pests; however, methyl bromide, an ozone-depleting substance, is also considered to be a greenhouse gas. Research is now underway to find suitable alternatives to methyl bromide ([Appendix A, Table 2](#)).

- 5.a.iii. A description of how any climate change related risk identified pursuant to paragraph (i) of this subsection that is deemed so significant that it impairs an agency's statutory mission or operation will be addressed, including through the agency's existing reporting requirements

APHIS has not identified any climate change risks that could potentially impair, obstruct, or prevent the success of agency mission activities, both in the near and long term.

- 5.a.iv. A description of how the agency will consider the need to improve climate adaptation and resilience, including the costs and benefits of such improvement, with respect to agency suppliers, supply chain, real property investments, and capital equipment purchases such as updating agency policies for leasing, building upgrades, relocation of existing facilities and equipment, and construction of new facilities

APHIS considered the need to improve climate change adaptation and resilience as it relates to procurement, acquisition, real property, and leasing decisions. During 2014, APHIS intends to achieve 85% compliance in the procurement of Energy Star qualified computers through USDA blanket purchase agreements. In addition, APHIS will continue its work with USDA's Office of the Chief Information Officer to consolidate data centers to ensure resource optimization. These actions will decrease the computing footprint and energy consumption. They will also improve resilience to increased power needs for heating and cooling in the face of climate change and reductions in power supply in the event of climate-related emergencies ([Appendix A, Table 3](#)).

- 5.a.v. A description of how the agency will contribute to coordinated interagency efforts to support climate preparedness and resilience at all levels of government, including collaborative work across agencies' regional offices and hubs, and through coordinated development of information, data, and tools, consistent with section 4 of this order.

A program that will enhance climate change resiliency involves eliminating nutria and their destructive impacts to the Delmarva Peninsula. Nutria is an invasive exotic rodent that severely damages wetlands by destroying native vegetation. In its undisturbed state, this vegetation provides not only essential natural habitat, but also serves as natural infrastructure to protect this coastal region from storms and floods. APHIS Wildlife Services participates in the Chesapeake Bay Nutria Eradication Project, a partnership between the Agency, U.S. Fish and Wildlife Service (USFWS), Maryland Department of Natural Resources, Virginia Department of Inland Fisheries

and Wildlife, and Delaware Fish and Wildlife. Funding and administrative control is provided by the USFWS, and APHIS is responsible for development and implementation of the program with mission critical support from relevant State agencies and the voluntary cooperation of hundreds of private landowners throughout the area of impact. The partnership as a whole is responsible for oversight ([Appendix A, Table 4](#)).

The goal of the project is to eliminate this invasive species to protect the remaining wetlands for the ecological and economic benefit of the human population and fish and wildlife resources. Nutria have impacted more than 250,000 acres and severely degraded the ecological value of tens of thousands of acres of emergent marsh. Coastal wetlands provide critical ecological functions that contribute to the region's resiliency to climate change, particularly sea level rise and increased frequency and severity of coastal storms. Coastal wetlands dampen the effects of storm surges, reducing the inland impacts of storm driven flooding. They also help protect upland habitats, including forest and agricultural resources from saltwater intrusion.

Additional actions that support climate change resiliency include the development of continuity of operations protocols (see Section 5.a.ii for more information) and information technology protocols. Development of information technology protocols permits the use of interagency tools and data. These protocols will support climate change simulation systems and database support. APHIS completed the transition in 2013 from a single pest forecasting provider to an interagency approach formalized through a multi-institution cooperative agreement in 2014 ([Appendix A, Table 4](#)).

Modernizing Federal Programs and Policies to Support Climate Resilient Investment

Section 2(a) of Executive Order 13653 states that Federal agencies shall address efforts to modernize federal programs and policies “(to) support the efforts of regions, States, local communities, and tribes,...consistent with their missions and in coordination with the Council on the Climate Preparedness and Resilience (Council) established in section 6 of this order...” that section also states that agencies shall “report on their progress in achieving the requirements identified above, including accomplished and planned milestones, in the Agency Adaptation Plans developed pursuant to section 5 of this order.”

- i. Identify and seek to remove or reform barriers that discourage investments or other actions to increase the Nation's resilience to climate change while ensuring continued protection of public health and the environment

APHIS has not identified any policies or programs that unintentionally discourage or disallow investments by external partners or grant recipients that would improve their preparedness for climate impacts.

- ii. Reform policies and federal funding programs that may, perhaps unintentionally, increase the vulnerability of natural or built systems, economic sectors, natural resources, or communities to climate change related risks

Animal and Plant Health Inspection Service

During 2014, APHIS will examine its cooperative agreement process to ensure that it is responsive to increased demand for collaboration and partnership with others on climate change issues.

- iii. Identify opportunities to support and encourage smarter, more climate-resilient investments by States, local communities, and tribes, including by providing incentives through agency guidance, grants, technical assistance, performance measures, safety considerations, and other programs.

APHIS has not pursued a process to identify opportunities that may support and encourage smarter, more climate-resilient investments by States, local communities, and Tribes. APHIS will, however, engage international, Federal, State, local, and Tribal partners as well as other stakeholders to gather relevant information to support decision-making and, where applicable and appropriate, to partner in program delivery. APHIS also will work with other State, Federal, and Tribal entities to ensure impacts associated with Agency actions in response to climate change provide for continued existence of other fish, wildlife, and plant communities consistent with the National Fish, Wildlife, and Plant Climate Adaptation Strategy ([Appendix B, Table 1](#)).

Sustained Adaptation Process

Priority Setting

APHIS will define program elements that can be strongly influenced by climate change by establishing clear science- and programmatic-based criteria and evaluate the importance of the information using an analytical process to evaluate the relative importance of the potential impacts associated with climate change on APHIS' ability to meet its mission.

Sources of Information

APHIS will review and apply information from federal agencies, international initiatives and academic institutions with demonstrated expertise in climate change (predictive modeling, basic and applied research on pest/disease biology, ecology and environmental impacts) and integrate the relevant information into its Climate Adaptation Plan and program performance measures.

Performance Metrics

APHIS programs will identify performance metrics that demonstrate climate change adaptation is integrated into each program's policies, response plans, risk assessments, and environmental analyses.

Methods APHIS will use to evaluate progress

APHIS Leadership will review program operational plans and policies to ensure that adaptation to climate change is factored into our planning, implementation and evaluation of program performance.

Appendix A. Section 5(a) Planning for Climate Change Related Risk

- i. Identification and assessment of climate change related impacts on and risks to the agency’s ability to accomplish its mission, operations and programs.

Table 1. Identification and Assessment of Climate Change Related Impacts and Risks

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
Incorporate climate change modeling into risk assessments	Develop process to determine when risk evaluation should incorporate effects due to climate change	VS Centers for Epidemiology and Animal Health	Risk reduction – assure that the possibility of new risks to imported animals/animal products as a result of climate change are evaluated timely	National and International	Ongoing	Research, collaboration with other agencies/ countries and development of methods	Projects completed as forecasted		Need for funding anticipated	Availability of information	Initiated development of process to interact with select countries to determine if climate change is affecting risk of disease.
Identify specific pests, diseases, or vectors that are changing their distribution in the United States as a result of climate change	Develop partnerships to leverage resources and minimize impacts of changing pest, disease, and vector distribution on the health and value of U.S. agriculture, natural, and other resources	VS Centers for Epidemiology and Animal Health and WS National Wildlife Research Center	Risk mitigation – assure that shifts in disease and vector occurrence are known so appropriate mitigation methods can be established	National and International	Ongoing	Identify specific diseases and information needed to assess and potential partners for collaboration	Adaptation of climate models for forecasting vector distribution on a temporal, landscape, and local scale	As needed	Need for funding anticipated	Availability of information and resources to determine disease distribution	1) Historical prevalence of Bluetongue and Epizootic Hemorrhagic Disease in United States examined. 2) Collaboration with National Center for Atmospheric Research and APHIS WS to develop National Science Foundation grant proposal to predict redistribution of orbiviruses.

Animal and Plant Health Inspection Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
											3) Initiated collaboration with University of Calgary and University of Prince Edward Island on climate change related projects
Develop guidance on how to address impacts associated with climate change, including those on low income, minority and Tribal communities, in environmental compliance documents	Develop an analytical framework to assess impacts associated with climate change for Agency actions subject to the National Environmental Policy Act, consistent with draft CEQ guidance.	PPD Environmental and Risk Analysis Services	Climate change is expected to impact the systems that APHIS regulates (e.g., plant and animal pests and diseases), which in turn can impact the need and type of actions necessary. Because some pests (e.g., forest insects) can increase net carbon release, long term impacts of agency actions may result in a net decrease in carbon release, whereas actions to fight the pest (e.g., tree removal) may result in temporary and local increases in carbon release.	APHIS	Ongoing		Percentage/ number of Agency environmental compliance documents that address impacts of climate change	N/A	Time and resource constraints	Developing a unified approach to climate change in environmental compliance documents despite diversity in nature of agency programs and corresponding actions.	Internal draft near completion

Animal and Plant Health Inspection Service

- ii. Description of programs, policies and plans that the agency has put in place and additional actions that the agency will take to manage climate risks in the near-term and build resilience in the short and long term:

Table 2. Actions Taken to Manage Climate Risks in the Short Term and Build Resilience in the Long Term

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
<i>Revision of the Emergency Support Function (ESF) #11 Annex to the National Response Framework</i>	To ensure that ESF#11 activities include technical assistance for animal and agricultural emergency management that may be necessary following increased frequency or intensity of extreme weather and weather-related events (e.g., floods, hurricanes, fires).	MRPBS Emergency Management Safety and Security Division		National- -multiple Federal Departments and Agencies , local, State, Tribal and territorial governments and NGOs	Ongoing		Revision to emergency response plans, and CONOPs (Concept of Operations)				ESF#11 Annex revised in May 2013: Revised the Emergency Support Function #11 (ESF#11) Annex to the National Response Framework and changed the scope of ESF#11 activities such that ESF#11 now includes technical assistance for animal and agricultural emergency management. Implementation is ongoing.
Developing Food and Agriculture Incident Annexes for each of the FEMA Regions and at the national	Develop Food and Agriculture Incident specific annexes to the National Response Framework	MRPBS Emergency Management Safety and Security Division		APHIS, USDA, HHS, multiple Federal Departments and Agencies , local,	Ongoing		Completed Food and Agriculture Incident Annexes				Beginning template with FEMA Region VII.

Animal and Plant Health Inspection Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
level				State, Tribal, territorial governments, and NGOs							
Train Type3 Incident Management Teams to respond to animal and plant health emergencies. These Incident Management Teams may be activated, if available, to support all-hazard emergencies	<i>Provide trained Type 3 Incident Management Teams to respond to all-hazard emergencies, some of which will be associated with climate-related extreme-weather events.</i>	MRPBS Emergency Management Safety and Security Division Emergency Preparedness Branch		APHIS	Ongoing		Completed training consistent with National Incident Management System requirements				As of August 2013, provided complete training for 8 Type 3 Incident Management Teams to respond to animal and plant health emergencies. On-going training is planned for team member replacement and refresher.
Develop, maintain and update continuity plans to include business continuity and property protection	Ongoing Development of Continuity plans to sustain Mission Essential Functions in multiple geographic locations, during, and after a catastrophic incident	MRPBS Emergency Management Safety and Security Division Emergency Preparedness Branch		APHIS	Ongoing		Complete and signed plans; training, tests, and exercises for continuity personnel				Agency-level plan revised in 2013. HQ (NCR) Annex in preparation.

Animal and Plant Health Inspection Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
	(including climate-related events)										
Work with USDA and DHS to develop procedures for requesting support and coordinating activities for large-scale emergency responses.	<i>Develop process to request support from USDA and/or the Federal community for large-scale responses</i>	MRPBS Emergency Management Safety and Security Division		APHIS, USDA, DHS	Ongoing		Written process for requesting assistance				Initial meeting held with USDA-OGC and with DHS-OCC.
Continue to implement and follow the USDA Telework Directive		MRPBS Human Resources Division	Widespread use of telework will allow the Agency to continue the work of the Government despite workplace interruptions resulting from climate change		Ongoing		Telework implementation is widespread; work continues with little disruption in inclement weather situations		Cost of agency-provided equipment/capabilities		More than 63 percent of APHIS employees have telework agreements in place, which cover Ad Hoc telework used in emergency situations.
Deploy established flexibilities to support employees affected by designated	To ensure that agency employees are able to receive administrative leave and	MRPBS Human Resources Division and Financial Management Division	Supervisors may grant 40 hours of administrative leave to employees affected by a designated disaster. Affected employees	APHIS	As needed		Continued productively in spite of emergency situations faced by individual		Temporary drop in productivity; increased workload on payroll, financial and HR personnel		In an effort to provide assistance to Agency employees affected by Hurricane Sandy, APHIS created an

Animal and Plant Health Inspection Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
research to develop and introduce alternatives to methyl bromide as a treatment against various regulated plant pests.		and Technology	regulatory pressure from Montreal protocol, EPA, and USDA to further reduce use of QPS methyl bromide (an ozone-depleting substance considered to be a greenhouse gas).								funded in PPQ-Science and Technology to develop alternatives to methyl bromide
Provision of regulatory and non-regulatory support for emergency preparation to improve animal welfare. Specifically, publication of regulation to require entities regulated by APHIS under the Animal Welfare Act to prepare contingency plans for the care of their animals in the event of an emergency. Also, development	To better prepare businesses (where animals are integral to that business) and pet owners to respond to disaster in order to reduce the burden on local, State, and Federal response personnel; to protect public health by safely evacuating or sheltering dangerous animals; and to support	Animal Care	Natural disasters present a risk to animals and their owners	National – Emergency response is led by FEMA but involving other Federal, State and local agencies and non-governmental organizations and businesses	Ongoing			Federal level horizontal coordination among USDA, HHS, FEMA, DHA, and other Agencies responsible for animal issues during disaster. Vertical coordination is needed to integrate the efforts of Federal, State, and local government with the efforts of NGOs, businesses, and pet owners. Presidential Policy Directive #8 calls for this	Appropriated funds for disaster planning and response are directed to FEMA.		1)In FY13, APHIS Animal Care published a final rule requiring all dealers, exhibitors, intermediate handlers, carriers, research facilities and other entities regulated by the agency under the Animal Welfare Act to develop contingency plans for responding to and recovering from emergencies most likely to impact their facility and animals, as well as train their employees on those plans. This

Animal and Plant Health Inspection Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
of best practices for animal emergency planning and response and provision of training exercises in animal disaster response.	business continuity by helping owners and managers to be prepared.							level of integration. The FEMA National Response Plan, Emergency Support Function #11 provides the framework for this integration.			regulation is currently under review. 2) APHIS coordinated the development of best practice documents for animal emergency planning and response and co-sponsored exercises in animal disaster response.

- iv. Description of how the agency will consider the need to improve climate change adaptation and resilience, including costs and benefits, regarding suppliers, supply chains, real property and capital equipment

Table 3. Actions Taken to Improve Climate Change Adaptation and Resilience as it relates to Procurement and Acquisition

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
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Animal and Plant Health Inspection Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
Ensure acquisition of Electronic Product Environmental Assessment Tool (EPEAT) registered and 100% Energy Star qualified Federal Energy Management Program designated electronic products	APHIS will purchase Energy Star computers thru USDA blanket purchase agreements. The same blanket purchase agreements have EPEAT-only imaging equipment	APHIS MRPBS Information Technology Division and Administrative Services Division		Interagency	CY 2014		Achieve 85% compliance in the procurement of these technologies				
Consolidation of APHIS data centers	Ensure APHIS-wide resource optimization, including data and systems. Decrease computing footprint and energy	APHIS MRPBS Information Technology Division		APHIS/USDA	CY 2014		Consolidate 100% APHIS data centers at the NITC and the 100% of update backup and disaster recovery activities				

Animal and Plant Health Inspection Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Accomplishment Highlights to Date
	consumption.										

v. Description of how the agency will contribute to interagency efforts, including regional offices/hubs and coordinated development of information, data and tools:

Table 4. Climate Preparedness Interagency Efforts

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Accomplishment Highlights to Date
Work towards APHIS IT protocols that permit the use of interagency tools and data	Coordinate with APHIS IT to establish a “development space” to test and integrate state of the art simulation systems	MRPBS Information Technology Division and PPQ Center for Plant Health Science and Technology		APHIS	Review the strategy white paper planned in CY 2012. Verify agency progress in the plan.		Protocols for IT interagency communications to support climate change simulation systems and database support				Completed transition in 2013 from a single pest forecasting provider to an interagency approach formalized through a multi-institution cooperative agreement in 2014. IT protocols necessitate the development of a ‘scientific computing environment’ due to regulatory security requirements. Strategy for this environment is expected in 2014.
The Chesapeake Bay Nutria Eradication Project (CBNEP) aims to	To eliminate this damaging invasive species in order to	APHIS WS Nutria Program	Coastal wetlands provide critical ecological functions that contribute to the region’s resiliency to climate change, particularly sea level	Regional at Federal and State levels.	Ongoing – estimated completion 2017	The CBNEP’s eradication strategy has 5 phases: 1)Delimiting – defining the geographic	Phases 4 and 5 of the eradication campaign involve extensive population	CBNEP is a partnership between APHIS WS, USFWS, Maryland Department of Natural	To date project funding has been provided entirely through the USFWS Partners for Fish and	Verifying eradication is the most challenging phase of eradication campaigns	The eradication team discovered established nutria populations in 9 major watersheds on the Delmarva Peninsula. As of

Animal and Plant Health Inspection Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
eradicate the invasive nutria from the Delmarva Peninsula, thereby preventing further erosion of coastal wetlands.	protect and preserve the remaining wetlands for the ecological and economic benefit of the Chesapeake Bay Region.		rise and increased frequency and severity of coastal storms. Coastal wetlands dampen the effects of storm surges, reducing the inland impacts of storm driven flooding. They also help protect upland habitats, including forest and agricultural resources from saltwater intrusion.			<p>extent of nutria;</p> <p>2)Knock-down - rapid reduction of established populations to near-zero densities;</p> <p>3)Mop-up – rapid removal of colonizing nutria that either escaped knock-down or immigrated;</p> <p>4)Verification.- confirming eradication has been achieved and that colonizing nutria are quickly detected;</p> <p>5) Surveillance-ensuring that nutria-free areas are maintained.</p>	monitoring using observer based surveys, device based detection strategies, and detection dog surveys to determine presence/absence of nutria.	Resources, Virginia Department of Inland Fisheries and Wildlife, and Delaware Fish and Wildlife. Funding and administrative control is provided by the USFWS and APHIS WS is responsible for development and implementation of the program with mission critical support from relevant state agencies and the voluntary cooperation of hundreds of private landowners throughout the area of impact.	Wildlife Program and National Wildlife Refuge System. Budget cuts resulting from the sequester have reduced the funding available to transfer to WS in 2013 and additional cuts, up to \$150,000 are possible in FY 2014. Maintaining the current WS work force and operational costs will require an infusion of funds from alternate sources to compensate for any cuts to the USFWS budget.	because of: 1. withdrawal of institutional and financial support as the problem is no longer so apparent; 2. The increased effort required to detect the rare survivors of knockdown; 3. Maintaining a skilled work force as the project nears completion	January 2014, 8 of the nine have been depopulated and the ninth is scheduled for depopulation in 2014. Recovery of damaged marsh has been documented by research partners with the U.S. Geological Survey.

Appendix B. Section 2(a) Modernizing Federal Programs and Policies to Support Climate Resilient Investment

iii. Identify opportunities to support and encourage (via funding programs, guidance, etc.) more climate-resilient investments by States, local communities, and Tribes.

Table 1. Opportunities to Support and Encourage Climate-Resilient Investments by States, Tribes, and local communities.

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Accomplishment Highlights to Date
Examine the cooperative agreement process to ensure that APHIS is responsive to increased demand for collaboration and partnerships with others on climate change issues.		MRPBS Financial Management Division		APHIS	CY2014		Agency cooperative agreements documentation addresses climate change				

USDA Agricultural Research Service
Climate Change Adaptation Plan 2014

USDA Agricultural Research Service
Climate Change Adaptation Planning Document

May 2014

Contact: Sally Schneider, Ph.D., Deputy Administrator, Natural Resources and Sustainable Agricultural Systems, 301-504- 7987

This plan has been prepared in accordance with Executive Order (E.O.) 13653, requiring all federal agencies to integrate climate change considerations into Agency operations and overall mission objectives. The Agricultural Research Service (ARS) prepared a climate change plan in response to EO 13514 and it was published with the June 2012 USDA Strategic Sustainability Performance Plan. Updating and building upon that plan, ARS has prepared this Climate Change Adaptation Plan that addresses how it is integrating climate change into its programs, policies, and operations.

ARS Policy: ARS is committed to mitigating its impact on climate change, responsibly adapting to the impacts of climate change on the Agency, and responding programmatically to the need for research and information on the challenges of climate change as they affect its mission areas.

ARS Vision: To lead America towards a better future through agricultural research and information.

ARS Mission: ARS conducts research to develop and transfer solutions of agricultural problems of high national priority and provide information access and dissemination to:

- ensure high-quality, safe food, and other agricultural products
- assess the nutritional needs of Americans
- sustain a competitive agricultural economy
- enhance the natural resource base and the environment, and
- provide economic opportunities for rural citizens, communities, and society as a whole.

ARS Goals and Strategic Approaches: ARS is the U.S. Department of Agriculture's (USDA) chief in-house research agency. It is one of the four component agencies of the Research, Education, and Economics (REE) mission area. Congress first authorized Federally-supported agricultural research in the Organic Act of 1862, which established what is now USDA. That statute directed the Commissioner of Agriculture "... To acquire and preserve in his Department all information he can obtain by means of books and correspondence, and by practical and scientific experiments,..." The scope of USDA's agricultural research programs has been expanded and extended many times since the Department was first created. Today ARS has a workforce of approximately 6,200 employees including 2,200 scientists

and post docs representing a wide range of disciplines. ARS has 800 research projects working at 90+ locations, including overseas labs.

To achieve its mission, the agency identifies critical problems affecting American agriculture, plans and executes the strategies needed to address these problems by: mobilizing resources (both human and financial); fostering multi-disciplinary research; linking research to program and policy objectives; and communicating and interacting with customers, stakeholders, partners, and beneficiaries to insure program relevancy. Currently, ARS research is organized into 18 National Programs that provide a coordinating structure that ensures the most important research is conducted with minimal risk of redundancy. ARS also works to ensure the timely transfer of new knowledge and technologies to potential users, and to broaden public understanding of the value of agriculture and agricultural research to ensure the continued primacy of the U.S. agriculture in the 21st century.

ARS’s current Strategic Plan is in effect for fiscal years 2012 through 2017. Echoing ARS’ National Program structure, the agency’s Strategic Plan is organized into four main Goal Areas: Nutrition, Food Safety, and Quality, Natural Resources and Sustainable Agricultural Systems, Crop Production and Protection, and Animal Production and Protection. These Goal Areas—and the goals, performance measures, and actionable strategies identified within them—align with the components of the USDA Strategic Plan Goals as follows:

ARS Goal Area	ARS Strategic Goal	USDA Strategic Goal Objective (s)
1: Nutrition, Food Safety & Quality	1.1 Human Nutrition	4.2
	1.2 Food Safety	4.3
	1.3 Quality & Utilization of Ag Products	1.3
2: Natural Resources & Sustainable Ag Systems	2.1 Water Availability & Watershed Mgmt	2.2 & 2.3
	2.2 Climate Change, Soils & Emissions Research	2.1, 2.2 & 2.3
	2.3 Bioenergy	1.1
	2.4 Agricultural & Industrial Byproducts	1.3, 2.1 & 4.3
	2.5 Rangeland, Pasture & Forages	2.1
	2.6 Agricultural Competitiveness & Sustainability	1.3, 2.1, 2.2 & 2.3
3: Crop Production & Protection	3.1 Plant Genetic Resources, Genomics, Genetic Improvement, and Crop Production	1.3, 3.1 & 4.4
	3.2 Plant Diseases, Crop Protection & Quarantine, and Methyl Bromide Alternatives	4.4
4: Animal Production & Protection	4.1 Animal Production	1.3 & 3.1
	4.2 Prevention and Control of Pests and Animal Disease that Threaten Agriculture	1.3, 3.1, 4.3 & 4.4

Each ARS Goal Area includes specific goals that are aligned groupings of ARS’ 18 National Programs, derived from the Agency’s specific mission, as outlined in each National Program’s five-year Action Plan. In developing their individual Project Plans, each ARS scientist will, in turn, align his or her research objectives with the overarching goals identified in this portion of the ARS Strategic Plan, thereby ensuring continuity with the USDA, REE, and ARS vision for agricultural research.

ARS will utilize its existing organizational structure to accomplish these goals so as to incorporate them into the core activities of the Agency.

Responses to changing climate and weather extremes and variability will be assessed annually in terms of the effectiveness of meeting expected research milestones as specified in peer-reviewed project plans. The degree of achievement of expected research milestones versus weather and climate related interference with research progress, personnel safety and health, and facilities management and costs will be reflected in the allocation of resources in subsequent years' evaluation process for each management unit. When weather and climate interfere substantially with research, personnel, or facilities, increased resources will be allocated for appropriate mitigation. Assessments and responses are expected to be iterative as required

Identification and assessment of climate change related impacts on and risks to the agency's ability to accomplish its missions, operations, and programs;

ARS is the largest research agency in USDA and has experimental stations and field plots throughout the United States. Extreme weather events have recently and will continue to damage research facilities and infrastructure. Experiments have been disrupted due to plant and animal loss. Heavy snowfall and rain events leading to flooding have impacted ability to care for animals, and greenhouse plants. Flooding of research facilities and fields has occurred. Drought has impacted experimental fields and animal facilities. Energy and water use has varied considerably from past experience due to prolonged high and low temperatures and drought. Heating and cooling expenses for workers, laboratories, and greenhouses have varied such that projecting needs and costs is increasingly difficult. Increased vigor of weeds and appearance of invasive species have required additional resources to control in experimental plots and fields. Wide temperature and precipitation swings affect work force health and food safety and increase likelihood of pathogens and skin irritants. Water quantity and quality needed to maintain research may become an issue for locations where prolonged drought occurs or where water-treatment plants are compromised by weather events. These occurrences may require a shift in research priorities. Incorporating additional environmental factors related to climate change must be considered in research planning for developing new crop varieties, management strategies, and conservation practices. Water is not only needed for buildings but for agricultural uses including irrigation, aquaculture and animal watering and cooling.

Thus, the ability of ARS to meet its mission can be compromised by climate change in several general ways:

- Reduced ability to conduct mission research at some current locations because environmental changes exceed the resilience of the agricultural systems under study at those locations.

- Changes in budget allocations to research topics, made necessary because new environmental conditions have unexpected or unmitigated impacts on agricultural production systems and resources, thus diverting resources from current high-priority research.
- Threats to personnel arising from extreme weather conditions, e.g., extreme temperatures, severe storms, flooding.
- Increased costs of heating, cooling, and other “overhead” costs to mitigating untenable conditions for employees or research material, thus diverting resources from mission research itself.
- Increased costs of buildings and facilities that must withstand extreme and variable conditions, including retrofitting existing facilities and costs of building new ones.

The following examples of these kinds of events and impacts illustrate the risks to ARS’s capacity to meet its mission.

Extreme conditions and animal research: Extreme conditions associated with climate change impact livestock, and potential impacts on ARS research may be significant. Direct effects are related to the intensity and frequency of animal summer heat stress. Heat stress in dairy cattle can have an effect lasting weeks to months on reproduction and milk production; milk production declines at temperatures above 24C and is worsened by high humidity. Under severe conditions, milk production may be reduced by as much as 20 percent per day. Poultry also are sensitive to stress from high heat and humidity. Although chickens can acclimate to heat, sudden heat waves significantly lower production (growth rate, egg production, hatching rate) and egg quality (smaller eggs, thinner egg shells, poor internal quality). Increased frequency and severity of heat waves can thus jeopardize ARS research on livestock and require ARS research locations to divert resources into mitigation costs such as increased energy costs for cooling, construction of facilities and equipment designed to keep research animals cool in hot conditions, and even relocation of research to cooler regions.

Indirectly, climate change can affect livestock research via increased costs of animal feed, as yields of grain, forages, and silage are suppressed by heat, drought, or heavy or ill-timed precipitation. The need for research on mitigating heat stress will divert resources from research on other aspects of livestock production and health. To better address extreme heat events in confined animal production operations, ARS devotes resources at the U.S. Meat Animal Research Center (USMARC) in Lincoln, Nebraska, to research focused on managing heat stress in confined livestock operations, in partnership with the National Weather Service. A website was developed which incorporates the Geographic Resources Analysis Support System and provides daily heat stress forecasts for livestock producers on line through the ARS USMARC website (<http://www.ars.usda.gov/Main/docs.htm?docid=21306>). Additional research identified as necessary is focused on developing precision animal management technologies to enable livestock producers to monitor the health and heat stress levels of individual animals housed in large groups typical of modern animal production.

Impact of climate change on crop research: There are many ways that climate change and weather extremes may affect ARS crop research and allocation of resources to crop research. Included are the many documented impacts of increasing CO₂ concentrations, heat, precipitation extremes, and the various combinations on crop growth, reproduction, and yield. Greater uncertainties are associated with the effects on pests and pathogens. In general, the geographic distribution of pests is largely dependent upon climate, whereas the incidence and severity of outbreaks are largely dependent upon weather. Consequently, there is broad agreement that climate change will have substantial ramifications for pest control in crop systems. While more rainfall increases the protection needed for cereals and root crops against many pathogens, higher temperatures are likely to increase pesticide applications needed to protect fruits, vegetables, and beans. Under projected climate change, the total external costs over all pesticide classes for U.S. agriculture per hectare could increase up to 70 percent from 2000 to 2100. Higher CO₂ concentrations provide a “fertilizer effect” to most plants, including crops, but there is likely to be a need for increasing rates of herbicide applications to control weeds because increased biomass of weeds requires more herbicide to kill them; ARS research has already demonstrated this.

In addition, climate change is anticipated to result in changes in predominant weed populations within a region as the weather and climate conditions become more favorable for some weed species and not others. In rhizomatous perennial weeds, this could be the result of combinations of CO₂ and weather conditions favorable for increased carbohydrate storage in rhizomes that may benefit overwintering and vegetative spread. However, ARS research has demonstrated that effects on weeds are not uniform for all weed species and all parts of the country. Plant invasions in pasture and rangeland are often preceded by major disturbances, such as wildfires. The incidence of wildfires is predicted to increase in areas of the south and west as precipitation in these regions declines with climate change. In general, adaptation to climate change probably will require more intensive pest management to protect crops. All this will mean new challenges for ARS in locating, designing, and conducting research programs on improving cropping systems – including the increasing costs of managing pests in research crops – to ensure that production and product quality of U.S. crops meet the needs of our citizens and on preserving our natural resources, while ensuring that our food supply is safe and our environment remains healthy.

Impact on food safety research: Flooding can have a major food safety impact, as has been evident by the many produce-related food safety outbreaks originating in the Salinas area of California. A notable example occurred with a particular ranch, which periodically flooded from overflow water from the Santa Rita Creek that bordered the property. This event led directly to a collaboration of ARS, the State of California, and academic institutions to redirect resources to an environmental study of the impact of flooding. To conduct this work, ARS redirected its produce-related food safety research portfolio at the Western Regional Research Center, Albany, California, and realigned staff assignments from other research. Studies on significant events in 2003-2005, 2006, and 2011 indicated that flooding of small and major waterways, including the Salinas

River, have major consequences to the economy (hundreds of millions of dollars) and public health (hundreds of illnesses and many deaths). A Food and Drug Administration (FDA) rule now considers ready-to-eat crops that have been in contact with flood waters to be adulterated due to potential exposure to sewage, animal waste, heavy metals, pathogenic microorganisms, or other contaminants.

