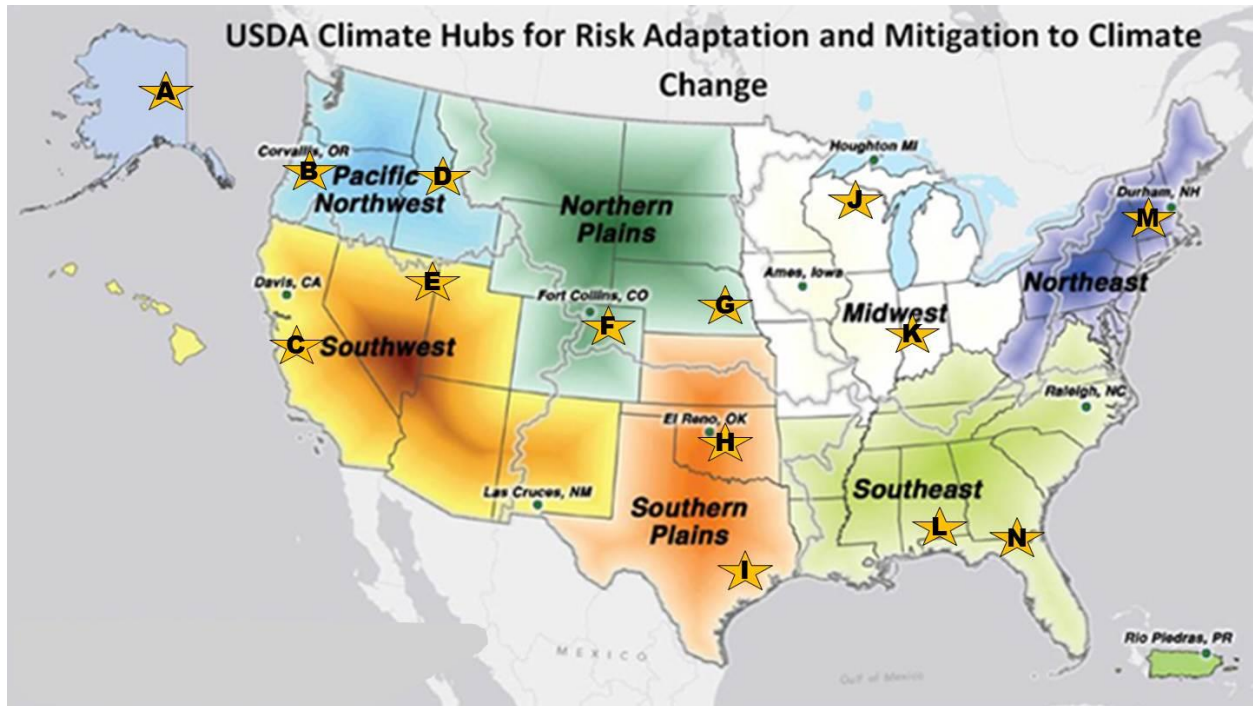


## USDA Climate Change Success Stories: Decision Making Tools



### A. Building a Stronger Bridge Between Traditional Knowledge and Science

The Forest Service's Alaska Region – Fisheries and Subsistence has partnered with Alaska Natives on climate change to build a stronger bridge of understanding and respect between traditional ecological knowledge and scientific methods. Native peoples face changing environments altering patterns of resource availability and traditional cultural practices. In Alaska, the Forest Service is working hand-in-hand with tribal partners to understand changes in climate to ensure traditional ways of life are preserved.

Cooperating starts with mentorship. Agency scientists built strong relationships with local schools and tribal organizations to educate Alaska Native youth about the scientific method, through programs at the [Héen Latinee](#) Experimental Forest. Likewise, Forest Service employees learn traditional ecological knowledge from Native elders through partner organizations like the [Alaska Coastal Rainforest Center](#). Fundamentally, our mutual successes are the product working together toward a common goal and recognizing our strengths. The Alaska Forest Service respects local clan traditions; and in return, they share knowledge, traditions, and labor. Together we are better able to address the challenges that face the communities and lands of Alaska, including climate change.

