

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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