The risks may be especially high for areas that have been under drought conditions immediately before flooding, since flood water can wash contaminants directly onto fields. To reduce the effect of seasonal extreme weather events, a significant amount of land susceptible to flooding has been taken out of production. This has affected ARS' ability to continue some of its important produce-related research. This limits ARS' capacity to provide research data to the FDA, which in turn uses such data with the produce industry and the State of California to develop actionable responses and corrective action plans through documents such as the Commodity Specific Food Safety Guidelines for the Production and Harvest of Lettuce and Leafy Greens. Unhindered research that allows the development of Good Agricultural Practices is at the heart of produce food safety, not only for California but for other fresh produce producing States such as Arizona, Colorado and the Delmarva Peninsula. Thus, extreme weather events affect not only food safety itself, but ARS' abilities to conduct research that would mitigate food safety risks.

Implications for natural resources in research: Short and long-term water shortages (drought) and excesses (too much, too fast leading to floods) are expected to increase in frequency with changing climate. Research that has always been based on rain-fed plots may thus require irrigation for the first time, resulting in significant costs for irrigation equipment, energy to pump water, and water itself (if not drawn from wells or surface water). Even among field plots that have been irrigated all along, greater amounts of water may be required, which can alter or compromise research objectives and/or progress. Water shortages may result in the loss of experimental material (plants, soil, animals). Insufficient moisture may delay planting dates, suppress yield quantity and/or quality, and increase the threat of fire on grazing lands research locations. Water shortages will affect research priorities, especially when reduced water availability for research and industry alters what, where and how a crop or livestock can be grown. Continued shortages of water may dictate a shift of research priorities to emphasize reduced water use, more efficient water use, and gray water use.

Conversely, excess water may stress plant research plots via flooding. Excessive moisture during a growing season may shorten available time for field access to plant, manage (treat pests, apply fertilizers, etc.) or harvest. A major concern is the threat of heavy rainfall intensities that exacerbate soil erosion, thus leading to degradation of topsoil and environmental quality as sediment, nutrients and pesticides move offsite with runoff and/or subsurface flow. Such erosion may incur costs associated with mitigation of sediment deposition off-site. The timing of rainfall events may also create pest and pathogen problems, for example, as increased frequency of precipitation lengthens the persistence of free water on leaves, which promotes fungal growth on late-stage crops and/or recently harvested crops. Under such conditions, costs of pest management or

even complete loss of experiments may occur. Flooding can also cause serious problems for livestock research units. Storage lagoons for animal waste management are vulnerable to heavy rainfall and may require modification to prevent overflows or collapse. Livestock waste spills cause spread of pathogens and excess nutrients to waterways, resulting in major environmental impacts and significant mitigation costs.

Costs of mitigating weather-related damage to research facilities: During January 2014, the Midwest and Eastern United States experienced three periods of polar temperatures that stretched the natural gas and electric power distribution systems to their limits. The electric bills of some ARS locations tripled in January 2014. Utilities normally are one third of the operations and maintenance cost of a facility and increased operating costs take funding away from research.

In addition to storms, ARS facilities are located where they are vulnerable to flooding and wildfires, along the Mississippi and Red Rivers, the Florida coast and in forested areas. The Mississippi river floods of April and May 2011 approached ARS lands in Mississippi. When the Army Corp of Engineers opened the Morganza spillway to protect Baton Rouge and New Orleans as well as oil refineries and chemical plants, it flooded ARS lands near Houma, Louisiana.

A tornado struck the Ohio Agricultural Research and Development Center in Wooster, Ohio on September 16, 2010, destroying the University-owned Ag Engineering Building that housed the ARS Application Technology Research Unit. The estimated cost to replace the structure is \$11 million, in addition to the \$260,000 worth of ARS equipment that was lost. The new facility will not be ready for occupancy before the end of 2014, and ARS research has been hindered by the loss of equipment and forced relocation to temporary space.

In El Reno, Oklahoma, a tornado struck the Grazinglands Research Laboratory on May 24, 2011. Five buildings were destroyed, nine buildings were heavily damaged, ten buildings sustained minor damage, expensive scientific equipment was damaged or destroyed, and more than 10 miles of fences were destroyed. The estimated funding needed to restore El Reno to its pre-tornado condition is \$5.1 million, which has not been appropriated and thus must be diverted from research. On May 31, 2013 a large tornado again hit the lab in El Reno Oklahoma resulting in \$132,000 in damage to windows, roofs, equipment and crops.

In September 2004 two major hurricanes hit Ft Pierce Florida 22 days apart, and while the ARS buildings survived with some damage, the research citrus groves suffered a big loss. April 14, 2012 a tornado damaged ARS fences and structures in Woodward Oklahoma as well as neighboring NRCS and FSA facilities and left a large amount of debris to remove from farmland.

On June 11, 2008, a tornado struck Manhattan, Kansas. It damaged or destroyed the ARS Center for Grain and Animal Health Research facilities, the Wind Erosion Research Laboratory, the laboratory's attached greenhouse and a vehicle garage, and a greenhouse

used for Hessian fly research. Congress appropriated \$2.8 million to replace the facilities, which took nearly four years.

In August 2005, Hurricane Katrina caused extensive damage to the 400,000 square-foot Southern Regional Research Center in New Orleans, Louisiana. A total of \$32.5 million was invested through a Rapid Recovery Phase and subsequent Long Term Recovery to replace major mechanical and electrical systems and equipment, repair buildings, renovate completely flooded and destroyed areas in the basement, and repair damaged areas on upper floors in the Main Building. Although the SRRC became fully operational again in August 2006, a full year earlier than expected, total recovery took six years.

Other recent severe weather events that have damaged ARS facilities and incurred aggregate costs of more than \$16 million to the agency include tornadoes in Houma, Louisiana; Beaumont, Texas, and Beltsville, Maryland; flooding in Grand Forks, North Dakota; and a hurricane in Miami, Florida In 2004 In addition to the cost to replace the facilities, there is significant impact on ARS' research capacity through interruption or loss of millions of dollars invested in experiments that have been lost, delays in planned research, and the obstacles inevitable in placing research programs in temporary space.

Impact to personnel and personnel-related costs: As a research agency, ARS' most valuable asset is its personnel, who apply their scientific, technical, and administrative expertise to accomplish the ARS mission. There are many weather and climate related impacts on personnel, and the exact kind and impacts vary across the country. Heat stress, severe cold, flooding, and wind all are examples of hazards to people working at ARS locations. Additional hazards arise from people whose performance may be compromised by such stresses or weather conditions, such as accidents associated with loss of control of heavy equipment, motor vehicles, hazardous chemicals, and others. Damage to ARS research facilities can result in major costs to the agency, diverting resources from research into emergency response. Included among such costs, aside from costs required for repair or replacement of facilities as discussed above, are those associated with personnel.

A striking example is the impact of Hurricane Katrina on the personnel associated with ARS facilities in Louisiana, especially the Southern Regional Research Center in New Orleans. Major damage and flooding of the Center occurred when Katrina made landfall in southeastern Louisiana on August 29, 2005, rendering the Center completely unusable. A total of 178 employees, along with their families, had to be relocated to 22 temporary duty stations in 12 states to maintain critical research projects and progress as much as possible. Personnel-related costs arising from Katrina totaled more than \$4 million over three fiscal years.

Description of programs, policies, and plans the agency has already put in place, as well as additional actions the agency will take, to manage climate risks in the near term and build resilience in the short and long term;

ARS locations and specific operations are highly dispersed and heterogeneous with respect to activities conducted to meet the agency's mission. ARS conducts research to address its mission at more than 90 locations in nearly all 50 states. Many locations have multiple research units with very different research (e.g., crop, livestock, natural resources, and/or post-harvest quality and safety research at a single location). Many ARS research units are co-located on university campuses, and at these locations, ARS research and personnel may be housed in facilities owned by the federal government, by the university, or some combination.

Other ARS units are housed in stand-alone, government-owned research facilities that may be in remote locations or in large cities. In addition, resources are allocated by Congress to the agency specific to locations for specific research. Thus, plans for adaptation to climate change must be highly specific and relevant for each research unit's unique combination of resources, research mission, facilities type and ownership, geographic location and environment, and climate change and weather variability/extremes in evidence. Adaptation strategies and plans for a natural resources unit in the desert southwest would not be appropriate for a human nutrition unit in hospital-like facilities in a large eastern city, nor for a crop breeding program operated by scientists conducting research on a university campus in the Midwest where management plans for university-owned facilities are in place.

Implementation plans for application of congressionally appropriated resources in research are developed annually by the Research Leader of each research management unit in consultation with, and approval by, the relevant Area Director (the most senior line manager in each of ARS' seven multi-state Areas and the Beltsville Agricultural Research Center). The Annual Resource Management Planning (ARMP) process includes allocation of resources for personnel, direct research costs, and indirect research costs (e.g., facilities management; safety, health, and environmental management). Allocation of appropriated resources among these and other aspects of the unit's operations may be affected by climate change and weather variability and extremes.

Accordingly, Research Leaders will allocate resources as required to respond to direct research costs (e.g., pest management in crops, heat stress management for livestock) and indirect costs (e.g., energy costs for buildings, equipment and supplies for personnel safety and health), as affected by climate change within the context of their research activities, facilities, and locale. Allocations of costs to respond to changes in research needs, personnel needs, and facilities management will be reviewed and approved by Area Directors in the ARMP process.

ARS sets its research priorities, develops National and management unit-level research plans, and implements its plans through a highly developed process that includes established procedures for obtaining formal input from a wide variety of customers, stakeholders, and research partners. These include priorities and needs expressed by the Administration and Congress; other departments of the Federal government and other

agencies within USDA, including action and regulatory agencies; state governments and agencies; non-government organizations such as commodity organizations; universities and other non-government research organizations; individual farmers and land-owners; and others. The five-year research project plans developed by agency scientists in response to input from customers, stakeholders, and partners are peer-reviewed by non-ARS scientists for adequacy of research approaches and likelihood of success in achieving stated objectives. As climate change and weather variability are manifest through changing pressures and needs related to crop production and protection, animal production and protection, natural resources and sustainable agricultural systems, and nutrition, food safety, and quality, we anticipate that the agency's customers, stakeholders, and partners will identify necessary changes to be recommended for research programs and changes in allocations of research resources to address any such issues that increase in importance.

One of ARS' 18 National Programs is Climate Change, Soils, and Emissions. Goals of this National Program include adaptation of agricultural systems to climate change and mitigation of greenhouse gases, including mitigating those originating from agricultural production systems and offsetting agricultural and non-agricultural emissions with carbon sequestration in soils. Inherent in this research program is consideration of the likely magnitude of climate change and scenarios of impacts on crops, livestock, natural resources, and post-harvest product quality and safety. Resources allocated to ARS locations for climate change, soils, and emissions research are applied to research on impacts, adaptation, and mitigation, and results of this work informs all climate and weather related research throughout the agency.

Most ARS locations have emergency generators fueled by diesel fuel, natural gas or gasoline. They can be operated in power outages, to reduce demand during the operation of certain equipment or when called on by utilities to reduce load on the grid during peak periods (demand response). Natural Gas microturbine powered generators at Ames, Iowa, have been decommissioned because they ceased to be cost effective. Often, however, due to budget constraints, this distributed generating capacity provides power to only the critical functions of a facility so systems like air conditioning may not be on emergency power. Property and research may be preserved but indoor air quality and working conditions may be compromised. Such measures are also dependent on a reliable supply of uncontaminated fuel after a weather event.

Some labs have changed their heating fuels. The New England Plant, Soil and Water Research Laboratory in Orono, Maine converted from burning fuel oil (kerosene) in its boilers to natural gas in 2013. Eastern Regional Research Center converted its backup fuel from #6 fuel oil to #2 fuel oil. These actions reduced Green House Gas (GHG) emissions, reduced energy costs, and increased energy efficiency among other things. Many locations have dual fuel boilers that can operate on fuel oil if there are utility curtailments in natural gas supply. But, fuel oil is more expensive and creates more greenhouse gas emissions than natural gas. There is also a disincentive to participate in demand response programs because 50 percent of utility incentives must be sent to Treasury which usually prevents demand response from being cost effective.

ARS is installing renewable energy as limited appropriated funds permit. Solar photovoltaic (PV) arrays are installed at several locations: Pendleton, Oregon –7 KiloWatt (KW); Parlier, California – 96 KW; Washington, DC – 21.1 KW; Hilo, Hawaii – 40.46 KW; Tucson, Arizona – 5 KW; and Bushland, Texas – 2.4 KW. ARS is planning a 1,000 KW PV project in Maricopa, Arizona. Solar cells also used widely for remote telemetry. Solar hot water is used at Stoneville, Mississippi; Gainesville, Florida and Morris, Minnesota.

ARS is utilizing performance contracting to leverage private financing in order to make cost effective energy and water saving improvements to its facilities. Financed Utility Energy Service Contracts and Energy Savings Performance Contracts are being awarded that are currently saving \$3.75 Million annually. These contracts have been used at 23 locations, representing 65 percent of ARS' energy consumption.

ARS policy requires that all new construction and renovations follow the US Green Building Council Leadership in Energy and Environmental Design (LEED) methodology for a silver rating. ARS' largest building which alone uses over 23 percent of the agency's total energy consumption is LEED certified.

ARS voluntarily participated in the road test of the public sector protocol for tracking greenhouse gas emissions and still closely monitors and reports its GHG emissions. ARS has brought its Scope 1 and 2 GHG emissions down to 13.5 percent below the goal set by USDA and Executive Order 13514. This was accompanied by a \$9.7 Million reduction in annual energy costs since FY 2008 from \$47.2 Million to \$37.3 Million.

ARS is changing the materials used for buildings in response to changes in hot and cold temperature extremes. For instance, reflective cool roofs are being installed when roofs are replaced. Biobased spray foam insulation is being added or increased in buildings.

Recovery of the SRRC in New Orleans, Louisiana after the flooding of Hurricane Katrina included raising equipment such as emergency generators above the flood level and changing the lower building level to limited use.

A description of how any climate change related risk identified pursuant to the first paragraph of this subsection that is deemed so significant that it impairs an agency's statutory mission or operation will be addressed, including through the agency's existing reporting requirements;

Funds intended to provide for mission support and the regular maintenance and replacement of equipment will need to be used for emergency replacement of equipment, facilities and infrastructures damaged or threatened by the more frequent and damaging storms and weather events. In the absence of increased appropriations this will create a larger backlog of deferred maintenance and decrease the operational life of equipment.

Facilities will be less viable into the future. In addition to emergency breakdown, ARS will be required to divert funds from research to pay for repair and replacement of facilities, fixtures and equipment damaged or destroyed by the impacts of climate change. The operating costs of ARS' facilities will increase due to the increased cost of utilities, and the premium cost of providing energy through emergency methods and distributed generation and the increased operation and maintenance cost of aging equipment.

A description of how the agency will consider the need to improve climate adaptation and resilience, including the costs and benefits of such improvement, with respect to agency suppliers, supply chain, real property investments, and capital equipment purchases such as updating agency policies for leasing, building upgrades, relocation of existing facilities and equipment, and construction of new facilities; and

ARS Design Manual 242.1 and Policy and Procedure (P&P) 134.2 Energy Water and Sustainability, will be updated to incorporate the requirements of Executive Order 13653. New construction and renovation of existing facilities will incorporate provisions for climate change resiliency. Those two policies, which form the basis of facility design and sustainable operations in ARS, already incorporate requirements for energy, water, and resource conservation and environmentally preferable procurement that reduce the agency's environmental footprint and greenhouse gas emissions. P&P 134.2 states the Agency's policy as:

Consistent with REE's mission and without compromising health and safety, it is REE policy to give energy and water conservation as well as sustainability, prime consideration in the acquisition, use, and disposal of all property and in the performance of all functions. This action will reduce the impact of our activities on the environment and help conserve resources. Efficiency and conservation shall be integrated into the core activities of the Agency. It shall be every employee's responsibility to ensure that every reasonable effort is made to reduce operating costs and conserve energy, water, and resources.

Following the lead of the Secretary, and the Telework Enhancement Act of 2010, ARS is implementing an agency wide telework policy and encouraging employees to participate with several initiatives. 75 percent of USDA's scope 3 GHG emissions were the result of commuting in FY 2008. ARS also encourages the use of public transportation and the reduction of business travel. USDA's new goals are 60 percent participation in core telework and 50 percent participation in situational telework.

ARS uses the GSA Solicitation for Offers in leasing, which incorporates sustainability.

A description of how the agency will contribute to coordinated interagency efforts to support climate preparedness and resilience at all levels of government, including collaborative work across agencies' regional offices and hubs, and through coordinated development of information, data, and tools, consistent with section 4 of this order.

ARS participates actively in interagency working groups on energy, sustainability, greenhouse gas and water for its facilities and programs. ARS coordinates with other agencies to share information and cooperates in the development of guidance.

The US Meat Animal Research Center is working with the Army Corps of Engineers on a groundwater cleanup effort in Clay Center NE. Groundwater is contaminated by munitions from prior DoD use of the area. The Corps is pumping water from the plumes, cleaning it and providing it to ARS for irrigation. This allows the water to percolate back into the aquifer rather than be dumped into the West Fork of the Big Blue River where it will not recharge the aquifer. The Ogallala aquifer, much of which is under Nebraska, is stressed by drought and irrigation demands. They are pumping the north plume at a rate of 2,500 gallons per hour (gph) now and preparing to pump the south plume at 1,300 gph into about 300 acre feet of ponds to be completed by April, 2014. Six center pivot irrigation systems are using the water now and twelve more are in design to be installed March, 2015. This offsets a portion of the Center's regular irrigation.

Identify and seek to remove or reform barriers that discourage investments or other actions to increase the Nation's resilience to climate change while ensuring continued protection of public health and the environment;

Demand response programs, where facilities are paid by curtailment service providers to disconnect from the grid during times of high demand, are difficult to participate in, not only because research operations demand uninterrupted utility service but 50 percent of payments are required to be deposited in the general fund of the Treasury by Pub. L. 104-52, § 625, 42 U.S.C. 8256 note. And, 40 CFR Part 63 Subpart ZZZZ limits the hours diesel emergency generators are allowed to run.

Solar photovoltaic and wind projects are difficult for USDA to install at Federal facilities because they have a large upfront cost, require a 20 year payback, and USDA lacks authority for long term contracts, power purchase agreements and enhanced use leasing. Renewable energy projects make ESPCs nonviable and UESCs under a GSA areawide contract are limited to 10 year terms.

Reform policies and Federal funding programs that may, perhaps unintentionally, increase the vulnerability of natural or built systems, economic sectors, natural resources, or communities to climate change related risks;

Not Applicable.

Identify opportunities to support and encourage smarter, more climate-resilient investments by States, local communities, and tribes, including by providing incentives through agency guidance, grants, technical assistance, performance measures, safety considerations, and other programs.

ARS is participating in the Agricultural Technology Innovation Partnership (ATIP) Foundation which will provide grants to implement agricultural research results. It will help scientists take their research to market. The ATIP foundation has formed the Resilient Economic Agricultural Practices public private partnership to sustain long term research on land management practices across the United States.

ARS will also be participating in the Foundation for Food and Agriculture Research established under the 2014 Farm Bill. The Foundation will advance research addressing key problems in plant and animal health and production, food safety, nutrition and health, renewable energy, natural resources and the environment, agricultural and food security, agricultural systems and technology and agricultural economics and rural communities, and to foster collaboration.

USDA Farm Service Agency
Climate Change Adaptation Plan 2014

FSA Climate Change Adaptation Plan

Background

FSA's mission is to deliver timely, effective programs and services to America's farmers and ranchers to support them in sustaining our Nation's vibrant agricultural economy, as well as to provide first-rate support for domestic and international food aid efforts.

To assist the country in addressing today's challenges, FSA's Strategic Plan has four goals:

- Provide a financial safety net for America's farmers and ranchers to sustain economically viable agricultural production,
- Increase stewardship of America's natural resources while enhancing the environment,
- Ensure commodities are procured and distributed effectively and efficiently to increase food security, and
- Transform and modernize the Farm Service Agency.

A particularly relevant Goal 2 objective is for FSA to "lead efforts to mitigate and adapt to climate change." Strategies that have been identified in the Plan to achieve this objective include the following:

- Promote planting of trees, shrubs, grasses and forbs.
- Collaborate with partners to develop planting and management specifications that are adaptive to climate change.
- Provide financial incentives to mitigate the upfront cost of establishing practices adopted to adapt to climate change.
- Educate producers on the impact of climate change.
- Partner with external agencies to expedite extension and technical assistance.

Vulnerability and adaptation to climate change

Given the sensitivity of crop and livestock production to climate, the agricultural sector and producers will be disproportionately affected by climate change. Assuming current climate change predictions are borne out, producers will face increased average temperatures, more frequent temperature extremes, and changes in precipitation patterns. Climatic change may also pave the way for weed and insect pests and plant and animal disease vectors, increasing their geographic distribution. Even if producers are not directly impacted by climate change, they will feel its effects on other producers through the interconnected global market for agricultural commodities.

On one hand, producers most vulnerable to climate change will have challenges with responding to changing agronomic and market conditions when changing their production systems.

On the other, meaningful adaptive strategies undertaken by producers may include one of more of the following:

- Switching crops and varieties to those more conducive to changing conditions,
- Diversifying crops,
- Integrating livestock production and/or forestry (agroforestry) with crop production,
- Increasing water use efficiency and conserving soil moisture,
- Altering the timing of cropping activities, and
- Using climate forecasting to support farm planning.

FSA programs will affect the climate change adaptation process to varying degrees and in various ways:

- Commodity programs: FSA supports farm livelihoods by providing a financial safety net designed to address uncertainties with markets and weather
- Conservation programs: The Conservation Reserve Program (CRP) is the largest conservation program administered by FSA. By taking marginal lands out of production for at least 10-15 years, the CRP can help sequester carbon.
- Farm loans: Because adaptation is likely to involve significant investment in new technologies and infrastructure, some producers facing challenges with climate change may be those with limited access to credit, such as beginning and disadvantaged farmers. These populations are also more likely to be farming marginal lands that are more susceptible to climate change effects.
- Disaster programs: This assistance can be a lifeline to farmers who suffer losses from extreme weather events. The short term support offers farmers the opportunity to adapt.

FSA's vulnerability to climate change relates to the increased outlays and pressure on staff resources that result.

Actions

FSA has identified three actions related to climate change adaptation on which it will continue to work in FY 2014, assuming that sufficient staff resources are available:

Action 1: To ensure that FSA programs encourage farmers to adapt to climate change, FSA will review programs and policies to assess whether they affect how producers respond to climate change, whether this impact is positive or negative, and whether opportunities exist to enhance or ameliorate this impact. Opportunities identified will be flagged according to whether they require a change in policy, a regulatory change, or an act of Congress

This action will take place as NEPA and other regulatory process requirements are satisfied for the Agricultural Act of 2014. An informational memorandum for the Administrator will synthesize findings across programs.

Action 2: The seven regional and three subsidiary USDA Climate Change Hubs recently announced by the Secretary are intended to make science-based knowledge and practical information available that support climate change mitigation and adaptation in agricultural settings. With more than two thousand state and county offices throughout the U.S., the Farm

Service Agency is the “face” of USDA to producers who participate in the conservation and energy, commodity crop, disaster assistance, and farm loan programs it manages. Through participation on the Climate Change Hubs steering committee, the agency will help deliver meaningful information at the hubs to the hands of producers.

Action 3: FSA will conduct “continuity of operations” exercises to better understand the administrative implications of and prepare headquarters, state, and field office staff for large-scale crop failure, which will be increasingly likely with climate change.

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Appendix

Actions to address risks and opportunities

Action	Agency Lead	Risk or opportunity	Scale	Timeframe
Policy review	FSA	Opportunity to highlight to Administration and Congress policy changes to facilitate adaptation	National	Every Farm Bill
Outreach efforts	FSA	Opportunity to use field offices to deliver information available at hubs to producers	National	Ongoing
Continuity of operations exercise	FSA	Opportunity make sure agency can adequately deal with / respond to large-scale climatic events	National	Periodically

**USDA Foreign Agricultural Service
Climate Change Adaptation Plan 2014**

USDA Foreign Agricultural Service Climate Change Adaptation Plan 2014

I. Policy framework

a. Describe your agency vision, mission, goals, and strategic approaches

The USDA Foreign Agricultural Service (FAS) has defined its mission and vision in its 2012-2016 strategic plan as, “Linking U.S. agriculture to the world to enhance export opportunities and global food security.”⁴ To do so, FAS works around the globe building new markets for U.S. agricultural exports, sustaining and expanding existing markets, improving the competitive position of U.S. agriculture, and ensuring food security and building agricultural capacity in fragile and developing markets.

Various U.S. laws define specific duties that FAS is obliged to undertake. These include: (1) Acquiring information pertaining to agricultural trade; (2) Implementing market development programs; (3) Providing agricultural technical assistance and training; and (4) Carrying out specifically authorized food aid programs. Furthermore, USDA departmental regulations state that FAS is responsible for coordinating Department agencies’ functions involving foreign agriculture policies and programs and their operations and activities in foreign areas.

To achieve its mission and fulfill its statutory duties, FAS has aligned its operations under three core activity pillars: (1) Trade Promotion; (2) Trade Policy; and (3) Trade Capacity Building and Food Security. Each activity pillar has specific program objectives that have been evaluated for their vulnerabilities to climate change. This process of considering vulnerabilities and planning climate change adaptation strategies aligns to FAS management initiatives that aim to incorporate new strategies and policies to improve FAS performance and efficiency.

II. Vulnerability Assessment:

a. Describe both the risks and opportunities associated with changing climate that your agency will face. For example, how will climate change affect: assets, operations, worker health, natural or cultural resources, security infrastructure, economic activities, or coordination. In this discussion you should consider physical factors such as temperature shifts, hydrological changes, extreme events, sea level rise, etc.

A changing climate poses a number of vulnerabilities for FAS to address in order to continue to fulfill its mission. In addition to creating vulnerabilities, climate change may provide new

⁴ http://www.fas.usda.gov/FAS_SP2012-2016Final5-16-12.pdf

opportunities that FAS should prepare to capitalize on. In the tables below, major vulnerabilities and opportunities are mapped to FAS activity pillars and objectives.

Pillar #1: Trade Promotion

	Vulnerability	Opportunity
Objective 1.1: Increase effectiveness of FAS market development programs and outreach activities	Increased frequency of extreme weather events may destabilize import markets and increase the volatility of prices. Increasingly volatile trade conditions may make it more difficult to develop long term strategies to build markets for U.S. products. Also, increased variability in U.S. product supply and quality may make it more problematic to consistently promote U.S. products.	Climate change may cause geographic shifts in production that create new markets and/or less competition for U.S. agricultural exports
Objective 1.2: Manage FAS credit programs to yield the greatest benefit to U.S. agriculture	NA	NA

Pillar #2: Trade Policy

	Vulnerability	Opportunity
Objective 2.1: Negotiate and enforce market-expanding trade agreements for U.S. exporters of agricultural, fish, and forest products	Climate change may lead to production shortfalls and export bans abroad, undermining FAS efforts to promote free trade.	Climate change may require some countries to rely more on agricultural trade and imports from the U.S. to make up for domestic production shortfalls.

Objective 2.2: Prevent or resolve foreign Technical Barriers to Trade (TBT) or Sanitary/Phyto-Sanitary (SPS) measures that hinder U.S. agricultural exports	Warmer average temperatures may increase the range and severity of disease outbreaks in the U.S. raising TBT and SPS concerns abroad.	NA
Objective 2.3: Pursue the development of rules-based international systems that facilitate global trade	Climate change may be used as a pretext for implementing new labeling standards or trade rules that make claims about “sustainability” or “climate-smart” but are not based on reliable science.	<ol style="list-style-type: none"> 1. Climate change may increase international demand/adoption of genetically engineered (GE) crops and products of other emerging technologies for sustainable agricultural intensification and innovation. 2. Increasing international awareness of agriculture and climate change creates opportunities in international fora to promote science-based free trade rules. 3. Climate change mitigation policies may present an opportunity for USDA stakeholders to consider new voluntary market incentives.

Pillar #3: Trade Capacity Building and Food Security

	Vulnerability	Opportunity
Objective 3.1: Address food security challenges by building food and market systems that expand trade and economic growth through food assistance programs	U.S. agricultural productivity may stagnate or decline due to increases of atmospheric carbon dioxide (CO ₂), rising temperatures, and altered precipitation patterns. Climate change will exacerbate current biotic stresses on agricultural	NA

	<p>plants and animals.</p> <p>Accordingly, U.S. commodities may become less available to meet future demands for FAS food assistance programs.</p>	
<p>Objective 3.2: Enhance partner countries' capacity for agricultural development, participation in international trade, and reduced dependence on fossil fuels.</p>	<p>Climate change may disrupt and stymie agricultural development and trade in some countries. Countries are too dependent on high-carbon emission fossil fuels.</p>	<p>Increasing demand for FAS to coordinate USDA capacity building for climate change mitigation and adaptation may be met through increasing FAS scientific exchanges and interagency funding agreements for activities that accelerate countries' climate change mitigation and adaptation strategies.</p> <p>Increased demand for biofuels in liquid transport sector can support increased US ethanol and biodiesel exports.</p>

III. The Adaptation Planning and Evaluation Process

- a. Integration: Describe agency plans to integrate climate change adaptation into policies, programs, and operations. This includes coordination with stakeholders including local, state or tribal entities and private landowners, as applicable.

FAS relies on its Climate Change Working Group to raise awareness and disseminate information across FAS about emerging climate change issues that may impact the mission, strategic objective pillars, and objectives of FAS. The group meets on an *ad hoc* basis and is charged with developing and evaluating the FAS climate change adaptation plan. The Climate Change Working Group is led by the Office of Agreements and Scientific Affairs (OASA) and has representation from each FAS program area.

FAS is developing the internal capacity to tackle emerging climate change issues and is receptive to stakeholder concerns about climate change. Each summer, FAS Foreign Service Officers attend an Attaché conference in Washington, D.C. for briefings on emerging policy and trade issues, including the Department's activities regarding climate change and the

agency’s involvement. FAS also participates in many regular stakeholder meetings and *ad hoc* consultations with cooperators. Regularly scheduled stakeholder meetings include:

Pillar Focus	Meeting	Stakeholders
Trade Promotion	U.S. Agricultural Export Development Council Annual Workshop	Commodity and food export interests
Trade Promotion	Data Users Meeting	Agricultural traders and exporters
Trade Policy	Agricultural Technical Advisory Committee (ATAC)	Private industry representatives
Trade Policy	Agricultural Policy Advisory Committee (APAC)	Private industry representatives
Trade Capacity Building/Food Security	The annual International Food Aid and Development Conference	USAID, Private voluntary organizations and US agriculture, and trade associations

- b. Understanding risks: Briefly describe actions that your agency will take to better understand risks and opportunities. This may include methods to assess vulnerability, to monitor climate impacts, or to project impacts based on scenarios.

FAS is currently engaged in assessing the risks and opportunities associated with climate change. There are various means by which FAS understands and evaluates these risks and opportunities. These mean include engaging in climate change related intra- and inter-departmental working groups (e.g. USDA’s Global Change Task Force, and Feed the Future working groups). FAS also relies on the extensive market intelligence gathering of Foreign Service Officers and Locally Employed Staff, who are the “on-the-ground” sources of information for over 100 countries. FAS also monitors and advises the work of various international organizations [e.g. UN, FAO, OECD, World Bank] and participates in several United Nations activities [e.g. Framework Convention on Climate Change (UNFCCC), Commission on Sustainable Development (CSD), and the Environmental Program], WTO committees [e.g. Agriculture, Trade and Environment, Trade and Development, the Subcommittee on Least Developed Countries, and Technical Barriers to Trade], and OECD committees [e.g. Committee on Environment, the Joint Working Party on Agriculture and the Environment (JWPAE), and the World Bank’s Global Environment Facility and development of Environmental Guidelines].

The FAS Climate Change Working Group will further consider additional actions to better understand the risks and opportunities that may affect FAS’s key strategic pillars:

Trade promotion.

Proposed Actions: Participation in interdepartmental climate change modeling groups that can inform the integration of climate change projections into USDA agricultural production and trade models utilized by FAS’s Office of Global Analysis.

Trade policy.

Proposed Action: Continued leadership in key international activities including the United Nations Framework Convention on Climate Change, Climate Smart Agriculture Alliance, and the Climate and Clean Air Coalition. Active engagement will ensure that the interests of USDA stakeholders are adequately considered and that emerging policies are based on sound science.

Trade Capacity Building & Food Security.