### B. ForWarn Tool Monitors Forests Coast-to-Coast

A web-based tool provides a weekly snapshot of U.S. forest conditions to aid forest managers and natural resource managers rapidly detect, identify, and respond to unexpected changes in the Nation's forests. Scientists and collaborators with the Southern Research Station, the Forest Service Eastern Forest Environmental Threat Assessment Center and the Pacific Northwest Research Station Western Wildland

Environmental Threat Assessment Center developed ForWarn, a monitoring and assessment tool that produces sets of national maps showing potential forest disturbances every eight days. This tool posts the results to the Internet for scientists and natural resource managers to examine.

ForWarn compares current forest vegetation greenness with the normal greenness that would be expected for healthy vegetation for a specific location and day of the year, and then identifies areas that appear less green than expected. This tool provides a strategic national overview of potential forest disturbances that can focus and direct ground and aircraft observation efforts and resources. ForWarn is the first national-scale system of its kind that was developed specifically for responding to forest disturbances. It has operated since January 2010 and has provided useful information about the location and extent of disturbances—including tornadoes, wildfires, and extreme drought. Eastern and Western Threat Center scientists released ForWarn in March 2012, followed by a series of online training sessions attended by nearly 60 early adopter State and Federal forest managers. ForWarn is the result of ongoing cooperation among Federal and university partners and can be accessed at <http://www.forwarn.forestthreats.org>.

### **C. Beetle Pheromones Save Endangered Pines from Bark Beetles**

High-elevation pines trees are protected by turning beetles' own pheromones against them. Forest Service scientists along with research partners from the University of California at Berkeley and the University of Alberta developed pheromone-releasing flakes that prevent bark beetle attacks and protect white-bark and limber pines. The flakes release a behavioral chemical that convinces beetles that the treated trees are not good host trees in which to reproduce. The scientists applied the pheromone releasing flakes in two ways: in aerial applications over large stands of trees and in sticker applications to individual tree trunks.

They compared subsequent bark beetle attack in treated stands with that in untreated stands. Protection ranged from 50 to 80 percent, even for trees baited with the beetle's aggregation pheromone. The flakes can be dispersed into remote, high-elevation stands even when snow is on the ground, when beetle attack commonly occurs. The flakes provide a nontoxic alternative to insecticides that protects high-elevation pines from bark beetles. The application of the flakes benefits public land managers attempting to protect and preserve fragile, high-elevation pine ecosystems that are habitat for grizzly bears and Clark's nutcracker. The most common uses for the flakes are at campgrounds, administrative sites, ski areas, and rust-resistant stands used for genetic conservation. Scientists conducted the research in Colorado, Montana, Wyoming, and Washington.

### **D. Scientists Conserve the Seeds of Today for the Best Adapted Plants of Tomorrow**

A Forest Service project is aimed at restoring damaged grasslands, shrublands, and deserts. Faced with extensive disturbances and climatological challenges that are rapidly changing ecosystems, scientists and land managers require the seeds of today to provide the plants of tomorrow. Researchers are currently studying more than 50 plant species in order to select the best adapted plants to current and future climate conditions. Forest Service scientists, in partnership with the Bureau of Land Management's Seeds of Success Program, are providing the resources necessary to restore damaged grasslands, shrublands, and deserts—especially in the sagebrush ecosystem. For commonly used restoration species, goals of the program are to ensure genetically diverse, regionally adapted plants, especially forbs (non-grass

herbaceous flowering plants), for reestablishing degraded landscapes, and that sufficient knowledge and technology is available to plant self-sustaining native communities on disturbed sagebrush rangelands.

Researchers evaluate each plant's likely contribution to improving habitat for more than 300 common and rare plant and animal species that depend on the sagebrush ecosystem. Along with cooperators, researchers have collected native grass and forb seed at more than 2,000 sites during the past 10 years. In addition to using the seed collections for research, when collection size permits, the researchers provide 10,000 seeds to the Seeds of Success program for deposit in the USDA Agricultural Research Service National Plant Germplasm System along with site details, photographs, and herbarium specimens. Preserving seeds has inherent value in the retention of the DNA (deoxyribonucleic acid) of native plants that are at a risk of loss because of ongoing disturbances and provides a library of plants' genetic material. This effort makes a variety of seeds available to sustain seed supplies for restoration on future landscapes.

