

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

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

Introduction

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

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

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

Policy Framework for NRCS Adaptation Planning

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PART 1: Conservation in the Context of Climate Change

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

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

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

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

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

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

Key Climate Change Impacts: Agricultural and Natural Resource Impacts

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

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

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

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

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

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

Precipitation Changes and Impacts on Water-related Issues

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

Temperature Effects

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

Other Possible Impacts

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

Potential Impacts to Agency Operations

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

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

Continuous NRCS Climate Change Risk Assessments

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

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

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

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

PART 2: NRCS Adaptation Actions

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

Conservation Program Delivery

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

Conservation Innovation Grants

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

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

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

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

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

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

National Soil Health Campaign

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

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

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

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

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

Landscape Conservation Initiatives

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

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

Conservation Practice Standards

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

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

Other Programs and Assets

Plant Materials Centers

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

Snow Survey and Water Supply Forecasting Program

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

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

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

Ecological Site Information

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

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

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

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

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

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

Watershed Rehabilitation Program and Small Watershed Program

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

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

Data and Databases

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

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

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

Snow Survey and Water Supply Forecasting (SS/WSF)

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

Soil Climate Analysis Network (SCAN)

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

Conservation Effects Assessment Project (CEAP)

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

PLANTS Database

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

National Cooperative Soil Survey Laboratory Characterization

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

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

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

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

National Resources Inventory

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

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Rapid Carbon Assessment (RACA)

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

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

Ecological Site Inventory

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

Field Office Technical Guide (FOTG)

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

Technology and Innovation

Training and Education

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

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

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

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

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

Conservation Effects Assessment Project (CEAP)

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

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

COMET-VR 2.0 and COMET-FARM

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

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

PART 3: Managing Significant Risks

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

NRCS has developed programs for emergency response and continuity that:

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

Identified Analysis Needs

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

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

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

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

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

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

PART 4: Procurement, Acquisition, Real Property and Leasing

Existing or Ongoing Activities

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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PART 5: Interagency Coordination

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

Regional Climate Change Hubs

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

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

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

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

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

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

National Drought Resilience Partnership

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

Climate Preparedness Water Resources Workgroup

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

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

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

Appendix: NRCS Contributing Author Team

- **Joel Brown – National Leader-Ecological Site Team, Soil Science Division (Soil Science and Resource Assessment)**
- **Adam Chambers – Air Quality Scientist, National Air Quality and Atmospheric Change Team (Science and Technology)**
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- **Noel Gollehon – Senior Economist, Resource Economic, Analysis, and Policy Division (Strategic Planning and Accountability)**
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- **Michael Strobel – Director, Water and Climate Center (Soil Science and Resource Assessment)**
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- **Michael Wilson, Team Leader, Acting National Leader-Climate Change, Soil Science Division (Soil Science and Resource Assessment)**

NRCS Adaptation Actions

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

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

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|-------------------------|--|-----------------|---|----------|--------------------|---|---|---------------------------------|-----------------------|---------------------------------|---------------------------------------|
| NRCS Practice Standards | Review and revise (if necessary) NRCS practice standards; outcomes, engineering design and adjustments from assessments based analyses of useful life, risk tolerance, and failure in relation to climate trends and projections | S&T, SSRA, Prog | Review, modify, and/or improve designs based on best available climatic data withstand climate extremes and variability | National | FY 2015 and beyond | Integrate into standing schedules for practice reviews and design updates | Percentage of existing structures, new designs, or practices evaluated; percentage using new and projected data | | | | |

OTHER PROGRAMS AND ASSETS

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

supply forecasting

forecasts

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

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