Proposed Actions: (1) The USDA Global Change Task Force is coordinating an assessment on climate change & food security. FAS will participate in the assessment steering committee to ensure that agricultural trade capacity is addressed in the report, and (2) Collaboration with other U.S. agencies through cooperative agreements for agricultural development and trade capacity activities related to climate change adaptation and mitigation.

Cross Cutting.

Proposed Action: Provide climate change reporting guidance for the Global Agricultural Information Network (GAIN). The GAIN system is a compilation of FAS information on foreign countries' agricultural economy, products and issues which are most likely to have an impact on U.S. agricultural production and trade.

IV. Sustained Adaptation Process

- a. What steps will your agency take annually in order to ensure that this Plan is current?

FAS will continue to rely on its Climate Change Working Group to coordinate annual reviews and updates to the Climate Change Adaptation Plan.

- b. How will you prioritize (actions)?

The following are the most important considerations for prioritizing FAS climate change adaptation actions:

- (1) The President's Climate Action Plan and U.S. Government priorities associated with climate change;
- (2) Executive Order 13653--Preparing the United States for the Impacts of Climate Change and Executive Order 13514--Federal Leadership in Environmental, Energy, and Economic Performance;
- (3) Departmental Regulation 1070-001 – USDA Policy Statement on Climate Change Adaptation;
- (3) USDA's Strategic Plan and priorities associated with climate change;
- (4) Financial resources and the availability of trained personnel;
- (5) Vulnerability, and threat to FAS mission; and
- (6) Opportunity to improve Agency services to stakeholders.

- c. What sources of information will your agency use to further develop the Plan through time?

FAS will rely on diverse information sources to aid in developing the Climate Change Adaptation Plan over time. As mentioned, FAS will consider the needs and input of stakeholders, the intelligence gathered by FSOs, as well as technical information on climate change impact reported in the National Climate Assessments. FAS relies on the USDA Global Change Task Force to provide linkages to cutting-edge scientific developments about climate change and agriculture. Additionally, FAS staff subscribe to the National Agricultural Library’s climate change and agriculture newsfeed to receive weekly updates on current events.

- d. Performance Metrics

- i. Describe the methods your agency will use to evaluate progress
- ii. Roadmap, Scorecards, etc.

The FAS Climate Change Working Group is the coordinating body for evaluating and updating the FAS Climate Change Adaptation Plan. This Working Group facilitates exchange of information and activity coordination within FAS, and has an advisory capacity to assist with answering questions from overseas offices of the agency. As part of the annual review process, each FAS program area is engaged to provide input on progress towards addressing the vulnerabilities and opportunities related to each FAS activity pillar. In addition to the performance metrics associated with specific activities listed in the Appendix, FAS will consider the following aggregate metrics:

Pillar Focus	Performance Metric
Trade Promotion	Improving FAS access to technical resources related to climate change
Trade Policy	Addressing climate change issues in a variety of forums
Trade Capacity Building & Food Security	Addressing U.S. and partner countries’ capacities for climate change mitigation and adaptation through FAS agricultural development and trade capacity building activities
Cross-Cutting	Sharing information about climate change issues relevant to sustainable, global food and agriculture systems.

Foreign Agricultural Service

V. Actions to address risks and opportunities (include as Appendix).

- a. This section should include pilot activities, the formal integration of adaptation into agency policy, the modification of programs or activities, or capacity building. It should be in tabular format and include the following:

FAS ACTIONS TO ADDRESS RISKS AND OPPORTUNITIES

Pillar #1: Trade Promotion										
Current Actions	Action Goal	Agency Lead	Description	Scale	Time-frame	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Highlights of Accomplishments to Date
Advising in the National Climate Assessment on Food Security	Contribute to the Assessment specifically the trade related aspects	OASA	The USDA Global Change Task Force is coordinating an assessment on climate change & food security. FAS will participate in the steering committee to ensure that agricultural trade is considered in the report	Global	Publish 2015	Active FAS participation in the drafting and review process	USDA-OCE	Limited resources available	Ensuring that relevant subject matter experts are consulted	Initial draft of the report (Zero Order Draft) is completed and distributed to the author team for review in Feb 2014

Foreign Agricultural Service

Pillar #2: Trade Policy										
Current Actions	Action Goal	Agency Lead	Description	Scale	Time-frame	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Highlights of Accomplishments to Date
Integrating climate change considerations into Country Strategy Statements (CSS)	Implement new climate change guidance	OCRA	Each year FAS develops country strategy statements to further the Mission of FAS.	Global	Once per Year	CSS Reports can include addressing relevant climate change issues	USDA-FAS	On-going annual activity	N/A	63 Country Reports Filed in 2013
Monitoring International Organizations	Representing and defending U.S. interests.	OASA	FAS Promotes the importance of agriculture in international organizations and discourages trade restricting agreements	Global	Ongoing	Input provided in meetings or reviewed reports by FAS in relation to climate change	State Dept., EPA, USTR	Limited resources available	Many organizations want to support global efforts regarding climate change making it challenging to effectively monitor and to respond given limited resources	

Foreign Agricultural Service

Pillar #2: Trade Policy (Cont.)										
Current Actions	Action Goal	Agency Lead	Description	Scale	Time-frame	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Highlights of Accomplishments to Date
UN climate change negotiations and other venues	Represent and defend U.S. interests	OASA	FAS has been participating in the UNFCCC negotiations since 2009 and seeks to ensure that agricultural issues are considered in the negotiations and do not hamper free trade; also FAS in involved in the Climate and Clean Air Collation (CCAC) and the Climate Smart Agriculture (CSA) Alliance	Global	Ongoing	Engage with relevant stakeholders; establish working relationships with various negotiation groups -establishment agriculture work program and launch agriculture initiatives in the CCAC and CSA Alliance	State Dept., USDA-Forest Service, USDA-FAS USDA-OCE	One FTE allocated 100 per cent to this action; also there is a need for additional staff support	Responding to additional work load with limited resources	Launched new agriculture sector initiative in the CCAC

Foreign Agricultural Service

Pillar # 3: Trade Capacity Building & Food Security										
Current Actions	Action Goal	Agency Lead	Description	Scale	Time-frame	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Highlights of Accomplishments to Date
FAS trade and scientific capacity building programs	Through OCBD programs, foreign participant receive knowledge, skills and technologies that may be applied in-country to accelerate climate mitigation or adaptation plans in the food and agriculture sector	OCBD	FAS-administered scientific exchanges and capacity- building programs are flexible, critical tools for USDA to engage countries on climate change priorities. These activities enable U.S. and international counterparts to jointly promote economic development and environmental quality in the agriculture sector and, overall, promote global food security.	Global	Ongoing	# of participants in FAS administered fellowships for the Global Research Alliance on Agricultural Greenhouse Gases (target: 2/year) # of FAS agreements with other federal agencies in support of international initiatives for climate change mitigation or adaptation (target: agreements with State and USAID)	OCBD collaborates with OASA, USDA/ARS and USAID on GRA fellowships OCBD has formal implementing agreements in place with State and USAID for international climate change initiatives	OCBD has a designated policy and planning coordinator for climate change issues and activities FAS appropriated funds are typically sufficient for only 5 GRA fellows per year, while recruitment of any additional GRA fellows requires prior commitments of extramural funding. Climate change activities carried out under interagency agreements are fully reimbursable	FAS relies heavily on extramural funding for climate change activities. In these cases, the scale and programmatic focus of the activities are largely driven by the external funding partner.	OCBD has delivered a total of 25 GRA Fellows, representing 10 countries* Though an agreement with State, OCBD delivered three ECPA demonstration projects. Two additional projects are underway.**

*= GRA Fellows have represented Chile, Ghana, India, Indonesia, Malaysia, Mexico, the Philippines, Thailand, Uruguay, and Vietnam

Foreign Agricultural Service

**= ECPA demonstration projects were completed in Ecuador, Honduras and Uruguay, while projects were initiated in Colombia and Panama

Pillar # 3: Trade Capacity Building & Food Security (Cont.)										
Current Actions	Action Goal	Agency Lead	Description	Scale	Time-frame	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Highlights of Accomplishments to Date

<p>Participating in Feed the Future (FtF) working groups</p>	<p>To increase the food security of FtF partner countries, particularly so that those countries become more resilient to possible climate change impact on their food and agriculture systems</p>	<p>OCBD</p>	<p>The FtF working groups assess prevailing conditions, define priorities and accordingly align USG resources that can develop the food and agricultural sectors of food insecure countries. .</p>	<p>FtF countries</p>	<p>Ongoing</p>	<p>OCBD participation in assigned FtF working groups (target: 100% OCBD attendance)</p> <p>-% of FtF countries OCBD recruits for participants in OCBD's capacity-building fellowship and scientific exchange programs (target: 100% of FtF countries)</p> <p>-# of participants from FtF countries in OCBD's capacity building fellowship and scientific exchange programs. (target: 68 participants)</p>	<p>USAID Bureau of Food Security leads the interagency FtF working groups</p>	<p>OCBD prioritizes candidates from FtF countries who are eligible to participate in OCBD capacity building and scientific exchange activities.</p>	<p>Climate change mitigation and adaptation may not be the most pressing concern of FtF countries to strengthen their food security measures</p>	<p>In 2013 OCBD fully participated FtF Working Groups for Climate Change, Resilience, Global Policy Enabling Environment and other relevant areas.</p> <p>In 2013, OCBD engaged participants from Bangladesh, Ghana, Guatemala, Haiti, Honduras and Kenya in capacity building activities, .</p>
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Foreign Agricultural Service

Cross-Cutting										
Current Actions	Action Goal	Agency Lead	Description	Scale	Time-frame	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Highlights of Accomplishments to Date
Change to: Maintain Agency wide Climate Change Working Group	Sustain Agency wide involvement in climate change matters	OASA	This Working Group acts to quickly communicate about climate change issues throughout FAS. Likewise, the Working Group may be quickly mobilized to help coordinate agency-level responses or tasks related to climate change.	DC and select FAS posts	Ongoing	Quality of response to climate change issues	USDA-FAS	Limited resources available	Sustain Agency climate change commitment given competing areas of responsibility	Working Group completed 2012 and 2013 Adaptation Plan and is currently drafting revisions to 2014 Plan
Providing guidance for Global Agricultural Information Network (GAIN) reporting on climate change	Issue guidance to overseas FAS Offices	OCRA	FAS has a section within GAIN for voluntary reporting on “climate change/global warming/food security”	Global	In 2014	Implement new guidance in 2014	FAS	Limited resources available	Keeping focused reporting that doesn’t require more time than resources available	Prepared draft guidelines for comment

USDA Forest Service
Climate Change Adaptation Plan 2014

Forest Service Climate Change Adaptation Plan 2014

DRAFT

I. Policy Framework

Mission

The mission of the Forest Service (FS) is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations.

Americans rely on their forests and grasslands for a wide range of benefits—for provisioning services such as water, wood, and wild foods; for regulating services such as erosion, flood, and climate control; and for cultural services such as outdoor recreation, spiritual renewal, and aesthetic enjoyment. These services are connected and sustained through the integrity of the ecosystems on these lands.

Goals and Strategic Approach

FS policies, developed over many years, were mostly devised before the agency took climate change into account in its programs for public land management, private forest landowner assistance, and research. Such policies might not provide the most effective means for guiding actions to address climate change across broad landscapes, jurisdictions, and resource areas; however, these policies did consider establishing and maintaining resilient forests and rangelands in light of stressors. The FS is identifying shortcomings in its current policies, procedures, and program guidance. The goal is to reformulate them where necessary to align resources with an effective climate change response and to more effectively collaborate with other Federal agencies, States, Tribes, and other stakeholders for landscape-scale conservation.

The FS approach for adapting to climate change encompasses a) climate-specific strategies across the agency and b) direct program-by-program efforts to integrate climate-related policies and guidance, where climate change is one of many drivers of change to be considered in sustaining forest and grassland ecosystems. Climate-specific goals and strategies include:

- **USDA 2010-2015 Strategic Plan - Goal 2.** Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources.
 - Objective 2.2 - Lead efforts to mitigate and adapt to climate change.
- **FS National Roadmap for Responding to Climate Change (Roadmap).** In October 2008, the FS had introduced a *Strategic Framework for Responding to Climate Change*. The Roadmap builds upon the strategic framework and lays out three types of actions for the FS to employ in a continuous cycle of adaptive management informed by monitoring and evaluation:
 - **Assess** current risks, vulnerabilities, policies, and gaps in knowledge.
 - **Engage** internal and external partners in seeking solutions.
 - **Manage** for resilience, in ecosystems as well as in human communities, through adaptation, mitigation, and sustainable consumption strategies.

All three modes of action are dynamic and mutually reinforcing. They are interconnected through monitoring and evaluation, forming a continual feedback loop to allow opportunities for adjustment in direction or tactics.

- ***FS Climate Change Performance Scorecard (Scorecard) Individual*** National Forest System (NFS) field units apply the Scorecard to facilitate implementation of the Roadmap and USDA Strategic Plan. The Scorecard is completed annually in fiscal years 2011-2015. By 2015, each field unit is expected to answer *Yes* to at least seven of the Scorecard's 10 elements (questions), with at least one *Yes* in each of the four dimensions outlined below. The Scorecard's multiple dimensions ensure that each Unit works toward a balanced response to climate change. The four dimensions and ten elements are:
 - **Organizational capacity - Engage employees through training and integrate climate change into program of work.**
 1. Employee Education
 2. Designated Climate Change Coordinators
 3. Program Guidance
 - **Engagement – Develop partnerships and transfer knowledge.**
 4. Science and Management Partnerships
 5. Other Partnerships
 - **Adaptation – Assess impacts of climate change and manage change.**
 6. Assessing Vulnerability
 7. Adaptations Actions
 8. Monitoring
 - **Mitigation and Sustainable Consumption – Assess carbon stocks and reduce our Agency footprint.**
 9. Carbon Assessment and Stewardship
 10. Sustainable Operations
- ***Executive Order 13514 – Federal Leadership in Environmental, Energy, and Economic Performance.*** Directs each agency to not only develop a sustainability strategy and reduce greenhouse gas emissions but to develop policies and practices to support the Federal Adaptation Strategy. The Scorecard will simplify accomplishment reporting for this order.
- ***Executive Order 13653 – Preparing the United States for the Impacts of Climate Change.*** Directs agencies to develop or continue to develop, implement, and update comprehensive plans that integrate consideration of climate change risks and vulnerabilities into agency operations and overall mission objectives.
- ***Forest Service Global Change Research Strategy 2009-2019.*** In keeping with the research goals of the U.S. Global Change Research Program, the FS Research and Development mission area helps define climate change policy and develop best management practices for forests (both rural and urban) and grasslands in order to sustain ecosystem health and services (adaptation), and

increase carbon sequestration (mitigation), all under changing climate conditions. The fundamental research focus of the FS Global Change Research Strategy is to increase understanding of forest, woodland, and grassland ecosystems, use this information to project potential futures. This information and the resulting tools will facilitate vulnerability assessments and the development of management practices to increase the probability of achieving projected futures that best meet the needs of the Nation.

The FS also incorporates climate considerations into program- or resource-specific policies and guidance. Examples include:

- ***Ecological Restoration and Resilience Directive (FSM 2020)***. The primary objective of this foundational policy for sustainable management of National Forest System (NFS) lands is to restore and maintain resilient ecosystems that will have greater capacity to withstand stressors and recover from disturbances, especially those under changing and uncertain environmental conditions, including climate change and extreme weather events.
- ***2012 Planning Rule***. This new rule provides improved ability to respond to climate change and other stressors through an adaptive framework of assessment, planning and monitoring and new provisions intended to improve resilience of ecosystems on NFS lands. Examples include:
 - 219.6(b)(3): “Identify and evaluate existing information relevant to the plan area for...the ability of terrestrial and aquatic ecosystems on the plan area to adapt to change.”
 - 219.12(a)(5)(vi): Monitoring programs must include monitoring questions and indicators that address “...measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area.”
- ***Genetic Resource Management and Climate Change: Genetic Options for Adapting National Forests to Climate Change***. This strategy provides an overview of current climate change knowledge and potential implications for forest tree species, as well as goals, principles, and recommendations for enhancing forest resilience and resistance through a re-aligned “climate-smart” NFS Genetic Resource Management Program.

II. Planning for Climate Change Related Risk

Section 5(a) of E.O. 13653 states that, “each agency shall develop or continue to develop, implement, and update comprehensive plans that integrate consideration of climate change into agency operations and overall mission objectives...” The five elements (subsections) are addressed in the remainder of this Plan.

Section 5(a)(i) - identification and assessment of climate change related impacts on and risks to the agency’s ability to accomplish its missions, operations, and programs;

Impacts, Risks, and Vulnerability Assessment

The FS uses numerous national, regional, and local scale assessments to inform policies, programs, and land management planning of the impacts of climate change and other environmental stressors and influences. Examples include the Forest and Rangeland Renewable Resources Planning Act Assessment; National Climate Assessment – Forest Sector Report; Southern Forest Futures Assessment; and NFS land management plan assessments.

Forest Service

- **Physical and Biological Climatic Concerns.** The FS mission is impacted by shifts in temperature and precipitation patterns and amounts, extreme weather events, and climate variability. The FS manages public forests and grasslands and works with States, Tribes and private landowners to restore and sustain the health, diversity and productivity of the Nation's forests and grasslands. Changes in key climate variables affect the seasonality of hydrologic regimes, reproduction cycles of pests and pathogens, and length of fire seasons. Fire seasons in the West have increased by 78 days since the mid-1980s.⁵ Disturbance facilitates the introduction and spread of invasive species, which increase extinction risks for native species and other alterations of ecosystem processes and functions. The changing climate is already altering species ranges and has the potential to alter ecosystem structure in the future as evidenced by the mountain pine beetle (a native insect) epidemic in the West. Management will require forward-looking approaches to novel ecosystems instead of depending on historical ranges of variability. These impacts pose challenges to sustaining forests and grasslands and the supply of goods and services upon which society depends, such as clean drinking water, forest products, outdoor recreation opportunities, and habitat.

- **Wildfires - Increasing wildfire season length and extent of fire on the landscape.**

Research estimates the potential for up to 100 percent increase in the number of acres burned annually by 2050. Increasing wildfire response requires increased funding. Fire suppression funding has grown from 16% of the FS budget in 1995 to 42% currently and funding is transferred from other agency programs in years when suppression funds are exhausted.

All FS program accomplishments are reduced when wildfire suppression funds are exhausted. The increased extent of high severity fire on the landscape coupled with communities expanding into in the wild land-urban interface are reducing capacity to provide other services, including increasing the residence of ecosystems, and puts personnel, the public, communities, and infrastructure at higher risk.

Tribal communities and firefighting- NFS lands and bordering tribal lands are increasingly at risk of fire. Tribes are particularly vulnerable to fires both on and off tribal lands (e.g., on NFS and/or private lands over which they have no control or jurisdiction) which complicates coordination of firefighting across shared landscapes with such frequent fires. These risks are frequently exacerbated by a lack of adaptive capacity due to lack of resources, poverty, poor or nonexistent infrastructure, and relative isolation.

Human Health and Safety – Firefighting employees and contractors, and residents in the wild land-urban interface are increasingly at risk due to extreme wildfire behavior.

- **Air Temperature – Prolonged personnel exposure to the elements during extreme temperatures.**

Human health and safety - Risk to employees and contractor/cooperators. Events that include atypical weather patterns experienced during the 2013-2014 winter season has result in extremely cold temperatures in most regions, especially unusual in the southern states. Higher summer temperatures may increase field personnel risk of heat exhaustion, heat stroke, and dehydration. Has the potential to impact operations at all levels.

- **Insects and Disease - Increased exposure to and spread of damaging insects and disease, especially invasive species.** Affects natural resource management on all lands. Tribal

⁵ Westerling, Hidalgo, Cayan, and Swetnam. 2006. Science 313: 940-943.

Forest Service

communities and Forest Health – NFS and bordering tribal lands are increasingly at risk of damaging insects and disease.

- **Water Temperature - Increased water temperatures in rivers and lakes, lower water levels in late summer, and drying of streams and ponds.** Tribal communities and Watershed, Fish, Wildlife, Air and Rare Plants– Forest Service and bordering tribal lands are increasingly at risk regarding watershed and fisheries maintenance. Tribes are particularly vulnerable to fluctuations in water temperatures and flow as many communities rely on aquatic species for subsistence and cultural purposes. These risks are frequently exacerbated by a lack adaptive capacity due to lack of resources, poverty, poor or nonexistent infrastructure, and relative isolation. A further consideration is that failure to manage trust lands in a sustainable manner may result in abrogation of treaty rights, creating a risk position for federal natural resource agencies.
- **Rising Sea Levels - Tribal communities, NFS lands, infrastructure.** Coastal NFS lands and coastal Tribes are increasingly at risk of damage to their lands, including infrastructure, due to rising sea level. Tribes are particularly vulnerable to sea level rise as many tribal communities are place-based, with limited or no opportunity to relocate without extreme cost and/or Congressional action. Those tribes that rely on aquatic species for subsistence and cultural purposes that are affected by sea level are further at risk. These risks are frequently exacerbated by a lack adaptive capacity due to lack of resources, poverty, poor or nonexistent infrastructure, and relative isolation. A further consideration is that failure to manage trust lands in a sustainable manner may result in abrogation of treaty rights, creating a risk position for federal natural resource agencies.
- **Extreme Weather Events - Impact to agency facilities, operations, and emergency response capability as a result of severe weather conditions.** Affects all agency operations and programs. Past events such as Hurricanes Katrina and Irene had significant impact to infrastructures and personnel. Because FS has employees in all states, there is a high probability that a major function could be impacted by such weather events, requiring those offices to transfer duties until they can relocate to their COOP facility and get up and running.
- **Increased Rainfall – Transportation infrastructure concerns.** With increasing heavy rain events, the extensive road system on NFS lands will require increased maintenance and/or modification of infrastructure (e.g. larger culverts or replacement of culverts with bridges).
- **Fluctuating Precipitation and Temperature - Outdoor recreation and recreation infrastructure.** Ski areas, reservoirs, and campgrounds are strongly influenced by past and current climate. Preserving high-quality outdoor recreation experiences will depend not only on the condition of the land, facilities, and transportation infrastructure but also on where such opportunities can be accommodated safely and managed under a changing climate. The projected increase in U.S. population and the continual decline of public access to privately-owned undeveloped land will increase demand for recreation opportunities on public land.
- **Economic and Marketing Concerns.** Climate change may influence the demand for energy and its mix of sources. Woody biomass is gaining attention as a renewable energy source. An increasing demand for renewable energy may affect how forests are managed and influence a wide range of ecosystem services, such as water quantity and quality, wildlife habitat, and carbon sequestration. Changes in forest management objectives could affect the price of traditional forest products and downstream products such as housing.

Management options to maintain healthy ecosystems include thinning stands to reduce moisture stress and regenerating stands where they have been decimated by insects or disease. Having a market for products from these operations is important to offset management costs and improve local/rural economies. Because of the demise of the forest industry in many areas, a major marketing effort will be necessary to reestablish mills and processing plants.

Potential impacts to other ecosystem services also may affect social and economic sectors. For example, climate change may adversely affect river-based outdoor recreation opportunities through changes in the timing and volumes of streamflow; thereby impacting many rural communities dependent on favorable water flow and a river based economy.

The economic benefits of outfitting and guiding and river-related recreation use are large contributors to local and rural economies where rivers are large enough to support such economies. They should be recognized just as are reservoir operations and other developed recreation opportunities (campgrounds) along riverways.

- **Capacity Building.** The FS provides a wide variety of climate change training opportunities and communication materials for its employees, other agencies, and the public. These range from basic awareness education to highly technical seminars, workshops, and courses for conducting vulnerability assessments and developing adaptation and mitigation strategies.

Partnerships between scientists and land managers are being strengthened to improve the focus of research and technology to address current and emerging science and information needs. Resource inventory, monitoring, and assessment activities and decision support tools are being better aligned and coordinated across FS programs and with partner agencies at multiple scales. Examples of ongoing and newly initiated capacity-building efforts are:

- **Climate Change Resource Center** – The primary web-based science delivery portal for FS employees and partners who need information and tools to address the impacts of climate change in land management decision making.
- **Environmental Threat Assessment Centers** (Eastern Forest Environmental Threat Assessment Center and Western Wild land Environmental Threat Assessment Center) - Provide interdisciplinary resources that are actively developing new technology and tools to anticipate and respond to forest threats, including climate change.
- **Regional Hubs** – Seven regional hubs now established across the US. They are repositories of data and offer practical, science-based tools and strategies farmers, ranchers, and forest land owners need to adapt and succeed in the face of a changing climate. The Hubs will provide outreach and information to producers on ways to mitigate risks; public education about the risks climate change poses to agriculture, ranchlands and forests; regional climate risk and vulnerability assessments; and centers of climate forecast data and information. They will also link a broad network of partners participating in climate risk adaptation and mitigation, including universities; non-governmental organizations; federal agencies such as the Department of Interior and the National Oceanic and Atmospheric Administration; Native Nations and organizations; state departments of environment and agriculture; research centers; farm groups and more.
- **Conservation Education Programs** - Increase environmental literacy through partnerships with groups who educate urban populations on the value of well-managed public and private forested lands and, through natural resource stewardship, improve the public's quality of life.

Frequency of extreme events and more climatic variability will challenge stewardship programs that directly benefit urban dwellers.

Framework to Continually Review and Update Impact Assessment and Risk Determination

- ***Understanding Risks – Actions the FS takes to better understand risks and opportunities.***
Management of forests and grasslands and associated resources involves making long-term commitments of resources and investments. The FS continues to refine its planning and decision making processes regarding the consideration of climate change risk and uncertainty. In January 2009, national guidance was developed for the NFS to address climate change in land management planning and project-level National Environmental Policy Act (NEPA) analyses. The 2012 Planning Rule and forthcoming directives and guidance are updating that initial guidance.

Agency research scientists work closely with land managers to downscale climate projections to better understand the range of potential ecosystem impacts, conduct vulnerability assessments for key resources, and develop localized adaptation approaches and options. For example, vulnerability assessments for water resources and aquatic ecosystems were recently completed on 12 national forests, representing each of the nine FS regions. Likewise, two regions have completed risk assessments of their forest tree species. These serve as pilots for completing additional assessments. Also, comprehensive risk assessments are being completed when planning recreation infrastructure projects; and a risk assessment of all developed recreation sites was conducted recently to identify and mitigate public safety issues related to extreme weather events.

In cooperation with national, state, and local partners, urban forest health monitoring efforts of the FS are underway to identify existing and potential pest and disease threats to our urban forests and help understand the impact of climate change on the vulnerability of urban forests to infestations.

All NFS unit level land management planning and project planning involves collaboration with the public and key partners such as Tribes and local governments. The FS is engaged with Department of Interior and State agencies in using the newly formed Landscape Conservation Cooperatives (LCCs), Climate Science Centers, and USDA Regional Hubs to coordinate sharing of resource information and science and developing adaptation strategies across these broader landscapes.

Following are example policies, programs, processes, and actions that provide frameworks for regularly monitoring and assessing risks and vulnerabilities:

- Forest and Rangeland Renewable Resources Planning Act (RPA) Assessment - every 10 years
- National Climate Assessment – Forest Sector Report - every four years
- Regional assessments, such as the Southern Forest Futures Assessment.
- National Cohesive Wild Land Fire Management Strategy
- Collaborative Forest Landscape Restoration Program (CFLRP) monitoring

Forest Service

- Forest Health Monitoring Program – Determines the status, changes, and trends in indicators of forest condition on an annual basis and, in a federal/state partnership, produces the National Insect and Disease Risk Map every 5-6 years.
 - NFS Land Management Planning – Monitor and assess regularly. Revise plans every 10-15 years, including consideration of changes in environmental, social and economic conditions and stressors.
 - Watershed Condition Framework - assess conditions every four years
 - Continuity of Operations (COOP) Plans
 - FS Health and Safety Program
- ***Sustained Adaptation Process.*** The Climate Change Advisor’s Office will lead the Adaptation Plan’s review, monitoring of actions listed in the appendix, and Plan update. Monitoring of resource conditions and trends with input from FS Research and Development, field units, other agencies, and stakeholders will inform prioritization or adjustment of national policies and programs.

Climate Change Performance Scorecard annual reporting will track progress on implementing major actions of the Roadmap and this Adaptation Plan. Improvement in Scorecard results will reflect effectiveness of agency strategic approaches, policies, this Adaptation Plan, and other efforts within the FS and by partners. The Scorecard itself will also be reviewed regularly to ensure it continues to meet the agency’s needs, with potential to expand its application to other mission areas.

The *Adaptation Services Framework*, a State & Private Forestry companion to the Performance Scorecard is being developed.

National and regional assessments will continue to monitor the health and productivity of the Nation’s forests and rangelands. Examples include:

- Forest and Rangeland Renewable Resources Planning Act (RPA) Assessment
- National Climate Assessment – Forest Sector Report
- Southern Forest Futures Project
- Northern Forest Futures Project.

The 2012 Planning Rule requires national forests and grasslands to monitor progress towards their desired conditions and including key indicators of ecosystem status and measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area.

Section 5(a)(iii) - a description of how any climate change related risk identified pursuant to paragraph (i) of this subsection that is deemed so significant that it impairs an agency’s statutory mission or operation will be addressed, including through the agency’s existing reporting requirements;

Significant Risk

Forest Service

- **Impact/Risk Considered Significant.** Increasing wildfire season length, size and severity of large fires, coupled with an expanding wildland-urban interface, has been multiplying wildfire suppression costs. Fire suppression funding has grown from 16% of the FS budget in 1995 to 42% currently and funding is transferred from other agency programs in years when suppression funds are exhausted.

All FS program accomplishments are reduced when wildfire suppression funds are exhausted. The increased extent of high severity fire on the landscape coupled with communities expanding into in the wild land-urban interface are reducing capacity to provide other services, including increasing the residence of ecosystems, and puts personnel, the public, communities, and infrastructure at higher risk.

- **Rationale for Classifying the Risk as Significant.** Wildfire suppression expenditures are now a significant percentage of the agency's budget, reducing capabilities to provide other critical services, including our capacity to manage forests for increased resilience, to protect their capacity to sequester and store carbon, and provide other ecosystem services. Increasingly large and severe wildfires will result in increased restoration needs as well as decreased capacity to manage for other services. They also increase risk to personnel and communities.
- **Action(s) that may decrease the threat/risk.** Change funding mechanism for wildfire suppression to protect funding of programs and activities that restore fire-adapted ecosystems, resilience, and accomplish other adaptation priorities. The FLAME Act of 2009 established a separate account for funding emergency wildfire suppression activities undertaken on DOI and NFS lands. Additional legislation is being considered (Wildfire Disaster Funding Act of 2013 – HEN13D10).
- **Can the action be addressed exclusively by the agency or do others need to be involved?** Congressional action is required to change funding structure.

Section 5(a)(iv) - a description of how the agency will consider the need to improve climate adaptation and resilience, including the costs and benefits of such improvement, with respect to agency suppliers, supply chain, real property investments, and capital equipment purchases such as updating agency policies for leasing, building upgrades, relocation of existing facilities and equipment, and construction of new facilities;

FS Engineering and Watershed programs are developing national guidance to ensure flood emergencies are appropriately responded to and infrastructure is rebuilt to be more flood resilient. This guidance includes FS Manual and Handbook direction and development of incident command procedures. This is being coordinated with the USFWS, NRCS, BLM, USACE, and State Department.