#### **E. SNOTEL Data Helps Agricultural Producers decide What, When, and How much to plant.**

In southern Idaho, shareholders in the Salmon Falls and Twin Falls irrigation tracts rely on USDA-NRCS SNOTEL The Natural Resources Conservation Service (NRCS) installs, operates, and maintains an extensive, automated system to collect snowpack and related climatic data in the Western United States called SNOTEL (for SNOwpack TELEmetry) data used in making decisions about what, when, and how much to plant, as snow melt is an important source of water of irrigation of agricultural crops. In the Salmon Falls tract, which is dependent on limited reservoir storage for its water supply, access to Snow Survey and Water Supply Forecasting (SSWSF) Program data is particularly important to agricultural producers. Irrigation districts within this region inform their shareholders early in the season as to the percentage of their full irrigation allotment they should expect to receive in the upcoming growing season.

These reports are crucial to producers, who use them to make cropping and operations decisions well in advance of the growing season. In agriculture, Idaho Water Users Association members rely on SSWSF data to help them in the early-season contracting process. Mint growers'—whose crop value is maximized when they have water available to them through the month of August—contracts are based on water use. The primary buyer of mint crops has implemented a policy of only contracting with producers whose water supplies are predicted by SSWSF data as being sufficient to carry their crops through the growing season.

From the mid-1990s until the water year of 2005-06, the Intermountain West experienced drought conditions that ranged from mild to severe, depending on the specific location in question. During this drought, alfalfa growers within the Sevier River watershed based their production decisions on the information provided by the SSWSF Program and the SNOTEL system. Based on the data, many producers adjusted their cropping operations to compensate for the dry conditions and to counteract the water shortage they faced. By growing "horse" hay for out-of-state markets—which commands a market price that is 65 percent to 80 percent higher than does standard local "cattle" hay—these producers were able to avoid suffering any economic losses as a result of the drought. The average annual benefit to these producers during the drought was approximately \$15.57 million, and the total benefit during the drought was approximately \$109 million.

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## **G. Online Course in Animal Agriculture and Climate Change**

The University of Nebraska-Lincoln and five partnering Land-Grant Universities received a five years integrated research and extension project to address issues associated with climate change and animal agriculture. The goal of the Animal Agriculture and Climate Change project is to develop the national Extension capacity to address issues related to climate change and animal agriculture. The overall goal is for Extension—working with partner organizations—to effectively inform and influence livestock and poultry producers and consumers of animal products in all regions of the U.S. to foster production practices that are environmentally sound, climatically compatible, and economically viable. The project developed an online Animal Agriculture and Climate Change training course ([www.animalagclimatechange.org](http://www.animalagclimatechange.org)) for Extension educators, technical service providers and other animal agriculture consultants. The purpose of the 12 hour self-paced course is to examine the impact climate change is having on farmers and ranchers, tools to help adapt to risk and uncertainty, and strategies for communicating these topics. The course is offered monthly and participants who successfully complete the course receive a certificate and are eligible for ten Certified Crop Advisor Continuing Education Credits (CEUs) and eight American Registry of Professional Animal Scientists CEUs.

## **H. Climate Change Solutions for Great Plain Cattle Producers**

The Southern Great Plains states are one of the nation's most important beef-producing regions. USDA NIFA awarded a team of Southern Great Plains scientists and educators \$9.6 million over five years to improve understanding of the vulnerability and resilience of beef production in an environment of increased climate variability, dynamic land-use and fluctuating markets. The team is comprised of scientists from Oklahoma State University, the University of Oklahoma, Kansas State University, Tarleton State University, the Samuel R. Noble Foundation and U.S. Department of Agriculture - Agricultural Research Service laboratories.

The goal of the project is to mitigating the environmental footprint of beef production, while maintain productivity and livelihoods. A particular change for producers in the region is the great variability of annual precipitation, when compared to other regions in the U.S. Additionally, cattle are not produced using one single methods, as some producers raise their livestock using forages from rangeland, introduced perennial grasses and winter wheat.

The group is training young students and citizens to use GPS-enabled digital cameras and smartphones and web data portals to participate in field data collection. The geospatial data will be integrated into a portal for community-based analysis and inventory and used to educate the general public on climate change relative to range-based beef production. The team will work together with producers and the community to improve beef production in the region.