Section 5(a)(v) - a description of how the agency will contribute to coordinated interagency efforts to support climate preparedness and resilience at all levels of government, including collaborative work across agencies' regional offices and hubs, and through coordinated development of information, data, and tools, consistent with section 4 of this order;

The FS supports coordinated climate adaptation efforts through its substantial contributions of science, data, information, tools, and technical support to Federal, State, and local agencies; Tribes; the business sector and producers; other partners and stakeholders; and the international community. Examples include:

- Regional Hubs: FS is host to five of the seven USDA regional hubs recently established. These provide outreach and information to producers (farmers, ranchers, and forest land owners) on ways to mitigate risks; public education about the risks climate change poses to agriculture, ranchlands and forests; regional climate risk and vulnerability assessments; and centers of climate forecast data and information. They will also link a broad network of partners participating in climate risk adaptation and mitigation, including universities; non-governmental organizations; federal agencies such as the Department of Interior and the National Oceanic and Atmospheric Administration; Native Nations and organizations; state departments of environment and agriculture; research centers; farm groups and more
- Western and Eastern Environmental Threat Assessment Centers
- Climate Change Resource Center (www.fs.fed.us/ccrc)
- Forest Service Global Change Research Strategy 2009-2019
- Interagency Coordination on Climate Projections
- Inventory, Monitoring, and Assessment Strategy
- Watershed and Terrestrial Condition Frameworks for integrated resource restoration
- Genetic Diversity
- National Cohesive Wild Land Fire Management Strategy
- National Fish, Wildlife and Plants Climate Adaptation Strategy
- FS is an active partner in Landscape Conservation Cooperatives and is lead agency for the Caribbean LCC.
- Tribal support through:
 - National Fish, Wildlife and Plants Climate Adaptation Strategy, Landscape Conservation Cooperatives, and other interagency efforts.
 - Tribal Climate Change Network and FS Regional Climate Hubs
 - Backstop tribal representatives on the White House/CEQ climate task force.
 - Tribal Climate Change Adaptation Community of Practice (FS, White House, DOI's BIA and USGS, DOE, EPA, and CEQ)
 - Inter-Agency Forum on Climate Change Impacts & Adaptations.

Section 5(a)(ii) - a description of programs, policies, and plans the agency has already put in place, as well as additional actions the agency will take, to manage climate risks in the near term and build resilience in the short and long term;

FS actions already completed, initiated, or proposed in response to climate-related impacts and risks (Section 5(a)(ii)) are described in the Action Register below. In addition, the Action Register describes in greater detail those FS actions that contribute to interagency efforts to support climate preparedness and resilience, including coordinated development of information, data, and tools (Section 5(a)(v)).

**Executive Order 13653, Sec. 5 - Federal Agency Planning for Climate Change Related Risk
USDA Forest Service Action Register**

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Implement the USDA-Forest Service (FS) Climate Change Roadmap and Performance Scorecard	Integration of climate change response into the agency's policies, programs, and operations.	Climate Change Advisor's Office	Natural resources, FS mission and operations are broadly at risk Roadmap identifies ongoing actions and establishes short and longer term strategic actions and investments to respond and adapt to climate change. Performance Scorecard tracks progress implementing the Roadmap by individual national forests and grasslands.	Local, summarized at Regional and National levels	Ongoing	Through various means, including policy formulation, and science support at national, regional, and local levels.	Percent of National Forests in compliance with a climate change adaptation and mitigation strategy Annual reporting by field units on implementing at least seven of ten scorecard elements by end of FY2015.	Increased collaboration such as sharing of science, data, and tools,		Need to improve scorecard guidance; limitations of field units to conduct vulnerability assessments.	Roadmap and Scorecard issued in 2011. By end of FY2013, 49% of NFS units have met the performance scorecard target.

Forest Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Develop Adaptation Services Framework	Adaptation integrated into S&PF program and service delivery, improving assistance to forest landowners and managers, allowing them to continue to meet their unique management objectives in a changing climate	Climate Change Advisor's Office, S&PF-NA	Opportunity to collaboratively develop and provide a system to evaluate and adapt State & Private Forestry programs and policies in the delivery of climate change services to partners (non-Federal forest managers, landowners and urban communities).	National, but may include region-specific goals and guidance.	Draft Framework in development. Final in December 2014 Northeast Area pilot in FY2015 along with updated S&PF program guidance. FS-wide implementation of Framework reporting in FY2020.	The deliverable would be the S&PF counterpart to the NFS Climate Change Performance Scorecard.	Publication of the S&PF Adaptation Services Framework and Guidance Document				Framework Proposal drafted and currently under internal review.

Forest Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
<p>Develop national policy requiring the entire agency to develop COOP plans to ensure operability continues when impacted by an extreme weather-related event.</p> <p>Administrative units develop COOP Plans to ensure facilities have continuing operating capabilities if vulnerable to extreme weather events.</p>	<p>Entire FS will have COOP Plans to implement in the event of an emergency requiring relocation to an alternate operating facility, devolution of functions, etc.</p>	<p>Office of Safety and Occupational Health</p>	<p>Significant impact to facilities, other infrastructure, and agency operations, including emergency response, as a result of extreme weather events</p>	<p>National, Regional, Locals</p>	<p>Ongoing</p>	<p>WO will provide template to create COOP plans by October 1, 2014. Once created, plans will be reviewed/ updated at least yearly or when procedures change and warrant an immediate update.</p>		<p>Yes. Coordinate with local agencies, esp regarding continuity of FS emergency response assistance.</p>	<p>Personnel time required to develop new COOP plans</p>		<p>The WO and several regional offices currently have COOP Plans.</p>

Forest Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Safety Training: Train employees on proper procedures for working in and surviving extreme weather conditions, such as prolonged exposure to extremely high or low temperatures, precipitation, and wind	Employees are prepared to protect themselves when working in extreme weather conditions.	Office of Safety and Occupational Health	Human Health and Safety - Prolonged employee exposure to the elements during extreme high and low temperatures, potential flooding, or high wind events.	National, Regional, Local	Ongoing	Evaluations will be done during the WO assessments					USFS OSH currently has procedures and policies to ensure employees understand hazards associated with prolonged exposure to extreme weather conditions as outlined in the Health and Safety Code Handbook, FSH 6709.11.
Develop Flood Response guidance and teams	Rebuild infrastructure to be more flood resilient	Engineering/Watershed	Increased risk of flooding. Opportunity to create flood response guidance and teams to assist forest and non-forest lands in flood emergencies	National and International	December 2014	Guidance, manual handbook direction and development of incident command procedures	Flood emergencies responded to and infrastructure improved	USFWS, NRCS, BLM, USACE, State Department			Stream Simulation Design development

Forest Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Issue Ecological Restoration and Resilience Policy (FSM 2020)	Provides foundational policy for sustainable management of NFS lands.	Forest Management	Addresses all risks and vulnerabilities of ecosystems and associated infrastructure. Objective is to restore and maintain resilient ecosystems that will have greater capacity to withstand stressors and recover from disturbances, especially those under changing and uncertain environmental conditions, including climate change and extreme weather events.	National	Finalize directive in May 2014	Issue directive		USFWS and other federal land management agencies		Further integrating the policy into other agency policies and programs	Interim directive first issued in September 2008; reissued in 2010, 2011, and 2013; Proposed directive published in Federal Register
Revise NFS Planning Rule	National Forest System (NFS) land management planning policy and procedures include consideration of climate change	Ecosystem Management Coordination	Prior rule was out of date. Revised process for establishing, amending and revising land management plans for national forests and grasslands. Incorporates consideration of climate change into land management plans through assessments and monitoring.	National	Completed	Early adopter units are developing new approaches, tools, etc. New rule will be implemented as forests and grasslands revise their plans.	Number or percentage of LMPs revised under the 2012 Rule	Coordinated with CEQ, OMB, DOJ, EPA USFWS, and NOAA Fisheries	NA	Several lawsuits filed	Planning Rule finalized March 2012

Forest Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Revise Planning Rule Directives (FSM 1920 and FSH 1909.12)	NFS units will have land management plans that provide long term direction for climate change adaptation and mitigation address the impacts and risks of climate change.	Ecosystem Management Coordination	Opportunity to incorporate climate change adaptation guidance into 2012 Planning Rule directives. Will ensure consideration of climate change when NFS units revise their land management plans.	National	May 2014	Issuance of directives to field units.	Final directives are issued.	Coordinating with CEQ, OMB, DOJ, EPA USFWS, and NOAA Fisheries	NA.	Work with science community on estimating uncertainty and risk and providing additional guidance in risk and vulnerability assessments and adaptation options.	Addressing 17,449 public comments on proposed planning directives.
Revise National Forest and Grassland Land Management Plans (LMPs) under the 2012 Planning Rule and directives.	LMPs are “climate-smart.”	Ecosystem Management Coordination	Older LMPs may not reflect new science and information on risks to sustainable ecosystems and communities from impacts of stressors, including climate change. For plans under the 2012 Planning Rule, assessments should evaluate vulnerability of key resources related to LMP decisions. As LMPs are revised, climate adaptation strategies are developed and incorporated as needed.	Local	Ongoing. Unit LMPs are revised under the 2012 Rule and directives as per the national schedule	Land management planning process implemented by individual or grouped NFS units.	Number of plans revised annually under the 2012 Planning Rule.	Extensive intergovernmental coordination occurs at the scale of national forests, states and regions in preparation of these plans. Includes coordination with tribal, state and local governments and other federal agencies.	Budget limitations and collaboration slow the pace of LMP revisions. Insufficient field resources to complete revisions.	Difficulty meeting complex planning requirements . Controversy and litigation that drags out LMP revision process.	Baseline carbon assessments completed for each NFS unit. Publication of proposed final plans and Final EISs for 6 plan areas in the last 8 months.

Forest Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Update Silvicultural Practices Directive (FSM 2470)	Update directive to incorporate current Forest Service policy direction	Forest Management	Opportunity to provide direction and guidance on ecological restoration, management at landscape scale, and managing for climate change.	National	Finalize in FY 2014	Issuance of directive to field units.	Final directive is issued.	None	NA	Accompanying handbook needs revision to reflect changes made in directive.	Draft directive completed with collaboration from R&D and S&PF. Final draft submitted to ORMS for review and publishing.

Forest Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Implement National Cohesive Wild Land Fire Management Strategy	Landscapes are more resilient, communities are adapted to fire, fire personnel have safe areas to work within	Fire and Aviation Management	<p>Increasing wildfire season length, severity, and extent of fire on the landscape.</p> <p>Risk reduction - Addresses the nation's wildfire problems by focusing on three key areas: Restore and Maintain Landscapes, Fire Adapted Communities, and Response to Fire.</p>	National, Regional	Ongoing. Phase III of plan to be finalized in FY 2014	Strategy being implemented in three phases. Restoration component involves establishing resilient fire-adapted ecosystems, which would also be better adapted to the effects of climate change and other stressors. Implement through programs and projects, in collaboration with partner agencies, Tribes, landowners.	Cohesive Strategy Goals and Performance Measures being developed. Five-year review cycle to provide updates to Congress.	Wild land Fire Leadership Council (WFLC), representing FS, DOI , States, Tribes, and local agencies			Phases I and II completed.

Forest Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Implement National Fish, Wildlife and Plants Climate Adaptation Strategy (NFWPCAS) and FS goals	Landscapes are more resilient, maintain function and productivity	Watershed, Fish, Wildlife, Air, and Rare Plants	Opportunity to improve efficiency and effectiveness by identifying FS goals and strategic actions that can be implemented in alignment with NFWPCAS	National	2014	Review agency programs and strategic plans and NFWPCAS	Crosswalk established between FS goals and strategic actions and NFWPCAS goals, strategies, and actions.	Joint Implementation Working Group (JIWG)			JIWG established

Forest Service

<p>Increase the pace of restoration on NFS lands</p>	<p>Landscapes are more resilient so as to maintain function, productivity, and adaptive capacity.</p>	<p>Forest Management</p>	<p>Risk reduction - Initiative lays out a series of ongoing and future actions related to the use of active forest management as one important tool to maintain and restore the functions and processes characteristic of healthy, resilient forests and watersheds. Many of these actions also support adaptation of ecosystems to climate change.</p>	<p>Local</p>	<p>Ongoing. FY 2012-2015</p>	<p>On-the-ground resource management treatments</p>	<p>FS annual restoration performance metrics (Resiliency Measure) FY 2014 target is 2.7 million ac</p>	<p>FS and NRCS are working in partnership to accomplish needed restoration across national forest/private land boundaries</p>	<p>Budget limitations restrict how much restoration work is accomplished</p>	<p>Phase II of the Restoration Strategy to Deputy Under-Secretary requesting department support, included advocating expanding Good Neighbor Authority and reauthorization of Stewardship Contracting.</p>	<p>Restoration accomplishments from 23 Collaborative Forest Landscape Restoration Projects A team has been developing restoration performance measures expected to be included in FY 16 Congressional Budget justification in July. 2014. Put in place 3 new categorical exclusions for soil and water projects. Acres treated: FY 2012: 2.56 million ac; FY2013: 2.5 million ac</p>
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Forest Service

Implement Western Bark Beetle Strategy (NFS lands)	Improve 1) human safety, 2) forest recovery, and 3) long-term forest resilience	Forest Management	Risk reduction - Addresses the West's bark beetle problems by focusing on three goals: human safety, forest recovery, and long-term forest resiliency. Removal of standing or dead hazardous trees near roads, along trails, and in campgrounds is top priority. The strategy is restoring healthy forest ecosystems in beetle-killed areas through planting appropriate species and thinning.	National – the strategy covers regions 1-6.	Ongoing. FY 2011 - 2016	Through FS programs and projects, in collaboration with state governments.	Acres treated for: hazardous fuels; vegetation established and improved; noxious weeds and invasive plants; native pests; Acres of forestlands treated using timber sales	FS works in collaboration with state governments in the Western States.	Budget limitations	Limited markets for dead trees; litigations are on-going challenges.	FY11-FY13: 85,0703 acres treated; 3,838 miles of roads and trails had hazard trees removed; 851.4 MBF of timber and 410,823 tons of biomass were produced. FS spent \$321.3 M supporting safety, recovery and resiliency activities
Implement National Strategic Tree Planting Initiative	Dual goals: Increase community resilience and sequester and store carbon.	Cooperative Forestry	Risk reduction - Establish tree planting projects in urban and community forests to increase the amount of carbon sequestered and carbon emissions avoided. Also helps communities adapt to increasing temperatures by increasing cooling effect and other ecosystem services provided by urban trees.	National	Ongoing. FY 2012-2015	Through programs and projects, in collaboration with partner organizations and communities.	Number of trees planted. Amount of carbon sequestered and emissions offset per federal dollar invested	NA at this time.	Initiative made possible by a Cooperative Agreement in 2012 with Arbor Day Foundation. No other funding resource needs are anticipated at this time.	NA at this time.	Currently nine electric utility companies participate in the program with nearly 17,000 trees planted in the fall of 2013.

Forest Service

Promote wood as a green building material (FS)	Supports dual goals of adaptation and mitigation. Increases utilization of wood to help facilitate ecological restoration and adaptation activities.	Research & Development	Opportunity - Promote and seek recognition by the U.S. Green Building Council and others of the environmental benefits of wood building products. Supports restoration of forest ecosystems to make them more resilient to climate change and other stressors, while mitigating climate change through wood's substitution for energy-intensive building materials.	National	Ongoing FY 2012-2014		Percent completion of Life Cycle Inventory (LCI) wood database update for Life Cycle Assessment (LCA) use and EDP establishment for wood products to meet Green Building standards	Collaborate on changes in certification			
Wood To Energy	Supports dual goals of adaptation and mitigation. Increase utilization of wood to help facilitate ecological restoration and adaptation activities.	Cooperative Forestry	Opportunity to create and expand markets for small-diameter material and low-valued trees removed from forest restoration activities. Grant funds are targeted to help communities, entrepreneurs, and others turn residues into marketable forest products and/or energy products. Products help fund treatments that restore resilience of forests to stressors, including climate change	National	Ongoing	Grant Program	Metric Tons		Budget limitations		

Forest Service

Contributions to Coordinated Interagency Efforts, Including Development of Information, Data, and Tools											
Implement Forest Service Global Change Research Strategy 2009-2019	Provide science that supports adaptation	Research & Development	Fundamental research focus of the FS Global Change Research Strategy is to increase understanding of forest, woodland, grassland, and urban ecosystems so they can be managed to sustain and provide ecosystem services for future generations.	National	Ongoing FY 2009-2019	Research, publications and other technology transfer activities	Broad diversity of research products including peer-reviewed publications, number of tools developed, customer-satisfaction surveys and science delivery efforts, such as workshops.	Coordinates with USGCRP	Budget limitations		

Forest Service

<p>Forest and Rangeland Renewable Resources Planning Act (RPA) Assessments</p>	<p>Provide science to inform policy, including adaptation</p>	<p>Research & Development</p>	<p>Publication: <i>Future of America's Forests and Rangelands: Forest Service 2010 Resources Planning Act Assessment</i></p> <p>This scientific assessment provides a snapshot of current U.S. forest and rangeland conditions and trends on all ownerships, identifies drivers of change, and projects conditions 50 years into the future. Includes analyses of forests, rangelands, wildlife and fish, biodiversity, water, outdoor recreation, wilderness, urban forests, and the effects of climate change on these resources.</p>	<p>National, Regional</p>	<p>Ongoing - every 10 years</p>	<p>Conduct assessment. Distribute/post publications</p>	<p>Research publications</p>	<p>Useful to other agencies, land managers, and sectors</p>			<p>2010 RPA Assessment published in 2012</p>
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Forest Service

National Climate Assessment – Forest Sector Report	Provide science to inform policy, including adaptation	Research & Development	<p>Publication: <i>Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector.</i></p> <p>A scientific assessment of current condition and likely future condition of forest resources in US relative to climatic variability and change. Assessment provides technical input to the NCA and serves as a framework for managing forest resources in the US.</p>	National, Regional	Ongoing - every four years	Conduct assessment. Distribute/post publication	Research publication	Useful to other agencies, land managers, and sectors			Forest Sector Report published in 2012
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Forest Service

<p>Establish regional climate hubs for risk adaptation and mitigation to climate change. FS hosts five of the seven hubs.</p>	<p>Support adaptation by providing information and technical advice needed by producers (farmers, ranchers, and forest land owners).</p>	<p>Research & Development, USDA CCPO</p>	<p>Hubs will provide outreach and information to producers on ways to mitigate risks; public education about the risks climate change poses to agriculture, ranchlands and forests; regional climate risk and vulnerability assessments; and centers of climate forecast data and information.</p>	<p>Regional / Landscape, Local</p>	<p>Ongoing</p>	<p>Work through existing USDA programs.</p>	<p>In startup, but initially will examine the processes involved in vulnerability assessments and implementation of management actions</p>	<p>Yes, within USDA. Will also link a broad network of partners participating in climate risk adaptation and mitigation, including universities; non-governmental organizations; federal agencies such as DOI, NOAA, Native Nations and organizations; state departments of environment and agriculture; research centers; farm groups and more</p>	<p>No additional funding for this initiative</p>	<p>Limited resources</p>	<p>Hubs now established.</p>
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Forest Service

Implement Inventory, Monitoring, and Assessment Strategy	Provide monitoring and assessment information that support adaptation planning and other business needs	Ecosystem Management Coordination	Opportunity to improve resource inventory, monitoring, and assessment. Goal is for land management information to be comprehensive, inclusive, credible, and responsive and adaptive to changes. Supports adaptation and mitigation policies, such as the President’s Climate Action Plan and the National Fish, Wildlife, & Plants Climate Adaptation Strategy.	National, Regional, Local	Ongoing	Policy changes and improved information management	TBD - IM&A Strategy scorecard metrics	Coordination with other federal, state and local agencies on identifying and implementing opportunities to share data, standards, tools and products		Effectively addressing the large number of agency business areas and information needs; Conducting a collaborative process; Adjusting the way the agency has managed resource information over time – culture;	Drafted National Management Questions to guide Information Needs Assessment
Develop and implement Watershed and Terrestrial Condition Frameworks	Provide information that supports integrated resource restoration and CC adaptation	Sustainable Landscape Management Board of Directors	Opportunity to characterize and prioritize watersheds and landscapes for developing restoration and adaptation strategies. Continue effort to merge these into a comprehensive assessment tool and indicator set. Watershed Condition Framework is operational. TCF component is being developed.	National, Regional, Local	Ongoing FY2016	Development of indicators, tools, and guidance for assessments.	WCF and TCC become an integrated dataset, assessment, and monitoring tool.	Sharing of science, data, tools applicable to vulnerability assessments, priority setting, etc	Better coordinated land management across jurisdictions.		

Forest Service

Improve the Climate Change Resource Center (www.fs.fed.us/ccrc)	Provide access to information and training that supports CC adaptation	Research & Development	Opportunity to enhance this web-based science-delivery portal for Forest Service employees and partners who need information and tools to address climate change in project planning and implementation.	National	2012-2015	Website development and improvement	Annual monitoring of website improvements completed.	Share science, data, tools, educational materials			
Improve Interagency Coordination on Climate Projections		Climate Change Advisor's Office, Research & Development	Opportunity to coordinate and provide guidance within Forest Service on the selection & use of downscaled climate projections and expand across land management agencies and climate science providers. The goal of this larger effort is to simplify the complex array of choices in a rigorous, defensible manner and facilitate greater comparability in data use	National but nested to apply at multiple levels	On-going. Work plan defined June 2013, draft products expected by end of year.	Coordinating with other agencies	Published # of agencies on-board Publication of guidance Adoption/use of guidance Outreach activities to promote awareness	This one of several projects sponsored by the Interagency Landscape Management Adaptation Group (ILMAG). Interagency work group formed. Sharing science and coordinating further work.			Climate Projections FAQs publication completed and distributed.
Conserve Genetic Diversity	Improve the success of adaptation projects.	Forest Management, Rangeland Management	Risk reduction - Genetic differences found in forest and rangeland plant species would be mapped to the landscape using GIS and other spatial analyses. From these genetic landscape maps, develop seed movement guidelines for species of restoration and reforestation concern by predicting their ability to be adapted to future climates.	National	On-going	Research, publication of guidelines.	Number of species genetically analyzed	No inter government coordination exists. However, inter-agency coordination exist between FS, ARS, NRCS, and BLM		Lack of funding and loss of trained geneticists.	Studies have been completed or are underway for 15 grass species, 9 forbs, and 7 trees and shrubs

Forest Service

Improve Forest Tree Gene Conservation	Supports adaptation of forests to CC	Forest Health Protection	Risk reduction - Prioritize forest trees for gene conservation, develop conservation plans, carry them out	National	Ongoing FY2012-2015	Research, planning, implementation	Ensure at least 20 unrelated individuals (or seed) collected per seed zone.				
Implement National Insect and Disease Risk Assessment	Manage forest ecosystems to increase resilience	Forest Health Protection	Identifies areas at risk to catastrophic levels of forest insects, pathogens and abiotic mortality agents. Projects anticipated levels of tree mortality over the next 15 year period.	National, Regional, and Local	Completed in 2013	Risk map and supporting data and information are posted on Forest Health Monitoring website. information for strategic and tactical planning	Updated map is issued	Covers all treed lands in US. Assessment completed through Forest Health Monitoring Program – a federal and state partnership		Future plans include enhanced climate projections	National Insect and Disease Risk Map was just updated.
Create climate-sensitive version of the Forest Vegetation Simulator (FVS), a nationally supported forest dynamics model.	Improve ability to simulate effects of climate change on forested lands	Forest Management	Provides opportunity to model effects of climate change and develop management strategies that are likely to result in a resilient ecosystem when planning for restoration, watershed improvement, and other activities. Reduces risk of planning activities likely to have an adverse effect on ecosystem resilience as the climate changes.	National model applied at Regional and Local levels	2014 - 2015	Through collaboration with Research Stations and universities	Successful completion of the model and full integration into the production FVS software	An inter-agency steering team with members from the BIA, BLM, and NRCS helps direct work of the FVS staff, including development of the climate model.		Because climate change may result in conditions unlike anything recorded, data for validation of this model are lacking and will be slow to become available.	A climate sensitive version of FVS has been implemented for the western conterminous United States. Development of the eastern version is well underway.

Forest Service

R&D All Station Climate Change and Tribes Project	Learn from and Assist Tribes and other native peoples in managing our nations' natural resources in the context of changing climate	R&D (Northern Station currently serving as project coordinator)		National, Regional	On-going	Plan and facilitate workshops, support Regional Scientist-Manager networks, develop "portfolio" studies highlighting particular local challenges and adaptation options.	# of Tribes/Native orgs engaged	Collaborative Work with many DOI LCCs and CSCs.		Highlights needs for funding for monitoring culturally important species.	Work with over 80 Tribes and 20 intertribal/native organizations. Active science-manager networks established in PNW and SW. Over 60 tribal experts/students supported to attend climate-related conferences/workshops. Dozens of publications and guides for Tribes.
Synthesize climate change adaptation across all federal land management agencies	Coordinate adaptation among agencies	Climate Change Advisor's Office, Research & Development	Opportunity to improve coordination by documenting past and ongoing climate change adaptation efforts of all federal land management agencies, developing overarching inferences regarding adaptation, and emphasizing the consistency among agencies.	National, Regional, Local	2014	Research, review existing programs and efforts	Publication				

**Grain Inspection Packers and
Stockyards Administration**
Climate Change Adaptation Plan 2014

**Grain Inspection Packers and Stockyards Administration
Climate Change Adaptation Plan
January 2014**

I. Policy Framework (Describe your agency vision, mission, goals and strategic approaches)

The Grain Inspection Packers and Stockyards Administration facilitates the marketing of livestock, poultry, meat, cereals, oilseeds, and related agricultural products, and promotes fair and competitive trading practices for the overall benefit of consumers and American agriculture through its two primary mission areas, the Packers and Stockyards Program (PSP) and the Federal Grain Inspection Service (FGIS).

PSP promotes fair business practices and competitive environments to market livestock, meat and poultry. Through its oversight activities, including monitoring programs, reviews, and investigation, PSP fosters fair competition, provide payment protection, and guards against deceptive and fraudulent trade practices that affect the movement and price of meat animals and their products. PSP's work protects consumer and members of the livestock, meat and poultry industries. PSP is primarily responsible for administering and enforcing the Packers and Stockyards Act (P&S Act) enacted in 1921 to assure effective competition and integrity in the marketing of livestock, meat, and poultry. PSP is responsible for bringing formal actions for violations of the Truth-in-Lending Act and the Fair Credit Reporting Act by persons and firms subject to the P&S Act. In addition to its primary responsibility, PSP carries out limited responsibilities for the Secretary of Agriculture under Section 1324 of the Food Security Act of 1985. These responsibilities include review of "central filing systems" establish by the States for pre-notifications of security interests against farm products.

FGIS establishes quality standards for grains, oilseeds, pulses and legumes; provides impartial inspection and weighing service through a network of Federal, State, and private entities and monitors marketing practices to enforce compliance with the U.S. Grain Standards Act (USGSA), as amended and the Agricultural Marketing Act (AMA), as amended. FGIS administers uniform, national grain inspection and weighing programs established by the Act on a fee basis for both export and domestic grain shipments. The USGSA requires that most export grain be inspected and weighed, prohibits deceptive practices with respect to the inspection and weighing grain, and provides penalties for violations. The USGSA also requires most corn exported from the US be tested for aflatoxin prior to shipment

GIPSA's Strategic Goals are linked to the USDA Strategic Goal 1: Assist Rural Communities to Create Prosperity so They Are Self-Sustaining, Repopulating, and Economically Thriving. PSP does this through its strategic objective to protect fair trade practices, financial integrity and competitive livestock, meat and poultry markets. FGIS, in turn, has three strategic objectives:

- Provide the market with terms and methods for quality assessment
- Protect the integrity of the U.S. grain and related markets, and
- Provide official grain inspection and weighing services

II. Vulnerability Assessment (Describe both the risks and opportunities associated with changing climate that your agency will face)

Grain Inspection Packers and Stockyards Administration

Risks

- Cyclical crop production due to weather and other production variables stemming from climate change could affect GIPSA's ability to build steady inspection expertise.
- Increased need for quality verification of USDA food assistance purchases may overwhelm existing GIPSA capacity.
- GIPSA operations at both interior and US export locations may be more vulnerable to extreme weather events.

Opportunities

- Increased demand for genetically engineered crops modified to adapt to the effects of climate change.
- Increased development and deployment of pesticides to address the effects of climate change.
- Increased demand for inspection tools and methods with a reduced environmental footprint.
- Increased need for accurate collection and reporting of data indicating overall crop quality issues.
- Increased demand for verification of new crop varieties bred to adapt to the effects of climate change.

III. The Adaptation and Evaluation Process (Integration into policies, programs and operation, includes coordination with stakeholders including local, state or tribal entities and private landowners)

GIPSA's adaption and evaluation process addresses both continuity of operations and adaption of program operations.

A changing climate can result in more frequent, severe and longer term weather related disasters, which will require GIPSA to be more resilient to short and medium term weather events. GIPSA will improve current policies on reducing its environmental footprint. It will also review occupant emergency plans, employee notification and accountability, increased productivity of unscheduled teleworking days, and decreased potential for service disruptions.

GIPSA engages directly with stakeholders through its Grain Inspection Advisory Committee, which includes representatives from throughout the grain handling industry; direct interaction with various commodity groups; and with stakeholders in general through Federal Register publications soliciting input into what the grain and commodity market is most interested in GIPSA addressing. GIPSA relies on this information to establish strategic priorities for review of grain and commodity standards and methods development priorities.

Grain Inspection Packers and Stockyards Administration

IV. Sustained Adaptation Process (To ensure that the Climate Change Adaptation Plan remains current)

GIPSA Leadership will review program operational plans and policies annually to ensure that adaptation to climate change is factored into our planning, implementation and evaluation of program performance.

Grain Inspection Packers and Stockyards Administration

V. Actions to Address Risks and Opportunities

Proposed New Actions	Agency Lead	Description	Scale	Timeframe	Performance Metric	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Reduce GIPSA’s environmental footprint.	GIPSA	Examine all operations to reduce consumption of non-renewable energy and materials.	Global	3 years	# of operational facilities reviewed annually.	None	None	None	New plan
Confirm GIPSA’s ability to deliver service under extreme conditions.	GIPSA	Ensure Occupant Emergency Plans (OEP’s) and Continuity of Operations Plans (COOP) effectively address weather related service disruptions.	Global	3 years	# of operational facilities reviewed annually.	None	None	None	New plan
Enhance automated data collection and reporting systems.	GIPSA	Improve and refine data collection and reporting tools that assess the quality of crop data.	Global	3 years	% of available quality data accessible.	None	None	Funding	New plan
Review availability of inspection tools with a reduced environmental footprint.	FGIS	Evaluate efficacy of water based mycotoxin test kits	Global	Ongoing	# of GIPSA approved water based test kits reviewed.	None	None	None	New plan

Grain Inspection Packers and Stockyards Administration

Current Actions	Agency Lead	Description	Scale	Timeframe	Performance Metric	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Continue to develop proficiency in determining and confirming genetic events in grain.	FGIS	Conduct semi-annual biotechnology proficiency tests on corn and soybeans with collaborating laboratories.	Global	Ongoing	# of participating laboratories.	None	None	None	Program grew from initial 18 laboratories in 2002 to 77 participant laboratories in 2012.
Ensure pesticide residue services are available to detect pesticides most predominantly in use.	FGIS	Develop appropriate methods and conduct pesticide residue analysis as needed.	Global	Ongoing	# pesticide results tests conducted.	Agricultural Marketing Service	None	None	GIPSA continues to offer service as needed. In FY 2013, GIPSA upgraded instrumentation used in this program.
Facilitate identification of new crop varieties developed to respond the effects of climate change.	FGIS	Develop and publish FGIS' process for identifying new crop varieties.	Global	1 year	Process published.	Agricultural Marketing Service	None	None	New plan

USDA National Agricultural Statistics Service
Climate Adaptation Plan 2014

National Agricultural Statistics Service Climate Change Adaptation Plan (Action Registry)

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Industry consultation	Data User's Meetings or Advisory Committee on Agriculture Statistics	Agricultural Statistics Board	Opportunity - Outside review to identify ways to adapt	National	2013	Document, research, funding requests for implementation	Success of implementing recommendations	ERS, WOAB collaborate with the meetings	Program adjustments and additions need funding	None	2013 Data Users meeting held in October
Internal assessments	Internal Meetings of Senior Leadership	Senior Executive Team	Opportunity – internal assessment and reallocation	Agency-wide	2013	Document, research, funding requests for implementation	Success of implementing recommendations				
Education and training	Agency Training	Global Change Task Force Member	Opportunity - expanding knowledge	Agency-wide	Begin FY 2013	Ag Learn, personal research, seminars & conferences	Completion	USDA GCTF plan, promotes and publicizes events	Travel restrictions have limited attendance		NASS was represented at the Grand Challenge meetings of the Gate Foundation in October 2013
GCTF participation	Continue participation in USDA GCTF	Global Change Task Force Member	Opportunity - develop internal expertise	Agency-wide	FY 2013	Select, meet, communicate, implement	Implementation	Other USDA agencies			

National Agricultural Statistics Service

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Recording/budgeting extreme events	Document additional resources for re-interviews	Program Administration Branch	Opportunity - document	Agency-wide	FY 2013	Record keeping and budgeting plans	Agency resources expended in response to extreme weather events	NASS/National Agriculture State Departments of Agriculture	Resurvey costs	Late plantings	July 2013 soybean resurvey for 14 states
Document impacts	Document extreme weather and their impact	Geospatial Information Branch	Opportunity - document	Agency-wide	FY 2013	Record keeping	Agency resources expended in response to extreme weather		Produced internally in cooperation with Statistics Division	Satellite availability for ag monitoring	Derived independent July 2013 soybean analysis
Program review	5-year Program Review	Statistics Division	Opportunity - reprioritize agency programs	Agency-wide	FY 2014	Senior leadership	Program changes initiated due to climate change		Program expansions require funding	Documenting decisions and actions	
Sec. 5. Federal Agency Planning for Climate Change Related Risk.											
Develop budget offering	Develop climate	Geospatial Information Branch	Opportunity - document	Agency-wide	FY 2015	Document, research, funding requests for implementation	Congressional program approval	ARS	Scientific university collaboration	Staffing for new climate program	Budget offering submitted

Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Target upcoming NASA solicitations	Seek funding for NASA food security/water resources/ disaster solicitations	Geospatial Information Branch	Opportunity-document	Agency-wide	FY 2015	Seek collaborative partners for solicitations	Win solicitations	Leverage NASA scientific instruments/ satellites	Scientific university collaboration	Developing observations and systems	Waiting for solicitations

USDA National Institute of Food and Agriculture
Climate Change Adaptation Plan 2014

**USDA - National Institute of Food and Agriculture
Agency Climate Change Adaptation Plan**

I. Policy Framework

NIFA's mission is to advance knowledge for agriculture, the environment, human health and well-being, and communities by supporting research, education, and extension programs in the Land-Grant University System and other partner organizations. NIFA doesn't perform actual research, education, and extension but rather helps fund it at the state and local level and provides program leadership in these areas.

NIFA's two key mechanisms for accomplishing its mission of "advancing knowledge" are:

National Program Leadership: NIFA identifies and supports research, extension, and education priorities in areas of public concern that affect agricultural producers, small business owners, youth and families, and others.

Federal Assistance: NIFA provides annual formula grants to land-grant universities and competitively granted funds to researchers in land-grant and other universities, and other eligible institutions identified by law.

NIFA's National Program Leaders and other program staff are empowered to carry out the mission of NIFA. To accomplish this mission, these senior staff members perform critical tasks under the authority of the NIFA Director and report to NIFA Assistant Directors and Division Directors. These tasks fall into four general categories:

- Network and collaborate with partners and stakeholders to identify mission-relevant problems, opportunities, and issues requiring federal attention and support;
- Conceive, formulate, and direct programs and activities to respond to existing or emerging problems, opportunities, and issues through the development and application of science-based knowledge;
- Administer and manage programs and activities to develop and apply science and knowledge; and,
- Evaluate and assess the quality, outcomes, and impacts of these programs.

NIFA supports the base programs of state Agricultural Experiment Stations and the Cooperative Extension System nationwide at land-grant universities. As USDA's primary extramural research agency, NIFA provides working funds to researchers at institutions of higher education all over the United States. These research programs benefit all Americans. NIFA helps ensure that a high-quality higher education infrastructure will be available at the nation's land-grant universities to address national needs, and it uses the infrastructure of scientific expertise from these and other colleges and universities, and also of public and private laboratories, to partner in addressing national priorities.

NIFA collaborates or has formal working partnerships with many institutions and individuals. NIFA's key partners are the institutions of higher learning making up the Land-Grant University System. However, NIFA also partners with other federal agencies, within and beyond USDA; non-profit associations; professional societies; commodity groups and grower associations; multistate research committees; private industry; citizen groups; foundations; regional centers; the military; task forces; and other groups.

NIFA and its partners focus on critical issues affecting people's daily lives and the nation's future. The advanced research and educational technologies supported by NIFA empower people and communities to solve problems and improve their lives on the local level.

II. Identification and assessment of climate change related impacts on and risks to NIFA's ability to accomplish its missions, operations, and programs.

NIFA will face both risks and opportunities associated with changing climate from an operational and mission perspective and impacts to its infrastructure and personnel. Physical factors associated with climate have the potential to disrupt the grant review and award process that is critical to the progress of agricultural science and the infrastructure of the land-grant system. NIFA's climate adaptation strategic plan will focus on two major areas of vulnerabilities, NIFA's Science Programs and NIFA's infrastructure and personnel. Both these areas will be impacted by extremes and wide variations in temperature, precipitation, and the secondary impacts of these events on transportation, communication, information technology systems and coordination with other federal, state, municipal, county and non-government partners, and industry.

Impacts to Science Programs

NIFA's mission is to support exemplary research, education, and extension. As USDA's primary extramural research agency, NIFA provides funds for research, education and extension activities through the AFRI Climate Challenge Area. NIFA will need to balance the increasing demand for scientific research, modeling, educational programs, and extension activities to address climate change issues with other research, education, and extension needs for agricultural. For example, investigations of climate stressors and tipping points will become more essential to climate adaptation science research and will need to be balanced with vulnerable areas of crop and livestock production research and formal and informal state educational programs. There will also be a need to establish more long-term collaborations with federal funding agencies to provide research support to understand complex climate issues and develop the models and decision-making products essential for the sustainability of economic and natural resource systems.

NIFA collaborates or has formal working partnerships with many institutions and individuals. NIFA's key partners are the institutions of higher learning making up the Land-Grant University System, however, NIFA also partners with other federal agencies, within and beyond USDA; non-profit associations; professional societies; commodity groups and grower associations; multistate research committees; private industry; citizen groups; foundations; regional centers; the military; task forces; and other groups. NIFA and its partners focus on critical issues such as climate change that affects people's daily lives and the nation's future. NIFA will need to advance research and educational technologies that empower people and communities to solve problems and improve climate adaptation and mitigation efforts at the local level. NIFA also supports the base programs of state Agricultural Experiment Stations and the Cooperative Extension System nationwide at land-grant universities with support from formula funds. NIFA needs to foster a high-quality higher education infrastructure will continue to be available at the nation's land-grant universities to address national needs, and uses the infrastructure of scientific expertise from these and other colleges and universities, and also of public and private laboratories, to partner in addressing national priorities, such as climate change.

National Institute of Food and Agriculture

Impacts to Infrastructure and Personnel

A changing climate can result in more frequent, severe and longer term weather related disasters in the national capital region. There will be a future need to increase the agency's resiliency to short and medium term weather events. NIFA should strive toward improvements in employee notification, increased productivity of unscheduled telecommute workdays, as well as decreased panel impacts of weather related travel delays.

All of the approximately 350 employees of NIFA report to the Waterfront Centre, the Whitten and South Buildings in Washington DC and reside in the metro DC area (DC, Maryland, Virginia). Impacts of a variable and changing climate will require an adaption plan assessment that focuses on the ability to maintain primary operations when personnel are unable to report to the primary duty station. This also includes impacts to panels who are invited to DC to conduct reviews of proposals. Transportation and building infrastructure will also be impacted by climate and the safety of personnel travelling to and from the primary work site will need to be addressed. Climate will also impact the technological infrastructure at the Waterfront Centre where information systems are housed and require a controlled temperature and humidity environment. This also applies to NIFA's back-up systems located outside Washington D.C. Heating and cooling systems will also impact the performance of personnel in the building.

III. Programs, policies, and plans NIFA has in place to manage climate risks in the near term and build resilience in the short and long term;

NIFA implemented a set of enabling activities that will generate novel Ideas, Partnerships, and Tool for Discovery, Learning, and Outreach that will address climate change issues in multiple sectors. This includes plans to integrate climate change adaptation science and resiliency into relevant NIFA policies, programs, and operations. Accomplishments include:

- Preparation and implementation of a comprehensive Climate Change Portfolio Plan for NIFA: A NIFA Climate Change Science Plan is an essential document for establishing the Institute's goals and outcomes for research, education and extension activities addressing global change and climate. The plan includes adaptation, mitigation, and decision support as the primary components and would identify human, financial, and infrastructure resources to achieve goals. The plan is complementary to the USDA Climate Change Science Plan, and the REE Action Plan developed by the REE mission area. It would also support the goals of the USDA Strategic Plan and the U.S. Global Change Research Program.
- Maintaining a well-funded competitive challenge area in AFRI focused on Agriculture and Natural Resources Science for Climate Variability and Change: AFRI provides competitive grants for fundamental and applied research, education and extension projects. AFRI will support climate projects of various scales that promote collaboration, open communication, and the exchange of information; reduces duplication of effort; and coordinates activities among individuals, institutions, states, and regions.
- Collaboration with NOAA Sea-Grant for Climate Extension: NIFA has facilitated interactions with Cooperative Extension and NOAA's Sea Grant program to establish a joint climate extension service, to identify and agree upon common focused goals, outcomes, and targeted audiences. Significant new resources are being identified to support a coordinated national effort providing climate information and decision support tools to clientele and stakeholders. This collaboration would contribute to federal government efforts with the National Climate Assessment and the US Global Research Program.

- Collaboration with other federal funding agencies: NIFA continues to foster and advance NIFA climate science work through partnerships with other science agencies (e.g., NOAA, NSF, DOE) in order to capitalize on the resources available to support multidisciplinary work and bring climate science expertise to agricultural and natural resource subject matter.

NIFA continues to develop plans to manage climate risks in the near term and build resilience in the short and long term through professional development. Plans include:

- Expanding National Program Leadership Areas to Address Climate Change Issues: Current expertise within NIFA national program leadership has gaps in areas relevant to climate change science, especially in economics, social sciences, and behavioral sciences. The complexity of climate change impacts on the environment and society requires a well-coordinated, multidisciplinary approach in arriving at system science methods to address specific climate-related issues. Examples of expertise identified as important for implementing climate change research, education and extension activities include science writing, climate modeling and behavioral science. Social scientists, economists and educators with climate change science backgrounds would complement the current subject matter expertise at NIFA. There is also a need to maintain a standing division level unit within NIFA to address the larger climate portfolio.
- Developing a Plan for Workforce Development and Education: Educational programs at all levels need to address the critical skills and professions needed to meet the future demands for climate change research, education and extension in agriculture. Non-formal education programs, such as 4-H, and formal higher education curricula need to adopt a specific climate change component. Program developers need to be aware of the impacts of climate change on agricultural production and societal behavior so these can be incorporated into teaching and accompanying materials. Research and teaching capacity also needs to be built with minority serving institutions so they can advance their contributions to climate change science and workforce development.

IV. Climate change related risks that impair NIFA's statutory mission or operation and how they will be addressed.

A changing climate can result in more frequent, severe and longer term weather related disasters in the national capital region. There will be a future need to increase the agency's resiliency to short and medium term weather events. NIFA should strive toward improvements in employee notification, increased productivity of unscheduled telecommute workdays, as well as decreased panel impacts of weather related travel delays. The following are NIFA approaches to climate adaptation at its Headquarters.

- NIFA uses the MIR3 system to increase its ability to notify employees and gather status information in the event of a disaster in the national capital region. Over 90% of NIFA employees are MIR3 registrants. Users self-register with the following contact information: Work e-mail, work phone, home e-mail, home phone, mobile phone, pager, and/or emergency contact phone. The system can contact any or all of these devices, for any or all employees, and track message retrieval and responses. The agency plans to conduct four limited and two agency-wide MIR3 drills annually.

- The agency will continue to increase the telework capacity and capability of the NIFA workforce and IT system. Capacity is reflected by the number or percentage of employees that have a core or situational telework agreement in place, as well as the capacity of agency information technology resources to support simultaneous users. Capability reflects the ability of individual employees and the organization to be productive in a telework environment, which could include the variety of systems that employees can access and the types of tasks that can be conducted remotely. Regardless of whether conditions require a long term continuity of operations (COOP) plan deployment or a single unscheduled telework day, the ability of the workforce to productively telework will increase the agency's resiliency. Continuity plans will be adjusted to incorporate scenarios for devolution to a majority telework environment.
- Gathering together panels of experts to review funding applications is a significant function of the agency. Historically, these panels have gathered face-to-face in Washington, DC area, which makes them dependent on nationwide travel reliability and the operability of a central facility. NIFA plans to increase the employment of "virtual panels" as a method to decrease the process's dependence on live meetings based in the national capital region.

V. NIFA considerations to improve climate adaptation and resilience with respect to agency suppliers, supply chain, real property investments, and capital equipment

NIFA plans and implementation in this area are limited because of the small number of personnel allocated in the DC Headquarters. NIFA does not run any laboratories or operate any facilities. It does not own or operate any vehicles nor own buildings. Efforts have been made, however, to address real property issues in the following areas.

- Increased temperature extremes have the potential to increase stress on the Heating, Ventilation, and Air Conditioning (HVAC) systems. As a result of this planning process, NIFA has solicited competitive bids to increase preventative maintenance on these systems in order to decrease future breakdown and repair costs.
- Increased weather extremes can lead to a greater variety of safety hazards for the agency's lease facility and the employees it houses. NIFA will increase its all hazards education and safety programming in coordination with the USDA Office of Homeland Security and Emergency Coordination, Office of Operations, and the General Services Administration.
- Current online information technology asset backup on the east coast, coupled with planned server consolidation, will further distribute key data resources.
- Hotter days in summer are likely to lead to increases in air quality warnings and the severity of those warnings. NIFA will continue to promote use of public transportation resources and telework.

VI. NIFA interagency efforts to support climate preparedness and resilience at all levels of government

NIFA has established new opportunities and interagency partnerships to better understand risks and opportunities. NIFA will continue to promote strategic partnerships which will advance community preparedness for climate impacts and events. These partnerships have helped develop science-based

methods to assess vulnerability, to monitor climate impacts, and to project impacts based on scenarios. Current accomplishments include:

- **Interagency collaborations for funding basic and applied climate science:** Multiple interagency collaborations have been established to fund fundamental and interdisciplinary research that better understands the impacts and feedbacks of global and climate change on agricultural systems (including farm, crop, forest, and range lands) and provide potential adaptation and mitigation strategies, as well as discovery and demonstration of decision support tools for land, ecosystem and water resource managers to mitigate carbon and greenhouse gas emissions (i.e., increase carbon sequestration and storage). These projects will develop the science base and infrastructure to support a new generation of coupled agriculture and climate system models to improve attribution and prediction of high-impact regional weather and climate, to initialize seasonal-to-decadal climate forecasting, and to provide predictions of impacts affecting adaptive capacities and vulnerabilities of environmental and human systems.
- **Effective Communication and Marketing Strategies for NIFA Activities on Climate Change:** In order to engage stakeholders and elevate the science, a marketing strategy focused on climate change is needed. Marketing strategies would include web site development and other communication mechanisms that reach out to all public sectors for educational and service purposes. A well-developed marketing process would also improve post-award management and the quality of reporting to NIFA from funded projects.
- **Consultation with the USDA Office of the Chief Scientist, the REE and NRE mission area agencies, the OCE Climate Change Program Office, and APLU for stakeholder input.**
- **Cascade compliance related to the USDA Strategic Plan, NIFA Strategic Plan, USDA Research, Education and Economics Mission Area Action Plan, and the US Global Change Research Program Strategic Plan,**
- **Organizing and producing syntheses products in Agroclimate Science:** Syntheses products will be produced from, a series of project director workshops and symposiums on climate change to address the needs of the portfolio and provide a benchmark for the status of scientific knowledge, technological advances, and producer needs in agriculture and forestry. The syntheses activities would be led by NIFA funded scientists with possible support from NIFA and the USDA Global Change Program Office. The syntheses would include the science needed to implement a carbon trading system and for natural resource management to adapt to and mitigate climate change. The syntheses could also be the starting point for a sustained stakeholder input process.

VI. Sustained Adaptation Process

A. Agency steps for sustained planning

Climate Portfolio Review: NIFA conducts a portfolio review of its projects and programs to evaluate the program success in achieving goals for the environment and natural resources. The portfolio review makes use of NIFA's established knowledge areas of which Weather and Climate is one. In addition, a *National Institute of Food and Agriculture* based on climate change. A new portfolio review is a portfolio planning, assessment, and quality improvement plan.

Continuous Assessment through Post-Award Management of Climate Change Research, Education and Extension Projects to Identify Gaps: An inventory and assessment of climate change research, education and extension projects funded by NIFA is needed for advancing climate science and its delivery to intended users. The assessment would also include programs conducted by other USDA agencies to identify gaps and how NIFA's unique mission can fill those gaps. A reporting system designed to fit the needs of the inventory and stakeholder groups will need to be created.

Expand Climate Change Communities of Practice within eXtension: Climate change education and outreach has not yet been part of eXtension which has the capacity to reach a broad audience through its communities of practice. Resources related to consumer knowledge, carbon footprints and environmental markets are needed and should be developed. Significant efforts need to be made to soliciting these and other eXtension communities of practice for specific areas such as forest management, climate impacts on health, understanding carbon markets(such as cap and trade), and implementation of a National Climate Service.

B. Process for Prioritization

NIFA will establish a Core Set of Climate Change Priorities as a Component of multiple NIFA Portfolios: The portfolio management and competitive grants planning processes have been evolving to improve trans-disciplinary approaches to research, education and extension. The portfolio document, in particular, is becoming important for thematic planning purposes, in addition to its very important accountability function. Aligning portfolio outcomes to climate change will identify NIFA's investments in climate change research, education, and extension and facilitate the planning of future competitive and non-competitive grants. The quality of reporting would also improve as expected outcomes will be clearly defined in the solicitation planning process.

NIFA will establish a NIFA Science Priority-making Process for Climate Change: A climate science priority-making team with an established management structure and guidance from the NIFA science leadership council is needed to identify and manage a set of core climate change activities that cuts across agency programs and portfolios and would function as the central source of management for climate change research, education and extension activities. The collaborative team would be able to address portfolio goals as well as the planning of all competitive and non-competitive funding lines related to climate change managed by NIFA. A collaborative issue team would be composed of national program leaders, program specialists and support staff representing disciplinary and mission area expertise from across the agency and would be accountable to the senior leadership within NIFA. The team would be responsible for the development of criteria for competitive solicitations to achieve long-term outcomes. The collaborative issues team would be advised by the advisory group.

C. Sources of information for plan development

- External Advisory Group on Agriculture and Climate Change
- Diversified Stakeholder Base for New and Emerging Partners from industry and professional organizations
- Open Public Stakeholder Listening Sessions
- NIFA Project Directors Meetings
- NIFA Interagency Collaborations

National Institute of Food and Agriculture

- State Plans of Work and Annual Reports under the Hatch, and Evans-Allen Acts
- State Plans of Work and Annual Reports under the McIntire-Stennis Act

- State Plans of Work and Annual Reports under the Renewable Resources Extension Act
- State Plans of Work and Annual Reports under the Smith-Lever Act
- Consultation with the USDA Office of the Chief Scientist, the REE and NRE mission area agencies, the OCE Climate Change Program Office, and APLU
- 2013 President Climate Action Plan

D. Performance Metrics

- Climate Portfolio Review: The NIFA portfolio review process includes gap analysis and performance metrics to evaluate progress and improvement of climate projects funded by NIFA.
- External Advisory Group on Agriculture and Climate Change: The external advisory group will be part of an evaluation process of the science program planning.
- NIFA responses to the REE Action Plan on Climate Change progress through a scorecard method that tracks quarterly progress of projected accomplishments.
- NIFA responses to the annual call of agency accomplishments that is published in the
- Annual Report to Congress of the US Global Change Research Program
- NIFA contributions to the National Climate Assessment which is now a sustained assessment process.
- Federal Agency Climate Adaptation Plan elements outlined here.

National Institute of Food and Agriculture Climate Adaptation

Action Description	Action Goal	Agency Lead	Risk or Opportunity	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-governmental 1 Coordination	Resource Implications	Challenges / Further Implications	Highlights of Accomplishments
Maintain and expand Climate Change as a grand societal challenge for NIFA	Increase accessibility to funding opportunities	NIFA	Opportunity to advance the development of basic and applied science in agriculture to address climate issues	National	Ongoing	Agriculture and Food Research Initiative	Breadth and depth of portfolio of projects covering areas of need.	Not applicable	Existing and new resources	Farm Bill Resources	NIFA Climate Change Portfolio Strategic Plan completed
Maintain and expand priority areas in the Climate Change Challenge Area in AFRI	Increase areas of climate adaptation in agriculture	NIFA	Opportunity to develop regional based research to address regional climate impacts in agriculture and natural resources	National	Ongoing	Agriculture and Food Research Initiative	Amount of funds invested for climate change research, education and extension	Not applicable	Existing and new resources	Farm Bill Resources	Other AFRI Challenge Areas now include Climate Change priorities
Develop Climate Change programs at land-grant institutions	Increased capacity for climate science	NIFA	Opportunity to develop research, education and extension activities to address state-identified issues	National	Ongoing	Formula funds, Specials grants	Amount of funds invested for climate change research, education and extension	Association of Public and Land-grant Universities	Existing and new resources	Farm Bill Resources	Seven Climate Coordinated Agriculture Projects are supported by NIFA
Host and expand stakeholder listening sessions	Increased stakeholder input for priority making	NIFA	Opportunity to receive input to programs from stakeholders	National	Ongoing	NIFA Outreach	Number of participants reached through stakeholder sessions	Not applicable	Existing and new resources	NIFA Resources	Webinars for funding opportunities are held annually
Maintain Climate as a standing portfolio in NIFA	Increased opportunity for climate science	NIFA	Opportunity to evaluate progress, identify gaps and plan for climate activities funded by NIFA	National	Ongoing	NIFA Planning, Accountability and Reporting Process	Increased of Portfolio Implementation	Not applicable	Existing and new resources	Farm Bill Resources	NIFA Climate Portfolio Strategic Plan in 2 nd year of implementation
Establish Collaborative funding opportunities with other federal agencies	Increased funding capacity for climate science	NIFA	Opportunity to leverage funding for agriculture research in climate change	National	Ongoing	Memorandums of Understanding	Increased funds leveraged from other federal agencies	US Global Change Research Program	Existing and new resources	NIFA Resources	Memorandums of Understanding with NSF and DOE are currently in force
Conduct annual Project Director	Increased coordination of scientific investigation	NIFA	Opportunity to network and advance science for climate	National	Ongoing	Agriculture and Food Research Initiative	Increased number of publications and	Not applicable	Existing and new resources	NIFA Resources	Annual Project Directors Meeting have been held on schedule

National Institute of Food and Agriculture

meetings of NIFA funded and interagency projects			adaptation and mitigation				presentations of research projects.				
Work with extension for the translation and delivery of science to communities and decision makers	Increased delivery of science products	NIFA	Opportunity to deliver credible science and decision making tools to users	National	Ongoing	Agriculture and Food Research Initiative	Increased number of publications and presentations of research projects.	Association of Public and Land-grant Universities	Existing and new resources	Farm Bill Resources	Funding for extension projects is increasing.
Work with other USDA agencies and offices like the US Forest Service and the Climate Change Program Office on climate change science.	Increased coordination of scientific objectives	NIFA	Opportunity to better coordinate climate science research within USDA	USDA	Ongoing	Agriculture and Food Research Initiative	Increased number of coordinated research activities and opportunities within USDA	USDA Global Change Task Force	Existing and new resources	NIFA Resources	The USDA Climate Hubs is a coordinated effort at USDA.
Participation in the US National Climate Assessment	Increased assessment of knowledge gaps	NIFA	Opportunity to assess impacts of agriculture science on climate	National	Ongoing	USDA Global Change Task Force activity	Reduction in gaps of science and science delivery for agriculture	USDA Global Change Task Force	Existing and new resources	NIFA Resources	NIFA funded scientists contributed to the assessment
Support a robust Extension Disaster Education Network (EDEN) to increase Cooperative Extension's ability to decrease the impact of disasters through education.	Increased preparedness of communities for disaster management	NIFA	Opportunity for advancing climate science for risk management	National	Ongoing	Formula Funds	Increased number of communities trained in disaster preparedness	Cooperative Extension	Existing and new resources	Farm Bill Resources	EDEN network remains strong and is looking at potential collaboration with NOAA Sea Grant
Increase the agency's	Increased work	NIFA	Ability to notify employees of	NIFA HQ	Ongoing	NIFA supported activity	Increased number of	USDA HQ	Existing and new	USDA HQ Resources	Emergency notification system at NIFA is in place and annually tested.

National Institute of Food and Agriculture

ability to notify employees and gather status information in the event of a disaster in the national capital region.	capacity at HQ		hazards associated with workplace impacts of climate change				employees working under adverse conditions		resources		
Continue to increase the telework capacity and capability of the NIFA workforce and IT system.	Increased work capacity at HQ	NIFA	Ability to support continuation of NIFA’s activities under extreme weather	NIFA HQ	Ongoing	NIFA supported activity	Increased number of employees working under adverse conditions.	USDA HQ	Existing and new resources	USDA HQ Resources	All employees have telework agreements.
Refine continuity plans by incorporating scenarios for devolution to a majority telework environment.	Increased work capacity at HQ	NIFA	Ability to support continuation of NIFA’s activities under extreme weather	NIFA HQ	Ongoing	NIFA supported activity	Increased number of employees working under adverse conditions	USDA HQ	Existing and new resources	USDA HQ Resources	Increased training for supervisors for telework implementation.
Increase the employment of “virtual panels” as a method to decrease the process’s dependence on live meetings based in the national capital region.	Increased work capacity at HQ	NIFA	Ability to support continuation of NIFA’s activities under extreme weather	NIFA HQ	Ongoing	NIFA supported activity	Increased number of review panels working under adverse conditions	USDA HQ	Existing and new resources	USDA HQ Resources	Virtual panels now account for 50% of all review panels at NIFA.

USDA Natural Resources Conservation Service
Climate Change Vulnerability Assessment and
Adaptation Plan 2014

**USDA-National Resources Conservation Service
Climate Change Vulnerability Assessment
and Adaptation Plan**

Introduction

The Earth is undergoing climate change driven by human activities that are altering the Earth's surface and atmospheric composition. Conservation can serve as a gateway to a more resilient landscape that also efficiently sequesters atmospheric carbon in the terrestrial ecosystem. More than 70% of the land surface in the United States is privately owned, and the Natural Resources Conservation Service (NRCS) is the primary Federal conservation agency working with private landowners to preserve and enhance our Nation's natural resources. Actions must be taken in order to prepare these landowners for the inevitable impacts of climate change. NRCS is a dynamic, action-oriented agency with a mission and reputation for assisting citizens in land management and addressing natural resource concerns. These actions will require a substantial devotion of resources and effort by NRCS leadership over the next decade, yet this issue also presents an opportunity for our agency. We can assist landowners in both adaptations that will develop more resilient soils, and also to assist in mitigation strategies that reduce present and future atmospheric greenhouse gas (GHG) concentrations.

The anticipated impacts of climate change on private lands in coming years and decades will necessitate that NRCS place additional emphasis on actions that explicitly address climate change. NRCS is already well positioned to address (via adaptive strategies) soil quality, landscape stability, extreme weather events, climate variability, natural disasters, and other issues. The point at which existing systems are transformed will vary based on the interaction of climate change and variability of factors such as land use, land fragmentation, water availability, and energy costs. NRCS can work with a variety of research and development partners, as well as affected producers, to identify 1) land use alternatives, 2) land management systems, and 3) conservation priorities necessary to protect natural resources.

NRCS is committed to helping landowners develop coping mechanisms for climate-related impacts in coming years. This adaptation plan details the current conservation adaptation and mitigation efforts and includes an evaluation of NRCS infrastructure that may be impacted by climatic changes and/or extreme weather events associated with a changing climate. The report is designed to help NRCS management and employees understand and better prepare for current and future changes in the climate that impact all aspects of the environment and day-to-day operations. NRCS has set a goal of developing sub-national climate change adaptation and mitigation reports that will be consistent with the newly-formed USDA regional hubs and the U.S. Global Change Research Program's regions and sectors. Over the coming decades, NRCS technical assistance can help to transform vulnerable U.S. working lands to a more healthy and resilient landscape. NRCS is committed to delivering the necessary assistance to address emerging issues and resource concerns to helping private landowners manage their lands in ways that are more resilient to future environmental changes.

Policy Framework for NRCS Adaptation Planning

In October 2009 Executive Order (EO) 13514 (*Federal Leadership in Environmental, Energy, and Economic Performance*) was issued with a stated goal "...to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies." Following up on this EO, the President's Council on Environmental Quality (CEQ) issued *Implementing Instructions for Federal Agency Climate Change Adaptation Planning* in March

Natural Resources Conservation Service

2011 that provided guidance on how each Department and Agency should conduct a climate change vulnerability assessment and develop an adaptation plan. Shortly thereafter on June 3, 2011, USDA Regulation 1070-001 established a USDA-wide directive to integrate climate change adaptation planning and actions into USDA programs, policies, and operations. The Department Regulation directed each Agency within USDA to identify potential impacts of climate change on agency missions, programs, operations, policies, and authorities—and also include potential budget impacts.

In June 2013, The President's Climate Action Plan (CAP) was released with three key objectives: to cut carbon pollution in America; to prepare the U.S. for impacts of climate change; and to lead international efforts to combat global climate change. Initiatives to guide these objectives were to build stronger and safer communities and infrastructure, protect our economy and natural resources, and to use sound science to manage climatic impacts. NRCS plays a key role in addressing the CAP initiatives.

Plans in which NRCS is directly involved include removing barriers that hinder the support of climate-resilient investments, especially in the area of natural resource management. NRCS will ensure that there is connectivity throughout our Agency to the citizens of the U.S. to achieve these goals in both rural and urban communities. NRCS must become familiar with climate change vulnerabilities, and future conservation actions must be taken to protect agricultural enterprises, water supply, forests, air quality, wildlife, and public lands. The President's CAP directs NRCS to continue to develop, improve, and protect our natural resources, and to use those natural resources to minimize the impacts of climate change-related events.

NRCS is directly involved in ensuring agricultural sustainability through our partnership with other USDA agencies in the USDA Regional Climate Hubs to help deliver important science-based knowledge to farmers, ranchers, and forest owners. Along these lines, the President's CAP supports the grants and technical support NRCS provides for agricultural producers to develop more water efficient practices. And finally, the involvement of NRCS in the National Drought Resilience Partnership (established in the President's CAP) is a key to developing long-term resilience strategies and drought preparedness for U.S. citizens and producers.

To further develop the preparedness and resilience documented in the President's CAP, EO 13653 (*Preparing the United States for the Impacts of Climate Change*) was issued in November 2013 with the objective to modernize Federal programs for climate change. This EO encourages Federal agencies to engage in strong partnerships across all levels of government to promote information sharing and availability, create tools to make informed climate-preparedness decisions, use adaptive learning from past experiences to better prepare for the future, and for general preparedness planning. Part of EO 13653 is a self-examination or evaluation of agency infrastructure to determine weaknesses that may be faced during an extreme weather event or to prepare for the adaptive management associated with climate change and associated extreme weather events. The results of this evaluation will be an established process to identify potential changes, adapt to increasing weather variability, to reduce atmospheric concentrations of GHGs, and prepare to adapt to inevitable changes.

In order to adequately prepare NRCS for the future impacts, an NRCS Climate Change Coordination (CCC) Team was formed in December 2011. The initial purpose of the CCC Team in 2011 was to complete an assessment of NRCS's vulnerability to climate changes, and provide possible adaptation action items to NRCS leadership. Twenty NRCS staff composed the CCC Team, including three from state NRCS offices, with other members from Technology Centers and offices at National Headquarters (NHQ). Within the NRCS CCC Team, eight sub-teams were formed to assess potential natural resource impacts from changes in climate, and to evaluate how these impacts might affect NRCS operations. Sub-teams were formed around the major SWAPA+H,E conservation resource concerns. Each sub-team investigated the various intersections of resource issues with land use categories, and the sub-team reports

Natural Resources Conservation Service

formed the basis for the 2012 summary report. This report has grown from that CCC Team's efforts. The first USDA-NRCS Climate Change Vulnerability Assessment and Adaptation Plan (May 2012) is posted on the USDA website: http://www.usda.gov/oce/climate_change/adaptation/adaptation_plan.htm

The NRCS CCC Team currently consists of 11 members (see Appendix), representing the Soil Science and Resource Assessment, Science and Technology, Management, and Programs Deputy Areas, as well as the Regional Conservationists' Offices. The current task of this team has been to prepare an updated report addressing information required by EO 13653.