## **I. Latest NRCS science and technology helps agriculture mitigate climate change**

USDA's Natural Resources Conservation Service (NRCS) has developed the world's largest soil carbon dataset to help producers and planners estimate the impacts of conservation practices on soil carbon levels. USDA is committed to reducing agriculture's carbon footprint. Soil has tremendous potential to store carbon, which reduces the levels of carbon dioxide in the atmosphere, one of the leading greenhouse gases contributing to climate change. Storage potential varies among soils, land covers, land uses and

management, and NRCS soil scientists took 148,000 individual soil samples and evaluated them for carbon content. This Rapid Carbon Assessment, or RaCA, dataset serves as a baseline or snapshot in time for the amount of carbon each soil type is holding.

Increasing soil carbon is also the single most important component of soil health. Several conservation practices, such as conservation crop rotations or planting cover crops, help increase carbon storage in soil. These crops take carbon dioxide out of the atmosphere and deposit it into the soil as organic matter. They also help reduce erosion and increase water-holding capacity and water infiltration, which increases the resiliency to drought, heavy precipitation and extreme temperatures. Landowners can calculate how much carbon their conservation practices such as cover crops can remove from the atmosphere with the new tools, COMET- Farm™ and the Agricultural Policy Environmental Extender, or APEX model. COMET- Farm™, developed in partnerships between USDA and Colorado State University, is a free online tool that allows producers to enter information about their farm or ranch management practices and receive general guidance on actions they can take to build carbon in their soil. APEX, developed in partnership with Texas Agrilife Research, Texas A&M, and USDA's Agricultural Research Service and NRCS, is planned for use by NRCS conservation planners and private technical service providers. This tool will also assist NRCS and landowners with properly managing nutrients to keep a balance between soil carbon gains, production goals and impacts on water quality.

#### **J. Environmental and Economic Benefits of Short-Rotation Poplar Energy Crops**

Woody production systems and conversion technologies help maintain healthy forests and ecosystems, create high-paying manufacturing jobs, and meet local energy demands. Poplar energy crops have been extensively studied throughout North America for a half-century and are one of many alternative feedstocks contributing to energy security. Building on work that began in the late 1960s, Forest Service scientists and their partners have completed extensive studies that tested the genetics, physiology, and silviculture of poplar crops in a regional network of field trials first established in 1995. They are currently studying the carbon implications of 10- and 20-year-old plantations throughout the Midwest.

They have analyzed biomass, rooting, and other important traits from hundreds of genotypes grown throughout the Northern United States, as well as tree growth-regulating mechanisms in the face of varying environments and changing climate. These results are currently being used to increase the energy potential of the trees and increase the efficiency of plantation establishment, which helps meet U.S. energy demands. Research partners include Iowa State University, Michigan State University, University of Idaho, GreenWood Resources, Inc., Verso Paper, University of Minnesota–NRRI, University of Minnesota, University of Georgia, University of Wisconsin, Canadian Agroforestry Development Centre, and Gustav Luedemann GmbH.

#### **K. Useful to Useable (U2U): Transforming Climate Variability Information for Cereal Crop Producers**

Useful to Usable (U2U): a 5-year integrated research and extension USDA National Institute of Food and Agriculture funded project that aims to improve the resilience and profitability of farms in the Corn Belt

amid variable climate change through the development and dissemination of decision support tools, resources, materials, and training sponsored by USDA National Institute of Food and Agriculture. The U2U team is a diverse group of faculty, staff, and students from nine universities across the Corn Belt. The project is helping producers make better long-term plans on what, when and where to plant, and also how to manage crops for maximum yields and minimum environmental damage. The program has created a suite of online decision support tools, known as U2U<sub>DST</sub> Suite at [www.AgClimate4U.org](http://www.AgClimate4U.org) that provides easy to use historical climate data that can help inform purchasing, marketing and activity planning throughout the growing cycle.