This document (NRCS Climate Change Vulnerability and Adaptation Plan) is a revision and extension of the 2012 Adaptation Plan and consists of five parts that address components of climate change adaptation guidance provided by the President's Council on Environmental Quality:

Part 1: Identification and assessment of climate change-related impacts on and risks to NRCS's ability to accomplish its missions, operations, and programs. (*EO 13653 Section 5(a)(i)*)

Part 2: Description of programs, policies, and plans NRCS has already put in place, as well as additional actions the Agency will take, to manage climate risks in the near-term and build resilience in the short- and long-term. (*EO 13653 Section 5(a)(ii)*)

Part 3: A description of climate change related risks identified to be so significant that it would impair NRCS's statutory mission or operation, including the Agency's existing reporting requirements. (*EO 13653 Section 5(a)(iii)*)

Part 4: A description of how NRCS will consider the need to improve climate adaptation and resilience, including the costs and benefits of such improvements, with respect to agency suppliers, supply chain, real property investments, and capital equipment purchases such as updating Agency policies for leasing, building upgrades, relocation of existing facilities and equipment, and construction of new facilities. (*EO 13653 Section 5(a)(iv)*)

Part 5: A description of how NRCS will contribute to coordinated interagency efforts to support climate change preparedness and resilience at all levels of government, including collaborative work across Agencies' regional offices and hubs, and through coordinated development of information, data, and tools. (*EO 13653 Section 5(a)(v)*)

PART 1: Conservation in the Context of Climate Change

NRCS has a rich history of addressing environmental challenges on private working lands through a customized location-specific prescription of conservation practices. From wind erosion during the Dust Bowl era to more recent issues like aquatic nutrient-loading in sensitive water bodies, NRCS is tooled to address natural resource concerns and environmental degradation that result from both human-induced and natural disasters. Through the years NRCS has refined its analytical problem-solving methodologies and developed a robust suite of conservation practices that allow planners to turn environmental challenges into conservation opportunities. Climate change vulnerability and adaptation presents NRCS with a substantial conservation challenge, yet NRCS has tools in our toolbox for addressing conservation challenges like a changing climate.

Agricultural producers in the United States are on the front lines of climate change adaptation. NRCS will be required to implement conservation practices in a manner that is more considerate of emerging

Natural Resources Conservation Service

changes invoked by a shifting global climate. This comprehensive report of actions and evaluation of future ecosystem challenges is built on a solid conservation foundation and utilizes many advantages of NRCS's dynamic conservation legacy, including our established conservation practices and program delivery mechanisms.

An examination of current climate data used in NRCS and the likely data updates and enhancements needed over the next 40 years was conducted as part of NRCS's 2012 study. These conditions used in that evaluation have not changed since the 2012 report and provide a consistent evaluation framework for examining climate vulnerabilities and providing possible adaptation strategies at a national scale. Temperature and precipitation changes were largely consistent with those from various modeling efforts, including synthesis products from the Intergovernmental Panel on Climate Change (IPCC). If anything, the scenarios selected for this report were toward the higher end of the envelope of possible changes in order to provide a more thorough examination of impacts. The assumptions for this analytical exercise were:

- Analytical timeframe of approximately 40 years (2014 – 2050)
- Mean annual temperature 2.0⁰ C (3.8⁰ F) above current in 2050 – approximates to 4.0⁰ C by 2100
- Mean annual extreme minimum temperature (plant hardiness) 2.0⁰ C (3.8⁰ F) higher than current
- Mean annual precipitation -20% and +20% of current
- Precipitation amount 20% greater for all duration-frequency combinations

The direct effects of atmospheric CO₂ concentration increases on plants (CO₂ fertilization) was considered, using an assumed 2050 atmospheric CO₂ concentration of 430 ppmv, or an approximately 8% increase over current atmospheric CO₂ concentrations. The spatial resolution of this assessment is currently all states and U.S. territories, and all major land uses (crop, range, forest, etc.). The U.S. land area is very diverse; there certainly is a need for subdividing this report into similar climatic regions. The Climate Change Coordination Team recommends that future reports be subdivided into similar climatic regions.

Key Climate Change Impacts: Agricultural and Natural Resource Impacts

Key climate change vulnerabilities in the U.S. over the next 40 years are associated with projected increases in temperature across the entire country, with the most notable increases expected to occur in the coldest winter temperatures over interior and northern Alaska and across the northern tier of interior continental U.S. states. The Nation's heartland is going to get warmer, even on the coldest nights.

The coastal regions of the continental U.S. are expected to warm less rapidly than inland regions due to oceanic influences. Above normal temperatures are expected to occur more frequently throughout much of the country. Higher night time temperatures and higher annual extreme minimum temperatures are the most likely temperature changes, especially in more northern latitudes of the United States. Coastal storms, especially of tropical origin, are expected to increasingly contain damaging winds leading to greater extreme wave heights (storm surges) and coastal damage.

A warming climate is expected to reduce snow cover as well as the timing, duration, and magnitude of mountain snow water supply. Freezing elevations are expected to rise, causing low-elevation snowpack decline. Climate change is expected to modify the amount, intensity, timing, and location of precipitation. Increased precipitation intensity is expected to produce more frequent flood-producing storms. Changes in the frequency and duration of drought and flooding will also occur. Sea levels are

Natural Resources Conservation Service

projected to rise 6 to 8 inches over the next 40 years. Hurricane rainfall and storm intensity are expected to increase in response to climate change and additional heat in the atmosphere.

These anticipated changes in climate will have a variety of impacts on both agricultural production and natural resource management in the United States. Natural resource impacts will be driven by the underlying time scale of phenomena and the actual physical and ecological changes. For example, changes in the statistically-computed extreme 24-hour precipitation amounts may result in enhanced engineering for water control structures. Changes in the maximum 24-hour precipitation amounts will require changes in NRCS engineering designs. These transitions will occur gradually and the engineering staff will rely on changes in precipitation data as it is made available. It will become more necessary to perform detailed risk-based analyses of associated changes in magnitude and duration of flooding for large-scale projects. Changes in mean annual precipitation will be expressed in long-term changes in water supply, perennial vegetation, cropping systems, soil moisture, and groundwater recharge. NRCS will leverage the expertise at the USDA Regional Climate Hubs to help develop regional climate change adaptation strategies and lead enhanced GHG mitigation measures.

Impacts were examined in this evaluation for their relevancy to NRCS conservation work on private lands. Those impacts meeting this criterion of relevancy are the focal points of this plan. These impacts were assessed for their likelihood of occurrence in the next 40 years. Significant agricultural and natural resource impacts identified in this assessment include:

Precipitation Changes and Impacts on Water-related Issues

- increased soil erosion potential due to increased precipitation intensity and amount
- water supply challenges in areas already water-stressed, including the Southern Plains and the Southwest where drought is likely to become more frequent
- greater flood potential from increased precipitation frequency, duration, amount and intensity, especially in the East and Midwest
- water management challenges in the irrigated West—including amount and timing of water—due to changes in snowpack and snowmelt, with consequent impacts on water rights, fisheries, hydroelectricity, and others
- greater potential for water quality impairments in some areas due to increased sedimentation and nutrient loading
- increased salinization of near-coastal waters due to rises in sea level and greater storm activity

Temperature Effects

- changes in plant adaptability in specific locations, such as plant hardiness zone movements and shifts in crops
- increased stream and lake temperatures impacting fisheries and other biological processes
- increased pest and disease pressures due to temperature changes, in some regions including native and exotic pests
- changes in insect activity, including frequency, intensity, and location (including pollinators)
- greater ground-level ozone concentrations due to slightly warmer temperatures, and expansion of ozone nonattainment areas
- increased cooling-related energy demands in the warm months, including confined animal feeding operations
- increased energy demands associated with greater irrigation requirements
- increased melting of permafrost in transition zone regions in Alaska
- decreased soil moisture due to increasing rates of evapotranspiration
- decreased winter snowpack in the mountains due to a shift in the rain/snow transition zone and more rain-on-snow events

Other Possible Impacts

Natural Resources Conservation Service

- increased management concerns with manure and nutrient management to minimize the negative impacts of water quality and air emissions
- greater drought stress on rangelands used for grazing and negative impacts on range plant health
- increasing problems for livestock production due to forage supply uncertainty, including milk production and dairy-associated cooling costs
- possible extinction or certainly greater stress on endangered plant and animal species
- forested land health stresses due to climatic changes and pest pressure
- increased competition from weed and invasive plants
- wildlife/fish species and habitat changes due to climatic changes
- soil health challenges due to erosion increases and changes in soil chemical and biological processes
- increased wildfire risk in some areas due to moisture deficits and changes in pest and disease stress

Potential Impacts to Agency Operations

NRCS recognizes that impacts from climate change will influence NRCS's ability to deliver its programs. Shifts in weather patterns may also diminish the performance of past and current conservation efforts unless steps are identified and implemented to modify these legacy Federal investments.

NRCS has offices in every State, the Pacific Islands Area, and the Caribbean Area. As of January 2014, NRCS employed about 10,150 full time staff. While nearly 400 employees are based in the four offices in the Washington, DC metropolitan area, more than 95% of NRCS staff is located outside of the DC area. Those staffs are distributed among more than 2,600 offices across the Nation and across the organization. Field offices include Centers, State Offices, Service Centers, and Support Offices. NRCS has the benefit of an inherent resilience to local or regional disaster or disruption because staff is widely geographically distributed. Only a national-scale event (total or near-total electric grid failure, for example) is likely to incapacitate NRCS.

Continuous NRCS Climate Change Risk Assessments

Over the past 75 years, NRCS has developed a proficient and robust conservation delivery system to help private landowners address environmental challenges while maintaining economic viability and ecosystem health. With climate changes occurring, sustainable solutions are even more important to ensure agricultural systems remain productive and natural resources are preserved and enhanced.

Climate simultaneously impacts many resources that necessitate comprehensive and holistic approaches to conservation planning. This situation requires many disparate entities within NRCS working together to find solutions. For example, NRCS maintains hundreds of conservation practice documents that include practice standards, handbooks, manuals, technical notes, and many others. Every year, approximately one-fifth of these documents and associated background materials are reviewed and updated to ensure that they reflect the latest scientific knowledge and technology. From 2013 through 2017, all such document reviews will include the perspective of the potential impacts of climate change and extreme events on the integrity of the recommendations/guidelines provided in each document. For example, climate change predictions will be used to evaluate the adequacy of engineering design parameters (e.g. for animal manure storage lagoons) in light of extreme climate-induced weather events.

NRCS conducts three recurring, national-scale assessments to determine the status of the Nation's natural resources and to identify changes in extent and condition over time at a variety of scales. The Natural Resource Inventory (NRI) is a statistical survey of land use and natural resource conditions and trends on U.S. non-Federal lands. Data collection is continuous and updates are released every five years. Data from the NRI can be used to describe state trends, as well as regional and national trends. The Resource

Natural Resources Conservation Service

Conservation Act (RCA) Appraisal provides an overview of land use and the U.S. agricultural sector; of the status, condition, and trends of natural resources on non-Federal lands; and of USDA's program for soil and water resources conservation. It also examines interrelated issues that have implications for U.S. agriculture and forestry: climate change, biofuels production, and the quality and availability of water. The RCA appraisal is updated every five years and is a broad-based, strategic national assessment. The Conservation Effects Assessment Project (CEAP) is a multi-agency effort to quantify the environmental effects of conservation practices and programs and develop the science base for managing the agricultural landscape for environmental quality. CEAP studies are conducted on a watershed scale (from small 12- to 8-digit watersheds up to large watersheds such as the Chesapeake Bay Watershed or Upper Mississippi River Basin). The results of these assessments will continue to inform NRCS's work to deliver conservation that addresses current and future resource concerns.

PART 2: NRCS Adaptation Actions

NRCS is the principal Federal agency that provides technical and financial conservation assistance to private landowners. Much of this assistance can be interpreted as addressing climate change, both through adaptation (greater resiliency to climate variability to minimize risk associated with extreme weather events or changing climate in a region) and mitigation (via reduced greenhouse gas emissions and/or increased carbon sequestration). The following is a description of current activities and contributions NRCS will provide to address climate change within agency operations.

Conservation Program Delivery

The primary mechanism that NRCS has for addressing climate change adaptation is through its conservation programs. Climate change adaptation and mitigation is a growing priority in conservation program delivery. With 70% of the United States land base in private ownership, NRCS is strategically positioned to provide leadership in addressing the climate change issues. NRCS will pursue this opportunity through its technology, programs, assessments, and nationwide field conservation network.

Conservation Innovation Grants

The NRCS ***Conservation Innovation Grants (CIG) Program*** enables USDA to accelerate technology transfer and adoption of promising technologies and approaches to address some of the Nation's most pressing natural resource concerns. More can be learned about the CIG program at <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/>.

Emerging environmental markets and the valuation of ecosystem services may offer a unique opportunity for U.S. agriculture to harness a new revenue stream from corporate entities. Shareholders and CEOs are beginning to realize the multi-faceted co-benefits of conservation and agriculture-based carbon projects. Recipients of NRCS CIG funding are exploring conservation opportunities and identifying NRCS conservation practices that can generate carbon credits and provide additional value to agricultural producers. For example, in 2011 NRCS awarded more than \$7.4 million in nine CIGs that reduce greenhouse gas emissions or sequester carbon, and demonstrate transactions in emerging carbon markets (voluntary and regulatory). All grant recipients were tasked with originating agriculture-based carbon credits, verifying and certifying the credits, and then completing a credit transaction in the voluntary or compliance marketplace.

In late 2012, NRCS announced the availability of funds from the CIG Program to address drought. Focus areas included projects that demonstrated and quantified innovative cropping or grazing systems that used water-conserving crops, provided innovative cultural practices that increased drought tolerance, demonstrated innovative approaches to increased water use efficiency to increase drought resilience, and demonstrated nutrient management practices to protect water quality following an extended drought. In

Natural Resources Conservation Service

FY 2013, NRCS provided \$10 million in EQIP (Environmental Quality Incentives Program) funding distributed across 13 states to enable recipients of the greenhouse gas CIGs to further engage producers.

Grants will serve as demonstration projects for emerging environmental markets [See **Adaptation Actions Table; aligns with President’s CAP (Conserving Land and Water Resources); USDA Strategic Goal Objectives 1.1 (Enhancing Rural Prosperity) and 2.2 (Lead Efforts to Mitigate and Adapt to Climate Change); and NRCS Strategic Goal Objectives 1.1 (Advance the Performance of Voluntary, Incentive-based Conservation Solutions) and 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)**]. Three greenhouse gas CIG projects focus on nitrogen use efficiency and reducing emissions of nitrous oxide, a potent greenhouse gas, from row crops. The Fertilizer Institute, the Delta Institute, and the Chesapeake Bay Foundation all have nitrogen management projects underway that leverage EQIP resources. In 2013 these project participants worked closely with NRCS to implement and test these emerging nitrogen management techniques.

From 2013-2015, NRCS CIGs will support development of a model that accounts for the impacts of organic material chemical composition (e.g. crop residue and animal manure lignin, cellulose, carbon, nitrogen, air quality, etc.), organic material placement, temperature, water, soil particle size, and mineralogy on rates of soil carbon sequestration and its relationship with soil available water-holding capacity. As some models already exist that account for some of these variables on crop residue decomposition and soil organic matter, the most pressing and remaining step is to quantify and model the relationships between soil organic matter content and available water-holding capacity for a range of soils. This will allow prescribing particular crop rotations, cover crops, green manures, animal manures, and tillage practices for specific soils and regions in order to increase soil resiliency to both drought and heavy precipitation.

National Soil Health Campaign

NRCS launched an integrated campaign in 2012 to increase the adoption of Soil Health Management Systems (SHMS) among America’s farmers and ranchers. This campaign has the potential to lead to systemic, continental-scale improvements in soil, water, air, plants, livestock, and wildlife – all while reducing greenhouse gas emissions, increasing carbon sequestration, and enhancing long-term agricultural productivity.

A central tenet is enhancing a given soil’s capacity to function as a living system. This inherently includes increasing soil carbon sequestration (e.g. increasing soil organic matter), and the co-benefits of increasing resilience to drought, heavy precipitation, and extreme temperatures by increasing a soil’s available water holding capacity and water infiltration. Additional benefits accrue from using less petroleum based products (fewer greenhouse gas emissions) for tillage, fertilizer, and/or pesticides.

NRCS is focusing on several functional areas to encourage and facilitate the widespread adoption of SHMS that increase resiliency to climate change and reduce greenhouse gas emissions [See **Adaptation Actions Table; aligns with President’s CAP (Conserving Land and Water Resources); USDA Strategic Goal Objectives 2.1 (Restore and Conserve the Nation’s Forests, Farms, Ranches, and Grasslands) and 2.2 (Lead Efforts to Mitigate and Adapt to Climate Change); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)**]. Those areas include: developing specific SHMS conservation practice criteria; training and preparing the NRCS workforce; developing tools for assessment and interpretation of soil health status; integrating Agency programs and planning to facilitate SHMS adoption; and developing and implementing a soil health awareness and education campaign.

In addition, soil scientists (led by National Soil Survey Center staffs of Interpretations, Technical Soil Services, Soil Ecology, and Research and Laboratory) have **proposed to develop “fragile soil**

indicators” for the different ecological regions, to help recognize soils more vulnerable or susceptible to climate change [See Adaptation Actions Table; aligns with USDA Strategic Goal Objective 2.1 (Restore and Conserve the Nation’s Forests, Farms, Ranches, and Grasslands); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)]. Soil health assessment tools can be used as one basis of criteria. Interpretations may be developed as to specific soil health measures that can be used to minimize vulnerability, and interpretative maps developed across ecoregions for classes of these soils. Plant Material Centers can be used to develop targeted plant materials. Subsequently, Resource Soil Scientists and Soil Conservationists can do cooperative work to apply these technologies and assist land owners.

Landscape Conservation Initiatives

NRCS has implemented a broad spectrum of initiatives since January of 2009. These initiatives enable NRCS to more effectively address priority natural resource concerns by delivering systems of practices to the most vulnerable lands within geographic focus areas. Through these initiatives, NRCS seeks to accomplish (1) **Conservation beyond boundaries** (some landscape-scale natural resource concerns, such as species conservation and water quality, cannot be treated effectively based on geo-political boundaries); (2) **A science-based approach** (the Conservation Effects Assessment Project (CEAP) indicates the most effective way to increase protection of natural resources is to target conservation to the most vulnerable or valuable areas and to apply a systems rather than a practice-by-practice approach; (3) **Enhancement of existing locally-led efforts and partnerships** — NRCS seeks to maximize the success of initiatives by leveraging partner interest and resources through programmatic and other tools; and (4) **Regulatory certainty for agricultural producers** — Where applicable, NRCS is working with regulators so agricultural producers can have certainty that the voluntary conservation systems they implement are consistent with current and potential regulations, as well as sustained agricultural production.

Landscape Conservation Initiatives have been developed to address resource concerns such as water quantity (Bay Delta Initiative, Gulf of Mexico Initiative, and Ogallala Aquifer Initiative), soil and water quality (Mississippi River Basin Healthy Watersheds Initiative, Chesapeake Bay Watershed Initiative) and loss of habitat that includes wetland and forest habitats (Everglades Initiative, Northern Plains Migratory Bird Habitat Initiative, New England/New York Forestry Initiative, Long Leaf Pine Initiative, North Central Wetlands Conservation Initiative, and Red River Initiative). These initiatives increase the resiliency of the landscape and may have a significant impact on agriculture’s ability to adapt to the effects of climate change. **We plan to use regional assessment tools like CEAP to evaluate possible climate change impacts on targeted initiative outputs such as water quality** [See Adaptation Actions Table; aligns with President’s CAP (Conserving Land and Water Resources); USDA Strategic Goal Objectives 2.1 (Restore and Conserve the Nation’s Forests, Farms, Ranches, and Grasslands) and 2.3 (Protect and Enhance America’s Water Resources); and NRCS Strategic Goal Objective 1.1 (Advance the Performance of Voluntary, Incentive-based Conservation Solutions)].

Conservation Practice Standards

Conservation Practice Standards, along with the Conservation Planning Process, are the foundation of NRCS’s technical assistance program. NRCS’s Conservation Practice Standards are used by local, state, and Federal government agencies as well as by non-governmental organizations engaged in working lands conservation. NRCS conservation practices are being examined for 1) inherent climatic assumptions or data in relevant practice standards, and 2) modifications that might be needed in light of possible climate changes. Conservation practice standards (http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/references/?cid=nrcs143_026849) are dynamic and are reviewed and updated at a minimum of every 5 years. **This established review process is seen as a natural advantage for NRCS when evaluating future climate changes** [See Adaptation Actions Table; aligns with President’s CAP (Conserving Land and Water Resources);

Natural Resources Conservation Service

USDA Strategic Goal Objectives 2.1 (Restore and Conserve the Nation’s Forests, Farms, Ranches, and Grasslands) and 2.3 (Protect and Enhance America’s Water Resources); and NRCS Strategic Goal Objective 1.1 (Advance the Performance of Voluntary, Incentive-based Conservation Solutions)]. 35 of these Conservation Practice Standards were identified as having particularly positive benefits to reduce greenhouse gas emissions and increase carbon sequestration: <http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/air/?cid=stelprdb1044982>. This knowledge allows conservation planners to readily choose practices to reduce greenhouse gas emissions and/or increase carbon sequestration.

Other Programs and Assets

Plant Materials Centers

The NRCS network of geographically distributed Plant Materials Centers is already positioned to contribute regionally-adapted plants that increase carbon sequestration, increase nitrogen fixation, enhance soil health, reduce runoff, increase soil water-holding capacity, increase bioenergy production, provide wildlife habitat (including pollinators), enhance drought tolerance, reduce soil-borne diseases, and provide numerous other contributions to regional climate change hubs. Plant Materials Centers, with support from the National Soil Survey Center, has started **a coordinated evaluation of different combinations of cover crop species mixes and tillage practices across climates, soils, and cropping systems** [See Adaptation Actions Table; aligns with USDA Strategic Goal Objectives 2.1 (Restore and Conserve the Nation’s Forests, Farms, Ranches, and Grasslands) and 2.3 (Protect and Enhance America’s Water Resources); and NRCS Strategic Goal Objectives 1.1 (Advance the performance of Voluntary, Incentive-based Conservation Solutions) and 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)]. These centers seek to identify optimal combinations of cover crop mixes and management practices to increase soil carbon sequestration and drought resilience through enhanced soil health. These field evaluations serve as a training ground for NRCS field staff and to transfer technology to farmers and ranchers to increase adoption of these conservation practices for reducing greenhouse gas emissions and increasing carbon sequestration. The evaluations are planned for 2013-2016; however, it is NRCS’s goal to make these field projects an invaluable resource for training and technology transfer.

Snow Survey and Water Supply Forecasting Program

The NRCS Snow Survey and Water Supply Forecasting Program (SS/WSF) in the western U.S. provides important historical, current, and projected information on western snowpack, precipitation, stream flow, and water supply. As part of this effort, NRCS maintains the SNOw TELemetry (SNOTEL) network of 885 stations located in 13 States (including Alaska) and transmits snowpack and climate data hourly. The data collected at many of these sites includes snow depth, snow water equivalent, temperature, precipitation, relative humidity, solar radiation, wind speed and direction, and barometric pressure. In addition, many of the SNOTEL sites measure soil moisture and soil temperature at various depths. This is a critical source of high-elevation climate data for the mountainous West and is used extensively in climate change studies. In addition to the automated SNOTEL sites, there are over 1,000 manual snow courses providing snowpack and snow water equivalent data on a monthly basis during the winter and spring throughout the West, and many have extremely long and valuable historical records. Many climate groups, such as NIDIS (National Integrated Drought Information System), identify the NRCS Snow Survey as a major source of climate data for the U.S. These data are also used extensively in stream flow forecasting and water management by many Federal, State, local, and private entities. **These data, analyses, and forecasts make a valuable contribution to climate and water resources management for the regional hubs** [See Adaptation Actions Table; aligns with President’s CAP (Managing Drought); USDA Strategic Goal Objective 2.3 (Protect and Enhance America’s Water Resources); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)].

Natural Resources Conservation Service

NRCS operates the Soil Climate Analysis Network (SCAN) in 40 States and U.S. Territories. SCAN consists of 193 stations similar to SNOTEL that collect climate parameters, along with soil moisture and soil temperature at various depths below the surface. Soils can store large quantities of water, and greatly impact whether snowmelt and rainfall either infiltrate the subsurface or become runoff. Soil moisture and soil temperature relate closely to carbon storage, plant health, evapotranspiration, and drought determination. SCAN data are valuable input for making management decisions (e.g. planting, irrigation, fertilization, and harvest dates), drought assessment, soil climate and trends assessment, and flood forecasting. **These networks make significant contributions to drought assessment and monitoring, and predicting changes in climate** [See Adaptation Actions Table; aligns with President's CAP (Managing Drought); with USDA Strategic Goal Objective 2.3 (Protect and Enhance America's Water Resources); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)].

NRCS plans to continue these data collection and analysis activities. Currently, there is inadequate funding to maintain the current SCAN and SNOTEL monitoring sites and support the data analyses and forecasts at the NRCS National Water and Climate Center. This program is critical to drought assessment, water resource planning, energy management for irrigation scheduling, commodity crop predictions, and ecological site planning in the Western States. It is also part of the soil moisture network that is a cornerstone of the newly initiated National Drought Resilience Partnership. Funds must be increased to maintain existing sites, expand the networks to new locations as needed, develop data management infrastructure, and support thorough and high quality data analyses and water supply forecasts. Sites are proposed for the permafrost regions of Alaska, an area heavily impacted by climate change. Another long term (14-year) NRCS study of frozen soils has been performed in Antarctica in collaboration with LandCare Research and the University of Waikato of New Zealand. This study requires continued NRCS support for their effort to understand the fundamental properties and mechanics of cold and frozen desert soils, and to study the impacts of climate change on the soil active layer and upper permafrost.

Ecological Site Information

Ecological sites or ecosystems describe unique combinations of climate, soils, and plants. As climatic drivers change conditions across any region, alternative ecosystem states may develop. **Efforts are underway to develop ecological site plans by region across the U.S.** [See Adaptation Actions Table; aligns with President's CAP (Conserving Land and Water Resources); USDA Strategic Goal Objectives 2.1 (Restore and Conserve the Nation's Forests, Farms, Ranches, and Grasslands) and 2.3 (Protect and Enhance America's Water Resources); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)].

Ecological Site Descriptions (ESDs) are descriptions of how soils and vegetation respond to changes in climate and management. ESDs are based on groupings of soils and include information divided into two separate, but related sections:

- a description of states (vegetation and soils in the ecosystem) and transitions (pathways of soil and vegetation alterations that develop when that environmental change occurs; and
- ecological site values (such as forage or timber production, wildlife habitat, hydrologic yield etc.) associated with different discrete states that the soils and vegetation may provide.

ESDs go beyond basic soil survey information. They describe how important soil processes (infiltration, nutrient-holding capacity) change when vegetation changes, and they also express the probability of change in soil and vegetation properties associated with specific management practices. These probabilities, usually expressed categorically (high, medium, low) give guidance as to the risks and benefits associated with implementing a specific management option to achieve desired objectives.

Natural Resources Conservation Service

The soil-to-vegetation ratio information in ESDs can be very useful in estimating how changes in management or climate will affect soil carbon storage. Vegetation structure (shrub-to-grass ratio, species composition, soil disturbance) are important determinants of the amount of carbon stored in the soil on range and forest lands. In addition, the probability of maintaining that carbon in the soil and vegetation can be assessed in terms of the risk of wildfire.

ESDs are also a potentially invaluable technology to provide information for climate change adaptation. The ecological dynamics (including management) of a site respond to changes in climate, which in turn require management responses. While regional and state-wide analysis are important, eventually, conservation decisions must be made, implemented, and evaluated on a site-specific basis. Without an accurate working model for the interactions of climate and management, it is impossible to make cost-effective decisions.

Watershed Rehabilitation Program and Small Watershed Program

NRCS, in partnership with local watershed sponsors across the country, has constructed over 11,000 small dams to reduce the impacts of extreme precipitation and drought. By reducing peak runoff from extreme precipitation events and storing water during extended droughts, these Small Watershed Program dams reduce flood damages and provide critical water supply to agricultural producers and rural communities. Many of these dams are at the end of their designed life or no longer meet state or federal dam safety criteria. The Watershed Rehabilitation Program helps watershed sponsors restore these dams so they can continue to provide relief from the impacts of weather extremes and provide stronger and safer rural communities. In just one extreme precipitation event, Hurricane Irene, NRCS funded small watershed dams reduced flood damages to agricultural producers and local communities by about \$40 million.

In addition to the 11,000 dams constructed through the Small Watershed Program, NRCS has completed numerous non-structural watershed project measures to reduce flood damages. These projects include measures such as the relocation of buildings and infrastructure from the floodplain, “flood proofing” existing buildings and infrastructure, and purchasing floodplain easements to restore floodplain functions. In turn, healthy, functioning floodplains provide natural extreme weather buffers by receiving and storing flood water during extreme precipitation and providing water in wetlands and moist floodplain soils during extended droughts. NRCS evaluates the economic, social, and environmental impacts of extreme weather mitigation alternatives, and often uses a combination of structural and non-structural measures to optimize the federal investment in these locally led projects.

Data and Databases

NRCS manages, maintains, and delivers several national and regional datasets useful to the identification and assessment of climate change impacts. In addition, NRCS, in cooperation with a variety of partners, has developed a series of planning tools that can help land owners, land managers, and others estimate the effect of conservation practices on water quality, water quantity, and carbon sequestration.

NRCS is currently working on plans to **modify critical databases in order to create delivery systems that will simplify access to data and reports** [See Adaptation Actions Table; aligns with President’s CAP (Launching a Climate Data Initiative); with USDA Strategic Goal Objective 2.1 (Restore and Conserve the Nation’s Forests, Farms, Ranches, and Grasslands); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)]. Most data is freely and publically available in some format (data or reports). As part of the effort to provide information, data, and tools for climate change preparedness and resilience, **we propose to include these data sets in the proposed website “climate.data.gov” (See Adaptation Actions Table).** The first three

Natural Resources Conservation Service

listed below are currently posted in www.data.gov, but the others can be ready sources of data or interpretations of these data for private citizens, universities, or other government agencies.

Snow Survey and Water Supply Forecasting (SS/WSF)

Data can be accessed through NRCS's National Water and Climate Center website at <http://www.wcc.nrcs.usda.gov/> and at <http://catalog.data.gov/dataset/snowpack-telemetry-network-snotel>.

Soil Climate Analysis Network (SCAN)

Data can be accessed through NRCS's National Water and Climate Center website at <http://www.wcc.nrcs.usda.gov/> and at <http://catalog.data.gov/dataset/soil-climate-analysis-network-scan>.

Conservation Effects Assessment Project (CEAP)

CEAP is a multi-agency effort to quantify the environmental effects of conservation practices and programs and to develop the science base for managing the agricultural landscape for environmental quality. Project findings are used to guide USDA conservation policy and program development and to help conservationists, farmers, and ranchers make more informed conservation decisions. CEAP reports are available from NRCS's webpage at <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap/>.

PLANTS Database

The PLANTS Database is a repository of plant data. It provides standardized information about the vascular plants, mosses, liverworts, hornworts, and lichens of the U.S. and its territories. This information primarily promotes land conservation in the United States and its territories, but academic, educational, and general use is encouraged. These data are available at <http://plants.usda.gov/>.

National Cooperative Soil Survey Laboratory Characterization

The NCSS Laboratory Characterization Database contains soil characterization data from NRCS's Kellogg Soil Survey Laboratory as well as cooperators' laboratories. The data can be accessed at <http://ncsslabdatamart.sc.egov.usda.gov/default.htm>.