#### **L. AgroClimate: Tools for Managing Climate Risk in Agriculture**

Southeast Climate Consortium, or SECC, is a coalition of six universities that is support by USDA National Institute of Food and Agriculture as well as other governmental agencies including NOAA, USDA, and NASA. The SECC developed AgroClimate.org, a web-resource of tools and data on climate and crops that can be used to assist with decisions about the management of agricultural systems in the Southeastern U.S. AgroClimate is an interactive website with climate, agriculture, and forestry information that allows users to assess resource management options with respect to their probable outcomes under forecast climate conditions. AgroClimate uses crop simulation models along with historic and forecast climate data to allow decision makers to compare changes in probable outcomes under different climate conditions.

One success story of many of this tool has been a project to make use of weather data and climate forecasts to advise Florida Strawberry growers on the timing of fungicide applications. The advisory system (<http://agroclimate.org/tools/strawberry>) uses weather data from stations operated by regional and national weather services as well as SECC developed climate forecasts to predict when weather conditions are favorable for strawberry diseases. Growers can thus apply fungicides only when conditions are favorable for disease, reducing the number and costs of applications while keeping strawberries healthy. One strawberry grower in Citrus County, FL, used the system during the 2008-09 season, reducing the number of fungicide applications by 50% and saving \$400 per acre. If all growers in Central Florida use the system for their 7,500 acres of winter strawberries, they can potentially reduce costs by up to \$3 million per year and significantly decrease the environmental risks associated with pesticide use

These tools are one of many USDA efforts to help America's farmers, ranchers and forest owners adapt to new challenges caused by a changing climate – ranging from more intense weather events, to increased risk of wildfire, to a greater prevalence of invasive species. While assessments on the future of agriculture and forestry show that climate change holds these and other challenges in the years ahead, American producers are longtime leaders in innovation, risk management and adaptation.

#### **M. Changing Climate, Changing Forests - Effects of climate change on forests of the Northeastern United States and Eastern Canada**

The climate of Northeastern North America has changed markedly during the past 100 years and computer models for the region forecast more change to come. Policymakers, land managers, citizens, and scientists must grapple with what this change means for the future of the region and its forests. Forest Service scientists and a large nationwide team analyzed the extensive literature on the potential effects of climate change on northeastern forest ecosystems and provided a concise scientific overview to inform

natural resource management and policy decisions. They found that the evidence is now irrefutable that the climate of the Northeastern United States and Eastern Canada has changed in the past century and greater change is projected in the future.

These changes have had, and will continue to have, dramatic effects on northeastern forests. Projections include shifts in suitable habitat for forest tree species, with significant declines in the amount of suitable habitat for spruce-fir forests and an expansion in areas that are suitable for oak-dominated forests; changes in forest productivity, with possible gains from extended growing seasons, carbon dioxide, and nitrogen fertilization offsetting losses that are associated with atmospheric deposition of pollutants, forest fragmentation, and forest pests and pathogens; changes in the distribution and abundance of wildlife species through changes in habitat, food availability, thermal tolerances, and susceptibility to parasites and disease; alterations in forest water and nutrient cycling; and expansions in the range and virulence of pests, pathogens, and invasive species. With the accumulating evidence that the climate is changing and the potential effects of those changes, forest stewardship efforts would benefit from integrating climate mitigation and adaptation options into conservation and management plans.

## **N. Mapping the Future of Southern Pine Management in a Changing World**

The Pine Integrated Network: Education, Mitigation and Adaptation project (PINEMAP) is a Coordinated Agriculture Project funded by the USDA National Institute of Food and Agriculture. PINEMAP focuses on the 20 million acres of planted pine forests managed by private landowners in the Atlantic and Gulf coastal states from Virginia to Texas, plus Arkansas and Oklahoma. These forests provide critical economic and ecological services to U.S. citizens. Southeastern forests contain 1/3 of the contiguous U.S. forest carbon and form the backbone of an industry that supplies 16% of global industrial wood, 5.5% of the jobs, and 7.5% of the industrial economic activity of the region. Overall understanding terms and concepts such as high pressure systems and oscillations will provide forest managers and landowners with a better set of tools to use for protecting their forested asset and managing risks.

Understanding how drought impacts the Southern Forests is important for forest health and resiliency. Being aware of La Niña and Bermuda High conditions - which can help identify the onset of drought -- will allow forest managers and landowners to anticipate changes in a stand's condition.