Soil Survey Geographic Database (SSURGO) and Gridded (gSSURGO)

These databases maintain detailed spatial and tabular data on the distribution and attributes of soils for the United States. Maps were primarily developed at scales of 1:12,000 or 1:24,000, and tabular data are available for soil and landscape attributes. Spatial data are available in raster and vector format for most of the U.S. Examples of information available from the database include available water capacity, soil reaction, electrical conductivity, and frequency of flooding; yields for cropland, woodland, rangeland, and pastureland; and limitations affecting recreational development, building site development, and other engineering uses.

SSURGO data can be accessed through the Web Soil Survey (<http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>) or the NRCS Geospatial Data Gateway (<http://datagateway.nrcs.usda.gov/>). More than 180,000 users access the Web Soil Survey every month, resulting in the creation of more than 20,000 printable soil survey reports and more than 75,000 individual soil properties and interpretation reports. In addition, more than 25,000 soil survey data exports are downloaded, making the Web Soil Survey the most frequently used USDA web site.

National Resources Inventory

The NRI is a periodic assessment of the status, condition and trends of the soil, water, and related resources on private land in the United States. The survey has been conducted at 5-year intervals since 1977, most recently in 2007, though a 2010 mid-cycle data release occurred in December 2013. NRI reports can be accessed through NRCS's webpage at <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/nri/>.

Natural Resources Conservation Service

Rapid Carbon Assessment (RACA)

NRCS has performed an assessment of the current carbon stocks in soils of the United States using statistically reliable methods in its Rapid Carbon Assessment project. Approximately 32,500 soil profiles have been sampled at 6,500 locations to develop the largest soil carbon dataset in the world. Data and maps are available from NRCS's website at

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=NRCS142P2_054164.

Ecological Site Inventory

Ecological Site Descriptions (ESDs) are descriptions of how soils and vegetation respond to changes in climate and management. ESDs are based on groupings of soils and include information on how vegetation and soils change in response to changes in management or other factors and the ability of the soil/vegetation community to deliver ecosystem services. Data can be accessed through the Ecological Site Inventory portal at <https://esis.sc.egov.usda.gov/Default.aspx>.

Field Office Technical Guide (FOTG)

The NRCS Field Office Technical Guides (FOTG) are the primary scientific references containing technical information about the conservation of soil, water, air, and related plant and animal resources (practice standard, specifications, physical effects analysis, and outcomes and costs). These technical guides are localized so that they apply specifically to the geographic area for which they are prepared. They are a comprehensive and locally-tailored data set for conservation of natural resources in different regions of the U.S.

Technology and Innovation

Training and Education

Climate change education for NRCS staff is a key priority [See Adaptation Actions Table; aligns with USDA Strategic Goal Objective 2.1 (Restore and Conserve the Nation's Forests, Farms, Ranches, and Grasslands); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)]. Most NRCS employees have strong backgrounds in agriculture, natural resources, or environmental sciences. NRCS continues to develop a climate change curriculum to ensure that staff also have a solid understanding of the risks and impacts associated with climate change, as well as mitigation and adaptation actions that can assist landowners in addressing these risks and impacts.

To date, NRCS has developed four courses for employees and others to improve their knowledge of climate change:

- Air Quality, Climate Change and Energy
- Greenhouse Gasses and Carbon Sequestration
- Why do we care about Climate Change?
- Introduction to Environmental Credit Training

Two other courses are in development: Climate Change Adaptation and Carbon Markets [See Adaptation Actions Table; aligns with USDA Strategic Goal Objective 2.1 (Restore and Conserve the Nation's Forests, Farms, Ranches, and Grasslands); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)]. All of these courses are part of an agency-wide climate change training program available to employees as well as private citizens via USDA's on-line training website AgLearn.

Natural Resources Conservation Service

In addition to understanding climate change basics, NRCS employees need to be fully aware of the potential climate change impacts in their region as well as strategies for addressing associated resource concerns, methods to increase system resiliency, and to recognize potential transformations. Variability in physiography, production systems, and potential climate change impacts across the country will require the development of regional- and/or state-specific training. **Thus, we need to explore the development of a course to help employees develop regional and sub-regional adaptation plans to properly address the changing climate [See Adaptation Actions Table; aligns with USDA Strategic Goal Objective 2.1 (Restore and Conserve the Nation’s Forests, Farms, Ranches, and Grasslands); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)].** When training is completed, employees should have the ability to evaluate and compile regional climate change plans documenting common crop and livestock production systems in each ecosystem and possible impacts that may occur from the changing climate or extreme climatic events.

Conservation Effects Assessment Project (CEAP)

CEAP is a multi-agency effort to quantify the environmental effects of conservation practices and programs and to develop the science base for managing the agricultural landscape for environmental quality. Assessments in CEAP are carried out at national, regional and watershed scales on cropland, grazing lands, and wetlands, and for wildlife. The three principal components of CEAP—the national assessments, the watershed assessment studies, and the bibliographies and literature reviews—contribute to building the science base for conservation. That process includes research, modeling, assessment, monitoring and data collection, outreach, and extension education. Project findings are used to guide USDA conservation policy and program development and help conservationists, farmers, and ranchers make more informed conservation decisions.

Future CEAP-related monitoring and modeling activities will enhance the development of cost and benefit analyses of conservation practices as they relate to climate change metrics. These include measurement and prediction of potential carbon sequestration/loss and greenhouse gas mitigation/emission under current conditions as compared to simulated conditions predicted by climate change projection models.

COMET-VR 2.0 and COMET-FARM

NRCS has partnered with Colorado State University to develop the on-line Carbon Management Evaluation Tool (COMET-VR 2.0) to help farmers and ranchers understand and assess impacts of changes in land management on soil carbon. The tool was initially designed as a simple and quick method to estimate management impacts on greenhouse gas emissions pertaining to soil carbon sequestration, fuel use, and fertilizer use. The most recent version of COMET-VR 2.0 estimates soil nitrous oxide (a potent greenhouse gas) emissions and gauges changes in biomass carbon stocks for agroforestry practices and perennial woody crops that include orchards and vineyards. COMET-VR 2.0 provides land managers with agricultural management scenarios and a broad variety of nitrogen management options to assist them with identifying management alternatives and understanding their associated impacts on greenhouse gas emissions and carbon sequestration.

Building on COMET-VR 2.0, the current model for evaluating management effects on greenhouse gas emissions and carbon sequestration, COMET-FARM was released in 2013 by Secretary Vilsack. COMET-FARM is available to create a whole farm and ranch accounting and reporting system for carbon and greenhouse gases. The decision-support tools help landowners and conservation planners account for carbon fluxes and greenhouse gas emissions on whole farm and ranch scales, and will provide alternative management scenarios for landowners and conservation planners to explore in order to reduce greenhouse gas emissions and increase carbon sequestration.

PART 3: Managing Significant Risks

To effectively respond to disasters of all kinds, NRCS established an Emergency Response and Continuity Programs Division. This division provides leadership and planning assistance to the various levels within NRCS to maintain Continuity of Government (COG); respond to crisis events of local, regional, and/or national significance; and recover from the effects of disasters that adversely impact the NRCS's capability to carry out normal business operations. Plans developed under the guidance of this division relate to short-term weather events such as flooding, tornadoes, hurricanes, fires, etc., as well as deliberate actions such as bombings, arson, and cyber-attack. Most anticipated shifts in weather patterns fall under this umbrella of preparedness; climate change is expected to intensify certain weather events and increase their frequency which may result in a cumulative strain on the ability of NRCS personnel to respond.

NRCS has developed programs for emergency response and continuity that:

- Test, evaluate, and validate senior leadership responses during simulated, scenario-based, crisis management activities;
- Work with NRCS soil and GIS specialists in 50 states and territories during exercise simulations involving dam safety/security;
- Support enhancing landscape conservation initiatives through a robust testing, training, and exercise program where real-world weather and natural disaster events are gained through exercise simulations that address emergency watershed protection, disaster response, and recover responsibilities, and State Office leadership collaboration with State, local, Tribal, and Federal partners;
- Support increasing conservation access for underserved communities by planning, developing, and conducting senior and subordinate level exercises that engage community groups in exercise play that would co-partner with NRCS during disaster response and mitigation activities.
- Assure that business continuity of operations and the continued performance of essential functions during and after an event of local, regional, or national significance continues.
- Establish strategic partnerships with various entities including other USDA agencies, law enforcement agencies, emergency response agencies, and private and public landowners.

Identified Analysis Needs

We must recognize potential impacts of climate change as a threat to continuity of operations. Future revisions to national, state, and local continuity of operations plans will account for adverse impacts of climate change. In addition, future decisions regarding establishment of new offices, consolidation of existing offices, and leasing of new office space should consider climate change impacts. Anticipated changes in weather patterns call for a number of actions to more clearly identify the scope of possible vulnerabilities or to determine the actions adequate to reduce the risk connected to these areas. NRCS has identified the following critical analysis needs related to NRCS mission and operations, and will develop plans to address them over the next several years:

Short-term events (develop within minutes or days, sustained for no more than one to two weeks)

- Evaluate possible risk events for severity and length.
 - Direct facility damage due to flood, fire, hurricane, etc.
 - Loss of critical infrastructure (electricity, natural gas, telecommunications, etc.).
- Review positions identified as Essential Personnel for purposes of planned disruption to operations (as determined for October 2013 lapse in funding). Determine:
 - If an adequate response to disaster events requires these same or different personnel to maintain critical NRCS services
 - Depth of redundant, alternate staff required for each essential position

Natural Resources Conservation Service

- Contingency plans for staffing locations (back-up power, secure space, etc.) to support Essential Personnel
- Contingency plans to assure staff are able to work with assurance their families are also safe and secure
- Alternate back-up staff for each position and associated plans for each
 - Evaluate original design parameters and expected changes in peak events relative to dams, manure lagoons, and other structures subject to catastrophic failure.
 - Identify and coordinate possible support outside NRCS (National Guard, State Emergency Response networks, etc.).

Long-term events (develop over multiple weeks, sustained for several weeks to months or years)

- Evaluate possible risk events for severity and length.
- Sustained drought, coastal flooding exacerbated by higher median tides, etc.
- Probable time scale to respond
- Relevant, impacted NRCS facilities or substantial projects (impoundments, etc.)
 - Steps to modify, move, or abandon threatened facilities or projects.
 - Identify, review, and revise (as needed) long-lived Conservation Practices that may be rendered ineffective or severely compromised by shifted weather patterns. Two areas of concern, for example:
 - Stream diversions may become ineffective if historic patterns of mountain snowmelt accelerate and surface water is no longer sufficient during the latter part of a summer growing season.
 - Substantial USDA investments to build Anaerobic Digesters (AD) may prove misguided without careful long-range planning. An AD system (designed to operate for multiple decades) could be rendered obsolete if a dairy is driven out of business (or forced to reduce herd size) due to sustained drought.

PART 4: Procurement, Acquisition, Real Property and Leasing

Existing or Ongoing Activities

Existing acquisition activities related to climate change impacts include development of policies, procedures, and requirement statements that incorporate “green” products and value-added service components that do not further environmental degradation or hasten negative climate change impacts. For example, NRCS participates in the Green Purchasing Program (GPP) which is a two-fold incentive program promoting Green Purchasing Categories and Labels (recycled content, energy efficient (ENERGY STAR® labeled, Federal Energy Management Program [FEMP]-designated, and low standby power); bio-based, environmentally preferable, Electronic Product Environmental Assessment Tool (EPEAT), water efficient, non-ozone depleting products; and alternative fuel vehicles and alternative fuels. NRCS incorporates a tracking system within the current reconciliation process. Purchase card holders are to document in the banking system when a “green” item is purchased and identify its recycled content.

NRCS conducted comprehensive assessments for all its owned facilities in FY 2013 for existing real property. This assessment includes an ASHRAE Level II Energy Audit and the USDA Sustainability Survey, along with identifying Energy Conservation Measures (ECMs). Energy, water cost, and usage data are detailed in the NRCS FEMP 2013 Annual GHG and Sustainability Data Report (version 3.2). This included compiling energy, water, and other data through FY 2012. This information will guide NRCS on future projects to meet energy and water efficiency goals to reduce CO2 emissions.

NRCS does not currently have a mechanism to compile energy and water usage data for leased facilities where NRCS is responsible for the utilities. The agency will develop a process during FY 2014 for

Natural Resources Conservation Service

improving its data collection for all utilities paid by NRCS under the USDA Amersco (Third Party) payment contract with the goal to reduce emissions.

The potential risk for loss of critical materials or inputs due to climate change, from an acquisitions perspective, may be assessed as non-major and limited in scope (typically due to a location-specific event). The types of materials and/or inputs at risk for loss would potentially be items such as office space, equipment, vehicles, desks, and/or electronic equipment such as computers, printers, plotters, etc. Critical inputs may be considered to be electronic systems, software, and access to communications networks such as the worldwide web.

Short-term events (develop within minutes or days, sustained for no more than one to two weeks)

NRCS will immediately evaluate possible risk events for severity and length. This will include:

- Direct facility/equipment damage due to flood, fire, hurricane, etc.
- Loss of critical infrastructure (electricity, natural gas, telecommunications, etc.)
- Review positions identified as Essential Personnel for purposes of planned disruption to operations. This will be done to determine:
 - If an adequate response to disaster events requires these same or different personnel to maintain or reconstitute critical NRCS services
 - The depth of redundant, alternate staff required for each essential position

NRCS will continue to develop contingency plans for staffing locations (back-up power, secure space, etc.) to support Essential Personnel. These will include:

- Plans to verify that staffs are able to work with reassurance their families are also safe and secure
- Alternate back-up staff for each position and associated plans for each
- Evaluate original design parameters and expected changes in peak events relative to dams, manure lagoons, and other structures subject to catastrophic failure
- Identify and coordinate possible support outside the Agency (National Guard, State Emergency Response networks, etc.)

Long-term events (develop over multiple weeks, sustained for several weeks to months or years)

NRCS will evaluate possible risk for severity and length. This will include:

- Sustained downtime/loss of critical internet or telecommunications and systems such as the Integrated Acquisition System
- Probable time scale to respond
- Relevant, impacted NRCS facilities/equipment or substantial projects (contracts, etc.)
- Steps to modify, move, or abandon threatened facilities/equipment/ projects or termination of contracts as needed for the convenience of the Government

NRCS will identify, review, and revise (as needed) response plans and strategies based upon the climate change impacts realized. For example, NRCS will charter a Space Utilization Management Strategy Workgroup to provide a proactive three-year strategy to optimize the Real Estate Footprint, reduce costs, make reductions in greenhouse gas and green building, and establish accountability and incentives for better space utilization.

Natural Resources Conservation Service

PART 5: Interagency Coordination

NRCS has a long history of working collaboratively with private landowners and partners from local, State, and Federal government, Universities, and non-governmental organizations to solve challenging conservation problems across the United States. Several Programs and Initiatives in NRCS have multiple partners, such as CEAP. Climate change preparedness and resilience efforts provide another opportunity for NRCS to actively engage the conservation partnership.

Regional Climate Change Hubs

NRCS's key partnership priority with regard to climate change preparedness and resilience is the establishment of the new *USDA Regional Hubs for Risk Adaptation and Mitigation to Climate Change*. **Seven USDA regional climate change hubs have been designated and their structure and activities will be developed over the next year [See Adaptation Actions Table; aligns with President's CAP (Maintaining Agricultural Sustainability and Assessing Climate Change Impacts in the United States); USDA Strategic Goal Objective 2.2 (Lead Efforts to Mitigate and Adapt to Climate Change); and NRCS Strategic Goal Objective 1.2 (Proactively Recognize and Address Emerging Natural Resource Issues)].** These hubs are designed to develop science-based regional climatic change information for distribution to citizens of the regions, particularly producers, ranchers, and foresters. NRCS personnel associated with these hubs will help to develop and deliver important science-based assessment and tools, and will provide science and outreach related to climate change to communities.

NRCS's primary role will be to connect farmers, ranchers, and other public sectors to advances in climate change research and applications. In addition to technology transfer, NRCS must actively participate in determining and directing important research activities in each Regional Climate Hub. We should assist in the development of applicable research programs through Agricultural Research Service and other research partners to evaluate production systems across a variety of climatic zones under credible climate change scenarios. The result will be to determine types of practice combinations that are most effective in increasing climate resilience to the adaptation and transformation process. We can then identify land use alternatives, land management systems, and conservation priorities necessary to protect natural resources in the face of climate change.

The NRCS field office staff across the U.S. provides the technical link between research and application for the climate hubs. NRCS is the primary Federal agency that supplies conservation assistance on a voluntary basis to private citizens through its Conservation Technical Assistance (CTA) Program. NRCS has staff located in nearly every U.S. county; thereby well-positioning this agency to provide outreach and support, and to implement conservation measures to increase resiliency to climate change and reduce GHG emissions as a member of the regional climate change hubs.

NRCS also has a network of soil scientists and other technical specialists distributed by Major Land Resource Areas (MLRA) across the U.S. that are positioned geographically to provide expert technical assistance in soil interpretations. The Web Soil Survey provides a means for spatial extrapolation of technologies to appropriate soils and landscapes, as well as providing base soil data and information for model simulations. In addition, state soil scientists, included on most NRCS state office staffs to provide technical soil services, are instrumental in linking soil science and conservation activities for these climate hubs. The National Soil Survey Center includes scientists from multiple disciplines as well as research soil scientists that can assist in research and application associated with climate change. The Kellogg Soil Survey Laboratory will continue to provide soil and water analyses for a variety of needs.

Natural Resources Conservation Service

In addition to this on-the-ground implementation capacity, NRCS has other resources that will contribute to acquisition and development of technology for increasing resilience to and reducing impacts of climate change and related extreme events. These resources include the National Air Quality and Atmospheric Change Team, National Water and Climate Center, National Water Quality and Quantity Team, National Energy Team, National Wetlands Team, National Grazing Lands Team, National Wildlife Team, National Soil Health and Sustainability Team, National Manure Management Team, and National Plants Data Team. Also, staff members are associated with the Resource Assessment Division, Soil Science Division, including the Soil Quality and Ecosystems and the Research and Laboratory Branches, Ecological Sciences Division, and Conservation Engineering Division at National Headquarters.

The technologies developed and acquired by these teams and divisions are transferred to field staff through the West, Central, and East National Technology Support Centers in Oregon, Texas, and North Carolina, respectively; the National Soil Survey Center in Nebraska; and the National Water Management Center in Arkansas. The capacity of these Centers can be coupled with the climate hubs to deliver region-specific climate change adaptation and mitigation assistance.

National Drought Resilience Partnership

Creation of a National Drought Resilience Partnership was mandated in the 2013 Climate Action Plan. Scientists at the National Oceanic and Atmospheric Administration (NOAA) are the lead agency and charged to facilitate development of a coordinated national soil moisture network. The purpose of this partnership and network is to help forecast drought conditions around the U.S., better prepare for future droughts, and decrease economic impacts. This development of a single soil moisture network will likely be based on SCAN criteria. NRCS leads the National Cooperative Soil Survey program and possesses the level of expertise and capability to inventory and monitor soils and soil moisture on a nationwide basis. NRCS can play a major role in the formulation and leadership of just such a network and we will continue to work in cooperation with other agencies within this partnership.

Climate Preparedness Water Resources Workgroup

This workgroup was formed by the Federal Interagency Climate Change Adaption Task Force sponsored by the President's Council on Environmental Quality to evaluate options of Federal agencies to help ensure freshwater resource managers would have adequate water supplies of needed quality to protect public health and support economic activity. The workgroup developed the "National Action Plan: Priorities for Managing Freshwater Resources in a Changing Climate" for Federal agencies.

The Freshwater Action Plan touched a limited number of NRCS programs. Among the activities of this workgroup with NRCS involvement was the completion of two reports on Incorporating Adaptive Management into Water Project Designs, Operational Procedures, and Planning Strategies. The first of these reports was a summary of current Federal agency adaptive management practices and policies for integrated water resources management. The second report provided recommendations for Federal agencies to develop five key benchmarks for incorporating adaptive management into their planning and operations. The reports were published by the U.S. Army Corps of Engineers, and NRCS was among the contributors in the interagency effort.

Additional activities from the Freshwater Action Plan continue for improved water project planning standards and increases in water use efficiency continue under the mandate of the Climate Preparedness Water Resources Workgroup.

Appendix: NRCS Contributing Author Team

- **Joel Brown – National Leader-Ecological Site Team, Soil Science Division (Soil Science and Resource Assessment)**
- **Adam Chambers – Air Quality Scientist, National Air Quality and Atmospheric Change Team (Science and Technology)**
- **Terry D’Addio – Natural Resource Specialist, Conservation Technical Assistance Division (Programs)**
- **Noel Gollehon – Senior Economist, Resource Economic, Analysis, and Policy Division (Strategic Planning and Accountability)**
- **Claudia Hoeft – National Hydraulic Engineer, Conservation Engineering Division (Science and Technology)**
- **Amanda Moore – Management Analyst, Office of the Regional Conservationists (Office of Regional Conservationists)**
- **Daniel Mullarkey – Acting Director, Resource Analysis Division (Soil Science and Resource Assessment)**
- **Kip Pheil – Energy Specialist and Acting Leader, National Energy Team (Science and Technology)**
- **Michael Strobel – Director, Water and Climate Center (Soil Science and Resource Assessment)**
- **Norman Widman – National Agronomist, Ecological Science Division (Science and Technology)**
- **Michael Wilson, Team Leader, Acting National Leader-Climate Change, Soil Science Division (Soil Science and Resource Assessment)**

NRCS Adaptation Actions

Action Description	Action Goal	Agency Leads†	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
CONSERVATION PROGRAM DELIVERY											
Conservation Innovation Grants	Develop demonstration projects for emerging environmental markets	S&T, SSRA, RCs or STCs	Help protect marginal lands and provide producers with additional revenue stream	National	2014 and beyond	Work with producers and C credit funding sources					
Soil Health Management System	Enhance promotion and implementation of Soil Health Management System concepts	SSRA, S&T, Prog	Develop and deliver field level training courses	Local	2014 and beyond	AgLearn, E-extension, on-site training courses	training delivered; webinars presented; fact sheets created	Coordinates with other USDA agencies, e.g., ARS, plus university partners			Multiple fact sheets created (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/resource/) ; webinars completed and archived (http://conservationwebinars.net), training cadre established and active in training
"Fragile Soil" indicators	Understand climatically vulnerable soils in each region and develop interpretations and maps from soil survey products; development of "Fragile Soil" indicators for different ecoregions	SSRA, S&T, Prog	Opportunity to use existing soil survey information to develop these indicators; useful for soil health applications.	National	2014 and 2015		Development of indicators for selected regions				

Action Description	Action Goal	Agency Leads†	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
Landscape Conservation Initiatives	Integrate potential for climate change impacts on national initiatives, like Mississippi River Basin, Chesapeake Bay, and Sage Grouse	S&T, SSRA, RCs or STCs		Regional	2012 and beyond	Use regional assessment tools like CEAP to evaluate possible climate change impacts on targeted initiative outputs such as water quality	Climate change factor evaluations used in specific initiatives and recommendations for management changes				In December 2013, USDA announced the approval of a carbon crediting protocol for the avoided conversion of grasslands and shrublands. The protocol was approved by the American Carbon Registry and spearheaded by Ducks Unlimited (DU). Using this protocol, DU has worked to purchase conservation easements on working grasslands in North Dakota. Carbon credits generated by these lands are being sold to Chevrolet. In February, the Chicago-based Delta Institute—another recipient of an NRCS Conservation Innovation Grant—will announce the sale of carbon credits to a local electric utility.

Action Description	Action Goal	Agency Leads†	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Highlights of Accomplishments to Date
NRCS Practice Standards	Review and revise (if necessary) NRCS practice standards; outcomes, engineering design and adjustments from assessments based analyses of useful life, risk tolerance, and failure in relation to climate trends and projections	S&T, SSRA, Prog	Review, modify, and/or improve designs based on best available climatic data withstand climate extremes and variability	National	FY 2015 and beyond	Integrate into standing schedules for practice reviews and design updates	Percentage of existing structures, new designs, or practices evaluated; percentage using new and projected data				

OTHER PROGRAMS AND ASSETS

Plant Material Centers	Plant Materials Centers evaluate plant attributes for adaptation and impacts	S&T	Revise/Improve vegetative recommendations to maintain the effectiveness of conservation practices	National	Begin FY 2015	Data collection/analysis	Updated vegetative recommendations				
Snow Survey and Water Supply Forecasting	Continued monitoring and possible expansion of existing SNOW TElemetry (SNOTEL) network; Continued data analysis and water	SSRA	Assess changes in water supply quantity, distribution and timing of snowmelt	Western US	Ongoing	Snowpack monitoring and water supply forecasting	On-going operation of data collection network and water supply forecasting: http://www.wcc.nrcs.usda.gov/			Additional funding is needed to maintain the current SNOTEL monitoring sites and support the data analyses and	

supply forecasting

forecasts

Action Description	Action Goal	Agency Leads†	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/Further Implications	Highlights of Accomplishments to Date
Drought Assessment	Continued monitoring and possible expansion of existing Soil Climate Analysis Network (SCAN)	SSRA, S&T	Assess hydrologic drought by measuring soil moisture at different depths using SCAN	National	Ongoing	SCAN in coordination with NIDIS (National Integrated Drought Information System) and US Drought Monitor	On-going operation of data collection network; Reports and maps: http://www.wcc.nrcs.usda.gov/scan/			Additional funding is necessary to maintain the current SCAN monitoring sites and support the data analyses and forecasts	
Ecological Site Information	Enhance understanding of responses to changes in ecosystem processes	SSRA	Document ecological sites in MLRA regions of the US - Identify major climatic changes and ecological impacts	National by LRR	2014	Evaluation of soils/vegetation/conditions in an area	Documentation and ESD Plans Completed				

†Agency: S&T = Science and Technology; SSRA = Soil Science and Resources Assessment; Prog = Programs; RC = Regional Conservationists; STC = State Conservationists

USDA Risk Management Agency
Climate Adaptation Plan 2014

USDA Risk Management Agency – 2014 Climate Adaptation Plan

Updated as of June 6, 2014

I. Policy Framework

The central vision of the Federal Crop Insurance Corporation (FCIC) is to provide world class agricultural risk management products.

Consistent with this vision, FCIC serves America's agricultural growers through effective, market-based risk management tools and solutions to strengthen the economic stability of agricultural growers and rural communities. As part of this mission, FCIC through the Risk Management Agency (RMA) administers the Federal crop insurance program. RMA managed over \$123 billion in liability in 2013 and paid over \$11.9 billion in losses from natural disasters (as of May 2014), RMA assists growers manage losses due to insured causes of loss which include but are not limited to natural disasters, drought or flooding . RMA's crop insurance policies provide financial stability for growers and are frequently required by lenders.

In addition to providing crop insurance coverage to growers, Section 522(d) of the Agricultural Risk Protection Act of 2000 authorizes RMA to enter into partnerships with public and private entities for the development of non-insurance risk management tools. These tools are developed for growers' direct use to assist in mitigating and adapting to increased risks from climate change, drought, and other weather related conditions. The partnerships are wide-ranging, multi-year, research projects that offer new and innovative approaches to risk management that extend beyond traditional crops.

As stated in its' Strategic Plan, RMA's goals are:

- Expand existing crop insurance programs where appropriate.
- Improve the effectiveness of existing programs in southern states and other regional or local areas by refining offers to be better tailored to unique types and practices, and where appropriate, adjusting premium rates, transitional yields, initial and final planting dates, acreage reporting dates, coverage conditions, and high risk or other map areas

within each county to recognize structural changes to the risks of growing the crop in those areas.

- Continue to refine and expand the availability of innovative, grid-based, weather-derivative, insurance products to crops and areas that are either uninsured or underinsured.
- Monitor climate change research, to the extent that climate changes emerge over time, and update program parameters such as final planting dates and sales closing dates, to reflect such adaptation or other changes.
- Regional Offices develop and maintain maps used to identify high risk areas, uninsured acreage, and coverage.
- Regional Offices develop special provisions of insurance to address unique crop or regional conditions to enhance the program or address potential program vulnerabilities

II. Planning for Climate Change Related Risk

On November 1, 2013, Executive Order (E.O.) 13653, “Preparing the United States for the Impacts of Climate Change,” Section 5(a) states, “Each Agency shall develop or continue to develop, implement, and update comprehensive plans that integrate consideration of climate change into Agency operations and overall mission objectives...” These 5 Parts are addressed in this USDA, Risk Management Agency – 2014 Climate Adaptation Plan:

Section 5(a)(i) - identification and assessment of climate change related impacts on and risks to the agency’s ability to accomplish its missions, operations, and programs;

RMA’s principle vulnerability to climate change is through the insurance coverage offered through its crop insurance policies. RMA provides coverage to farmers and ranchers for flood, drought, hurricanes and other natural disasters. Climate change is additive with other agronomic risks.

Farmers purchase crop insurance for protection against climate and weather related losses such as flood, drought, hail, etc. There is significant uncertainty about how climate change may affect crop yields – with improvements forecasted in some areas and decreases in others. In areas

where climate changes in a way that is less conducive to growing a given crop, either the growers' insurance guarantee will decrease (and premium rates increase) because of the falling yields or they will stop planting the crop entirely. Either way, the liability exposure of the crop insurance program to climate change tends to be self-limiting.

Agricultural producers have always faced numerous production and price risks, but forecasts of more rapid changes in climatic conditions in the future have raised concerns that these risks will increase in the future relative to historical conditions. In addition to implications for landowner decisions regarding land use, crop mix, and production practices, changing agricultural risks could potentially affect the performance of the crop insurance program. In addition, to the extent that changing climatic conditions are negatively affecting yields over time, there will be greater incentives to conduct research on drought-tolerant, heat-tolerant, and other crop varieties better suited to the changing conditions, which would tend to reduce climate impacts on crop yields. Technological improvements have the potential to decrease, or even negate, the impacts of climate change.

RMA will continue to evaluate and monitor potential risks that climate change presents to the Federal crop insurance program. With over a million crop insurance policies in force **and over \$11.9 billion paid out in natural disaster claims in 2013** and the world's most extensive database of actual farm yields, RMA will monitor program performance and to update program parameters such as the crop planting dates as needed to reflect the changing risks resulting from climate change.

Climate change effect on RMA Operations

- RMA predicts that climate change will only have a minor effect on operations in 16 states where RMA has offices.
- RMA will maintain a workforce that is resilient to weather and other climate change-related disruptions so that the work of the Agency can continue as seamlessly as possible.
- RMA will employ flexible management policies to assist employees impacted by disasters related to climate change (e.g., floods, hurricanes, wildfires) so that they may return to work as quickly as possible.

Section 5 (ii) a description of programs, policies, and plans the RMA has already put in place, as well as additional actions RMA will take, to manage climate risks in the near term and build resilience in the short and long term;

RMA has implemented and invested in a variety of programs and policies over the lifecycle of the federal crop insurance program and specifically to monitor and manage climate risks, these include:

Premium Rating Methodology: RMA continuously reviews and revises its premium rating methodology*. Recent changes include using a shorter historical timeframe to measure risk, and the introduction of a process that explicitly considers weather variables in calculating premium rates. This makes premium rates more responsive to any changes in agronomic risks, whether due to climate change or other factors.

*A document about the rate changes and their overall premium impact for 2013 can be found on RMA's website at <http://www.rma.usda.gov/news/2012/11/2013premiumrateqa.pdf>.

Climate and weather services: RMA has been using climate and weather services provided through a partnership with Oregon State University's PRISM Climate Group (Parameter-Elevation Regressions on Independent Slopes Model) *climate mapping system* to strengthen RMA's underwriting and oversight of the Federal crop insurance program. PRISM provides high quality climate and weather data that will assist RMA with its program underwriting and actuarial responsibilities by developing crop suitability maps based on climate and soils to more accurately assess the production potential of land being farmed; to account for variations in climate due to elevation, rain shadows, coastal effects, temperature inversions and other conditions that may affect crop production; and it is assisting RMA in developing nationwide Bio-fuel resource mapping.

The PRISM web portal has been available to RMA and the insurance companies since spring of 2012, to improve service to producers across the nation as losses can be adjusted quickly and

accurately. To expand RMA's initiative for a strong educational component for producers, PRISM also made a web portal available which is designed for producers to help them better understand their local climate and how changes in the climate effect their farming operations along with other decision support tools. It can also be used by growers to make planting and production decisions every day. The PRISM web portal for producers and general public **went live on October 2013**. It provides public access to a wealth of PRISM climate data, maps, and documentation. The URL for the public website is <http://prism.oregonstate.edu>.

Since it opened on Oct 1, 2013, PRISM has had 31,442 visits; 166,025 dataset downloads and 2.2 TB of data downloaded (not including a new ftp site we opened on Jan 1, 2014).

Catastrophic Loss Procedures - Emergency Loss Procedures for Crops Damaged by Hurricanes and other extreme events. For Example, on October 24, 2005, Hurricane Wilma made landfall in Florida. The President declared 29 counties Federal disaster areas and directed the Department of Agriculture to assist growers affected by the hurricanes. In Florida, RMA reported that Hurricane Wilma resulted in 2,420 citrus fruit crop loss claims totaling \$60.8 million in indemnity payments.

On November 4, 2005, RMA authorized emergency loss procedures via a Manager Bulletin, MGR-05-020, *Emergency Loss Procedures for Crops Damaged by Hurricane Wilma*, intended to streamline certain loss determinations⁶ on specific crops and accelerate the adjustment of losses, expedite processing of loss claims and payments to growers from Hurricane Wilma. The application of the emergency loss procedures was intended to be limited to those situations where the catastrophic nature of the losses was such that not authorizing these emergency loss procedures would result in unnecessary delays in processing claims.

These programs and policies guide RMAs decisions in supporting changes to planting patterns, agronomic practices, new varieties; varieties that can be planted earlier and revising the earliest planting date and final planting dates if planting earlier becomes a common practice. RMA will monitor the establishment of new practices for new areas/crops such as irrigation, limited irrigation, skip rows, cover crops, organic practices, and other insurance offers. Ten Regional

⁶ When losses occur, the Standard Reinsurance Agreement (SRA) requires that Approved Insurance Providers (AIPs) send adjusters into the field to determine the extent of damage and the appropriate losses under the insured's crop insurance policy.

Offices (RO's) will review planting dates periodically and recommend changes to existing final planting dates, if necessary.

Section 5 (iii) a description of how any climate change related risk identified pursuant to paragraph (i) of this subsection that is deemed so significant that it impairs an agency's statutory mission or operation will be addressed, including through the agency's existing reporting requirements;

RMA has not identified any climate change risks that could potentially impair, obstruct, or prevent the success of agency mission activities in the long term. As with all Federal agencies we remain susceptible to natural events that may disrupt operations in the short run, in the event of these cases-such as tornados, hurricanes, winter storms - RMA has developed a Continuity of Operations Plan as a directive to ensure minimal disruption to its mission.

Section 5(a)(iv) a description of how RMA will consider the need to improve climate adaptation and resilience, including the costs and benefits of such improvement, with respect to agency suppliers, supply chain, real property investments, and capital equipment purchases such as updating agency policies for leasing, building upgrades, relocation of existing facilities and equipment, and construction of new facilities;

The real property investments and capital equipment for RMA is limited and appears to have limited exposure to climate change risks. However, the crop insurance program can play a role in helping growers be more adaptive and resilient to climate change by making it easier for growers to invest in adaptation measures.

In general, uncertainty discourages investment. It can take years for an adaptation measure to pay off. Why should growers invest in an adaptation measure if they may go out of business before they can fully enjoy the long-term benefits of that investment? Crop insurance helps reduce that uncertainty, which can promote investment in the adaptation measure. We have frequently heard that banks strongly encourage, or even require, crop insurance in order for a grower to secure an operating loan.

5(a) (v) a description of how RMA will contribute to coordinated interagency efforts to support climate preparedness and resilience at all levels of government, including collaborative work across agencies' regional offices and hubs, and through coordinated development of information, data, and tools, consistent with section 4 of this order.

Understanding Risks: RMA, through USDA's Climate Change Program Office, will continue to evaluate and monitor potential risks that climate change presents to the Federal crop insurance program. RMA will monitor the Federal crop insurance program and administer it in an actuarially sound manner—planting patterns, agronomic practices, new varieties; varieties that can be planted earlier or we will revise the earliest planting date and final planting dates if planting earlier becomes a common practice. RMA will monitor the establishment of new practices for new areas/crops such as irrigation, limited irrigation, skip rows, cover crops, organic practices, and other insurance offers.

Limited Irrigation Practice - 2013: RMA is evaluating how Federal crop insurance currently addresses producers intending to apply reduced irrigation and evaluating the feasibility of establishing a limited irrigation guarantee for producers who apply less water than they may have historically applied to their irrigated acreage. This USDA initiative has led RMA to issue a contract to study initially the impacts of "limited irrigation" on crop insurance. For the study, "limited irrigation" is defined by RMA as "a method of producing a crop by which less water is artificially applied during the growing season by appropriate systems and at the proper times than the quantity of water that was used to establish the irrigated production guarantee or amount of insurance on the irrigated acreage planted to the insured crop." Options for alternative crop insurance approaches for handling reduced irrigation were delivered under the "Limited Irrigation Research Study Contract." RMA issued a new task order for development of one of the contractor's recommended approaches for addressing reduced irrigation. The report is available on the RMA website:

<http://www.rma.usda.gov/pubs/>

<http://www.rma.usda.gov/pubs/2013/insuringirrigationfeasibilityreport508.pdf>.

As part of the Limited Irrigation Research Study Contract study, two listening sessions were held to gather input from interested stakeholders on March 13, 2013 in Colby, Kansas, and on

March 14, 2013, in Kearney, Nebraska. RMA sought input from growers, insurance industry, and other interested stakeholders who were encouraged to attend and share their concerns and feedback about limited irrigation and ideas to address the crop insurance consequences of the changing irrigation water situation in future years.

<http://www.wattsandassociates.com/Press/LIListeningSession.aspx>

RMA will take additional actions to manage climate risks in the near future by monitoring climate data and research to the extent that climate changes over time, RMA will update program parameters (e.g. sales closing dates and earliest and final planting dates and other program dates) as needed to reflect such changes. In addition, RMA will continue to monitor premium rating methodology, loss adjustment standards, underwriting standards, and other insurance program materials to ensure that they are appropriate for new production regions or for changes in practices within existing regions.

New common, science-based guidance on when cover crops should be terminated: In 2013, RMA, Farm Service Agency (FSA), and Natural Resources Conservation Services (NRCS) engaged stakeholders, universities, and the crop insurance industry to make cover crop guidelines straightforward and sensible. New guidance was issued by RMA via a “Cover Crop” Fact Sheet <http://www.rma.usda.gov/pubs/rme/covercrops2.pdf> that contains links to the NRCS web site. This site has a new model that uses local climate data, tillage management and soil data to account for daily crop growth and use of soil moisture. With this information, experts determined the latest possible time to terminate a cover crop, to maximize carbon sequestration and at the same time minimize risk to the cash crop yield. Four cover crop termination zones have been established across the United States. These provide a regionally-appropriate approach to cover crops and the tools to identify the proper cover crop management in an area, taking into account local climate and cropping systems. With this consistent, science-based cover crop guidance, farmers will have more flexibility and a greater opportunity to utilize cover crops on their operations, while staying in compliance across all USDA agencies.

<http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/landuse/crops/?cid=stelprdb1077238>

Working Groups Regarding Climate Change: RMA will contribute to coordinated interagency efforts to support climate preparedness, stakeholders such as the 18 approved insurance providers and over one million crop insurance policyholders – farmers and others with an interest in the Federal crop insurance program to inform them of choices when dealing with climate, and weather related droughts and flood events that may have prevented them from planting insured crops. For example, as production areas shift due to climate change adaptation, RMA has procedures in place for growers to request insurance coverage for insurable crops that is not currently available in a county: <http://www.rma.usda.gov/pubs/rme/requestinginsurance.pdf>

RMA supports coordinated interagency climate adaptation efforts of the following: USDA Global Climate Change Working Group; USDA Regional Climate Hubs Working Group; USDA Drought and Water Team; Environmental Markets Working Group; and RMA also participates on the Council for Environmental Quality (CEQ) Working Group - President's Climate Action Plan - Insurance which includes members from various Federal Agencies, such as NOAA, FEMA, EPA, Treasury, HUD, National Institute for Standards (NIST); USGCRP, since 2013.

RMA plans to integrate climate change adaptation into Federal crop insurance policies, programs, and operations. RMA will increase its' coordination with stakeholders such as crop insurance policyholders and others with an interest in the Federal crop insurance program to inform them of choices when dealing with climate, and weather related droughts and flood events that may have prevented them from planting insured crops.

RMA is monitoring the efforts of the Working Group on Climate Change and Global Warming at the National Association of Insurance Commissioners (NAIC). This group is responsible for reviewing the enterprise risk management efforts by insurance carriers and how they may be impacted by climate change and global warming and investigating and receiving information regarding the use of modeling by carriers and their reinsurers concerning climate change and global warming and its possible impact on investments. Involvement with this committee allows RMA to be aware of climate change-related activities taking place in other lines of property and casualty insurance.

RMA and other USDA agencies engaged stakeholders, universities, and the crop insurance industry to make cover crop guidelines straightforward and sensible. New guidance was issued

by RMA via a “Cover Crop Fact Sheet” that contains website links to the NRCS web site. The NRCS website has a new model that uses local climate data, tillage management and soil data to account for daily crop growth and use of soil moisture. With this information, experts determined the latest possible time to terminate a cover crop, to maximize carbon sequestration and at the same time minimize risks to the cash crop yield. Four cover crop termination zones have been established across the United States. These provide a regionally-appropriate approach to cover crops and the tools to identify the proper cover crop management in an area, taking into account local climate and cropping systems. With this consistent, science-based cover crop guidance, farmers will have more flexibility and a greater opportunity to utilize cover crops on their operations, while staying in compliance across all USDA agencies. Publication on Cover Crops issued, June 2013: <http://www.rma.usda.gov/pubs/rme/covercrops2.pdf>

RMA funded through its Risk Management Education Partnership Program a Webinar on Cover Crops with the National Sustainable Agriculture Information Service, National Sustainable Agriculture Coalition, and NRCS on January 23, 2014, to provide outreach to farmers, agriculture professionals, crop insurance industry and other USDA employees to provide information regarding the new cover crop termination zones. The Webinar discussed the recent efforts to assure greater uniformity and clarity on its policy related to farmers who currently grow “cover crops” or may grow them in the future. In addition, critical questions about how the new policy is designed to answer: When and how can cover crops be terminated without jeopardizing valuable Federal crop insurance coverage of the cash crops grown with them? This policy arose out of the concern that farmers planting cover crops could lose their eligibility for crop insurance coverage of the following crop. The new policy addresses this concern, using science-based cover crop management guidelines accepted across USDA agencies. <https://attra.ncat.org/>

Another method RMA uses to manage climate risks, is to increase the number of press releases, interviews, factsheets and questions and answers pages on RMA’s website to inform stakeholders and others of our policies when dealing with the severe climate and weather events.

For example, RMA's Regional Offices issued press releases to provide information to farmers about new crop insurance procedures in place for "prevented planting" for crop year 2014:

http://www.rma.usda.gov/fields/mn_rso/2014/cipp.pdf

<http://www.rma.usda.gov/news/currentissues/prevented/>

Exhibit A.

Risk Management Agency

Executive Order 13653, Section 5: Federal Agency Planning for Climate Change Related Risk.											
Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
<p>PRISM Public Website A version of the PRISM portal designed specifically for climate and weather scientists and for farmers was released, October 2013.</p>	<p>To provide a tool that both Risk Management Agency (RMA) and Approved Insurance Providers (AIPs) and farmers (one day) can use.</p>	<p>RMA in partnership with Oregon State University</p>	<p>Assist producers to understand their local weather and climate patterns and to make appropriate adaptations in their farming operations in response to any changes in climate that might occur.</p> <p>Recognizes changes in climate patterns on a timely basis and provides current and historical weather and climate data at a localized level.</p>	<p>National</p>	<p>On-going Released to public in October 2013.</p> <p>Previously available since spring 2012 to RMA and AIPs.</p>	<p>The URL for the public website is http://prism.oregonstate.edu</p> <p>Released on to the public on October 1, 2013.</p> <p>Implemented Phase One of the public portal. The Phase One rollout is the raw data and the intended audience is the climate and weather scientists—</p> <p>Once the scientist test the data and we get the green light to go forward, we will roll-out Phase Two which will be for the farmers and general public.</p>	<p>Web portal oriented to producers and general public</p>	<p>N/A</p>	<p>N/A</p>		<p>Strong Interest from public.</p> <p>RMA and its Partner are tracking usage. Since it opened on Oct 1, 2013, we've had 31,442 visits 166,025 dataset downloads 2.2 TB of data downloaded (not including a new ftp site we opened on Jan 1, 2014).</p>

Risk Management Agency

Executive Order 13653, Section 5: Federal Agency Planning for Climate Change Related Risk.											
Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
RMA implementation of "Cover Crops Termination Guidelines."		RMA, Farm Service Agency (FSA) and Natural Resources Conservation Services (NRCS)	<p>A new model was developed that uses local climate data, tillage management and soil data to account for daily crop growth and use of soil moisture. With this information, experts determined the latest possible time to terminate a cover crop, to maximize carbon sequestration and at the same time minimize risk to the cash crop yield.</p> <p>Farmers will have more flexibility and opportunity to utilize cover crops on their operation, while staying in compliance across USDA.</p>		On-going since 6/2013	<p>Fact Sheets Available on RMA Website.</p> <p>http://www.rma.usda.gov/pubs/rme/covercrops2.pdf</p> <p>Webinar sponsored by RMA Risk Management Education Funding –1/23/2014 to provide education and outreach to farmers, and Ag Professionals on how to use the four cover crop termination zones --established across the United States.</p> <p>Created Frequently Asked Questions webpage in April 2014.</p>		Engage Stakeholders universities, grower groups and the crop insurance industry to figure out how to make guidelines straightforward and sensible.	Crop insurance indemnity payments if suffer loss; NRCS provides incentives to plant cover crops; and FSA provides commodity payments to qualifying farmer.		<p>Cover crops also sequester a significant amount of carbon; Farmers can reap conservation and economic benefits that cover crops can provide.</p> <p>Regional Offices provide updates on Cover Crop Management http://www.rma.usda.gov/fields/il_rs/2014/covercropfaq.pdf</p> <p>Frequently Asked Questions: http://www.rma.usda.gov/help/faq/covercrops2014.html</p>
Emergency Adjustment Procedures for Catastrophic Loss Events		RMA	Enhance ability to provide timely payments to growers	National	As needed.	Establish procedures for Approved Insurance Providers.					
Revise Key Program Dates		RMA	Ensure that the crop insurance program reflects changes in climate and agronomics	National	Annual	Revise actuarial documents to reflect revised dates.					

Risk Management Agency

Executive Order 13653, Section 5: Federal Agency Planning for Climate Change Related Risk.											
Action Description	Action Goal	Agency Lead	Risk/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenges/ Further Implications	Highlights of Accomplishments to Date
New Methods to Assign a Hardiness Zone to Insured Nursery Locations- RMA provides crop insurance coverage for Nursery.		RMA	As a consequence of the changes in the climate, some nursery plants may no longer be insurable in some specific locations or higher insurance premiums may be necessary. Agricultural Research Service released an updated version of the Plant Hardiness Zone Map (PHZM). The PHZM identifies the geographic location where plants are likely to thrive based on the average annual minimum temperature.	National	On-going	Revise insurance policy materials to reference new hardiness zone maps					Informational Memo issued, 9/17/2012 http://www.rma.usda.gov/bulletins/pm/2012/12-045.pdf
Program Expansion		RMA	Ensured the crop insurance coverage is expanded to new areas where crops are grown due to changes in climate and agronomies.	National	Annual	Revise actuarial documents to reflect new county crop expansion.					

RMA Final 6/6/2014

USDA Rural Development
Climate Change Adaptation Plan 2014

**USDA Rural Development
Climate Change Adaptation Planning Document
February 2014**

This plan originally prepared in accordance with Executive Order (E.O.) 13514, required all federal agencies to have a climate change adaptation plan submitted to the Council of Environmental Quality (CEQ) has been updated to comply with E.O. 13523, Preparing the United States for the Impacts of Climate Change, which was on November 1, 2013. USDA Departmental Regulation 1070-001 calls for the Climate Change Program Office (CCPO) to develop the USDA Climate Change Adaptation Plan with the full support and participation of USDA agencies and offices. To accomplish this, the Rural Development agencies (RD) have prepared this adaptation strategy that addresses how it is integrating climate change into its programs, policies, and operations. RD's plan is submitted with the intent that it will be included in the Department's response to CEQ. Per D.R. 1070-001, this plan will support USDA's requirement to:

- (1) Analyze how climate change may affect the ability of agencies or offices to achieve their respective mission and its policy, program, and operational objectives by reviewing existing programs, operations, policies, and authorities to: identify potential impacts of climate change on the agency's or office's areas of responsibility; prioritize, implement, and mainstream response actions, contingent on the availability of resources; and continuously assess and improve the capacity to adapt to current and future changes in the climate.
- (2) Identify to the Office of Budget and Program Analysis, under the Office of the Chief Financial Officer, as part of the annual budget process areas where budget adjustments would be necessary in order to carry out the actions identified under this Departmental Regulation and include this information on the Global Change Cross-Cut that is compiled each year;
- (3) Identify, as appropriate, for USDA's Office of the General Counsel areas where legal analysis is needed to carry out actions identified under this Departmental Regulation; and
- (4) Coordinate actions across the Department through USDA's Global Change Task Force, as appropriate.

Policy Framework

RD's mission is to increase economic opportunity and improve the quality of life for all rural Americans. RD's vision is to maximize our program benefits to support a rural America that is a healthy, safe, and prosperous place to live and work.

To assist the country in addressing today's challenges, RD supports the Secretary's Strategic Goals primarily through Goal # 1 *Assisting rural communities to create prosperity so they are self-sustaining, re-populating, and economically thriving* and Goal # 2 *Ensuring our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources.*

Particularly relevant are programs that focus on Climate Adaptation planning including:

- Rural Utilities Service
 - o Water and Environmental Programs providing clean and safe drinking water and sanitary water facilities.

Rural Development

- Technical Assistance
- Environmental Water & Waste Studies
- NEPA requirements on all projects
- o Electric Programs provide reliable and affordable electricity to rural areas and have
 - Improvements to and diversification of base-load power generation.
 - Renewable energy at the utility size & scope
 - Energy Efficiency programs
- Rural Business-Cooperative Service
 - o Alternative Energy: The Bio-refinery Assistance Loan Guarantee Program and the Advanced Biofuel Payment Program loan support America's development and use of alternative energies that benefit our country and are good for our environment.
 - o Energy programs, such as the Rural Energy for America Program, help to lower supply chain GHG emissions due to consumer demand and to help agriculture reduce energy costs to provide cash flow for other adaptation strategies needed on operation.
 - o Energy efficiency upgrades to rural business helping to reducing overall energy use to reduce strain of possible high unit energy cost.
 - o Agro Forestry - Wood to Energy project finance modeling which may help to lower the cost of forest restoration work due to increased fire, disease and pest damage
 - o Bio Fuels/Retail Infrastructure for lower GHG fuels to consumers
 - o Bioeconomy Based Products
- Rural Housing Service
 - o Multi-family Housing Energy Efficiency Initiative
 - o Multi-family Housing Portfolio Manager, Capital Needs Assessment/Utility Usage
 - o Energy Independence and Security Act compliance – Impacts Single Family Housing new construction
 - o Climate Action Plan installation of 100MW capacity onsite renewable energy Multi-Family Housing by 2020.
 - o Community Facilities Programs

Vulnerability to Climate Change

RD supports rural communities through loans, loan guarantees, and grants. For some of RD's programs, the agency holds liens or other security interests in facilities and related infrastructure in areas that could be affected by hydrological changes and sea-level rises resulting from impacts such as inundation and erosion. Additionally, many climate change models predict increased frequency and severity of weather events such as tornados and hurricanes, which can damage utility facilities and infrastructure. Climate change therefore represents a risk to these agency assets and the communities they serve. Damage that may occur to such infrastructure and facilities would create an increased demand on RD to respond to requests for financial assistance to repair, replace, relocate or otherwise improve these assets. There is a high confidence level that climate related impacts are now affecting rural communities, regions that are highly dependent on natural resources for their livelihoods and social structures, and that these impacts will progressively increase over time shifting locations of where rural economic activities will thrive. The potential for increased demands on financial resources could divert those resources from normal program operations, impacting RD's ability to achieve its mission and goals. An increase in financial assistance requests could burden all aspects of RD operations, including but not limited to underwriting, engineering, and environmental review activities.

Extreme weather events could also have devastating effects on rural communities as well as RD offices and their personnel stationed throughout the Nation. Events that could damage or destroy facilities and utility infrastructure needed to supply water, electricity, and telecommunications to communities and field

offices could create significant health and safety problems for the public and for RD employees. Additionally, emergency response can be affected by telecommunications failure, including failure of the Federal Communications Commission's Enhanced 911 (E911) system, which is supported by towers and infrastructure financed by RD programs. RD is highly confident that responding to additional challenges from climate change will require significant adaptation of rural transportation and infrastructure systems as well as health and emergency response capabilities.

RD provides support to low-income communities and businesses in rural areas. Rural communities face particular geographic and demographic obstacles in responding to and preparing for climate change risks because of physical isolation, limited economic diversity, higher poverty rates, and aging populations. Assuming current climate change trends continue communities in certain geographic regions that are served by RD will face increased average temperatures, more frequent temperature extremes, and changes in precipitation patterns. Scientists predict the severe heat experienced during summer 2003 in Western Europe, while exceptional for the past century, will be more typical of climate patterns expected in this century. Increased temperatures will likely increase the need for energy efficient homes in low-income communities and an increased demand on power generation capacity, which in turn will create a rise in the number of applications for assistance from residential applicants, electric cooperatives, and rural businesses. Climatic changes will disturb crop yields and modify growing locations, drought conditions may also lead to increased requirements for infrastructure to deliver water to areas that no longer have viable water sources as well as to power generation facilities, which may lead to a greater volume of applications for assistance from RD programs. This increased demand would divert resources from normal program operations, impacting RD's ability to achieve its mission and goals.

The Adaptation Planning and Evaluation Process

Through adaptive planning, RD can respond to potential impacts by conducting or utilizing risk assessments for new facilities and utility systems and determining what existing facilities and utility systems may be located in areas more vulnerable to the effects of climate change. Existing tools and available data can be used to consider the effects climate change may have on a proposed RD action, and can assist in contingency planning for existing assets and the communities they serve.

One example of a tool in development for this type of risk evaluation is the National Oceanic and Atmospheric Administration's (NOAA's) Sea Level Rise Viewer, available at <http://csc.noaa.gov/digitalcoast/tools/slrviewer/>. This is just one example of tools that RD can use to assess risk. As additional tools become more available, RD can use these tools in decision making to evaluate the feasibility of its proposed actions and prepare for potential threats to areas where RD has existing interests. Additionally, RD can expand tools that already exist within the agency. For example, a geographic information system (GIS) program developed by ESRI called "Community Analyst" is currently available through an online portal to a limited number of licenses to RD staff and has the capability for expanded usage and expanded unique RD data sets. Community Analyst can be used to identify a number of community variables in areas impacted by disaster to understand where RD's assets are threatened or impacted. This GIS assessment tool already has a wide range of environmental data layers and it could be expanded to include climate prediction models and to make this information available to RD program staff.

Sustained Adaptation Process

RD has identified five actions related to climate change adaptation that it will initiate in FY 2013, dependent on funding availability, RD leadership approval, and partner support:

Rural Development

Action 1: RD is in the process of rewriting its environmental regulations at 7 CFR 1970, which will include consideration of climate change in the environmental impact analyses it performs on each request for financial assistance. In addition, to ensure that RD programs have tools to consider how to adapt to climate change, RD will review programs and policies – with the assistance of Research, Education, and Economics (REE) mission area as necessary – to assess the extent to which there may be opportunities to improve RD decision making and prepare for and respond to potential impacts from climate change. Opportunities identified will be flagged according to whether they require a change in policy, a regulatory change, or an act of Congress. Changes in policy can be effected in the relatively short term. Regulatory changes will trigger longer term regulatory processes. Issues that require statutory changes can inform Farm Bill discussions.

A summary of information gathered throughout the year and associated recommendations will be provided to RD leadership annually. Questions RD will consider during this review include the following:

- Water, electric, and telecommunications programs: Do policies and regulations for these programs encourage adaptation to address potential effects of climate change? Are there opportunities to improve climate change adaptation considerations in the policies and regulations that define the management of these programs?
- Rural Business and Rural Housing Programs: Is the state of the art science sufficient to identify areas of the Nation where climate change prediction models suggest higher potential impacts from rising temperatures in the near future? If so, do the available data warrant a consideration of proposals for seeking appropriations to expand or supplement these programs in high risk areas to respond to expected increases in applications for energy efficiency and alternative energy improvements as well as retreat/relocation efforts?
- Disaster Response: How quickly can assistance be provided if losses are widespread? How could RD assist the traditional disaster response agencies in responding to widespread disasters? What type of programmatic partnership instruments could RD execute with other agencies and NGOs prior to catastrophic events to be poised to assist partner resources in the event of disaster response requirements?

Action 2: RD will partner with the REE mission area and non –governmental organizations (NGOs) to evaluate decision-support tools that are based on sound state of the art science and their applicability to RD programs. When tools are found to meet these criteria, RD will disseminate data to field offices to facilitate their outreach to program applicants. These data and tools will provide practical resources for both agency decision making and to support applicant due diligence in their application assessment processes.

Action 3: RD periodically, as new information becomes available, will prepare briefings or information packets to educate agency staff on the risks of climate change effects as they apply to specific program areas within RD. RD will continue to conduct “continuity of operations” assessments to better understand the administrative implications of climate change impacts to prepare headquarters, state, and field office staff to respond to events such as failures of borrower systems.

Action 4: RD will review mechanisms for improving climate change adaption, for example: evaluating the potential for integrating alternative energy sources in appropriate RD programs; or seeking ways to develop partnerships among regional water supplies to address drought.

Action 5: Evaluate whether through legislation USDA could pool funds allocated for a specific disaster, which are not expended during response to that disaster, and create a contingency fund for future disasters

or disaster preparedness. If possible, RD will evaluate budgetary methods by which such funds could be used to address climate change related disasters.

Attachment:

Table 1: USDA Rural Development (Rural Housing Service, Rural Business Service, Rural Utilities Service)

Rural Development

**Table 1: USDA Rural Development (Rural Housing Service, Rural Business Service, Rural Utilities Service)
Climate Change Adaptation Planning Document
February 2014**

Action Description	Action Goal	Agency Lead	Rick/Opportunity Description	Scale	Timeframe	Implementation Methods	Performance Metrics	Inter-Governmental Coordination	Resource Implications	Challenge/Further Implications	Highlights of Accomplishments to Date
1- Reissue Environment Policy Rule 7 CFR 1970 and evaluate other areas		RD	Highlight Policy Changes to Administration and Congress	National	Early FY 2105						7 CFR 1970 was published in the FR as Proposed Rule on February 4, 2014. Comment deadline April 7, 2014.
2-Partner with REE and NGOs to evaluate decision tools that incorporate sound climate in agency planning		RD	Leverage partnerships to improve climate change adaptation consideration in RD decision making	National	Ongoing						Rural Utility Service adopts Program Energy tool for energy efficiency programs
3-Prepare briefings or information packets to educate staff as new information on climate change becomes available		RD	Educate staff to encourage agency-wide participation in climate change adaptation efforts	Agency-wide	Periodically		Need to be developed	FEMA, USGS, NOAA, USACE			Environmental Briefing and Training for National Office Staff conducted December 2013
4-Review mechanisms for improving climate change adaptation		RD	Seek ways to creative approaches to addressing climate change impacts and improve sustainability	Agency-wide	Ongoing						
		RHS				Program Rule					Implemented USDA Rural Development Multi-Family Housing Energy ¹

	RHS				Program Rule		EPA, HUD, USDA RHS Treasury, DOE			Multi-family Housing Portfolio Manager, Capital Needs Assessment/Utility Usage ²
	RHS				Program Rule		USDA HUD Treasury DOE			Energy Independence and Security Act compliance – increase baseline energy code to IECC 2009 . Affects USDA RHS Single Family Housing new construction ³
	RHS				Program Rule		USDA HUD Treasury			100 MW installed capacity of on-site renewable energy on the collective portfolio of federally-funded multifamily housing by 2020 – part of Climate Action Plan ⁴
	RBS				9000 Series Program Rules					In the last 2 years RBS has helped to assist >4,000 individual producers of renewable energy responsible for generating the equivalent of >20,000,000 Megawatt hours of energy

		RUS				Program Rule						The Energy Efficiency and Conservation Loan Program Final Rule published December 5, 2013 in the FR. Provides funding for energy efficiency upgrades for utilities and end user consumers
5-Use funding flexibilities to be poised to respond to future emergencies		RD	Establish agency emergency responses affecting agency assets and communities served	National	Ongoing							Targeted efforts being tailored to special needs

Notes:

¹The USDA Rural Development Multi-Family Housing Energy Efficiency Initiative

In order to help create a more energy independent rural America for the next century, the USDA Rural Development Multi-Family Housing Energy Efficiency Initiative is enabling Section 515 Rural Rental Housing Program for New Construction, Section 514 Farm Labor Housing Loans and Section 516 Farm Labor Housing Grants for Off-Farm Housing, Section 522 Housing Preservation Grants, and Sections 514, 515 and 516 Multi-Family Housing Revitalization Demonstration Program applicants to increase their eligibility for program funding by incorporating energy-efficient practices into project designs, construction, and operations. An incentive scoring point system rewards projects that commit to energy-efficient building practices, on-site energy generation, and green property management. The initiative began in 2010 and continues today. Projects have been constructed that approach net zero energy consumption, with upwards of 80% of their energy requirements being produced on site with renewable sources such as geothermal heat pumps, solar panels, wood pellet boilers and wind turbines. We expect that this initiative will promote development projects that require a reduced quantity of energy to operate, use energy sources that do not produce greenhouse gases and that have little or no net emissions of greenhouse gases, and are economically viable.

²The Capital Needs Assessment e-tool – White House Rental Policy Working group with USDA, HUD and Treasury

The White House Rental Policy Working group includes two working groups that impact climate adaption. USDA RHS has been actively involved with the working groups on Energy Efficiency and another on the development of a common Capital Needs Assessments online tool (CNA e-tool) for almost two years. The CNA e-tool will facilitate better decision making in design and development of construction and renovation by allowing cost benefit and life cycle cost analysis on utility-consuming equipment and appliances. Multifamily housing owners and developers will be able to see quickly how an upfront investment in a more energy-efficient building component today will be a better choice for tomorrow – both economically and environmentally.

³Energy Independence and Security Act Compliance

USDA RHS has been working with HUD directly on the publication of a notice in the federal register regarding the affordability of bringing the baseline energy code from a current regulatory 1992 code that is out of publication to the International Energy Conservation Code (IECC 2009), which is currently the baseline code in at least 35 states. The publication is imminent and should be in the federal register within the next few weeks. This will allow both agencies to make changes to their regulations and guidance to cite the newer code as baseline. USDA RHS will be continuing to work with the interagency group to produce similar studies of affordability for the adaption of subsequent codes, as the IECC adopts a new code every three years. There is currently an IECC 2012, but it is adopted only in a few states. When that number increases and it is affordable enough to adopt the newer code, it is the goal of the agency to continually stay up to date. This compliance is mandated through the Energy Independence and Security Act of 2007, and affects only Single Family Housing, new construction at USDA, while affecting both single family housing and Multifamily housing at HUD.

⁴Joint Agency Commitment of HUD, Treasury and USDA to 100 Mega Watts of On-Site Renewable Energy on Multifamily Properties by 2020 through the Climate Action Plan

USDA is working with HUD and Treasury to develop strategies to meet the goal of having an installed capacity of 100 Mega Watts on the collective portfolio of federally-funded housing by 2020. Because of USDA's existing efforts in the Multifamily housing program, USDA is already on their way to this goal. Part of the strategy will be to explore collaboration between RHS and RUS with the RUS Energy Efficiency and Conservation Loan Program.