2011

State Accomplishments for the Formula Grants Annual Report Summary

United States Department of Agriculture
National Institute of Food and Agriculture

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Introduction

This summary report from the National Institute of Food Agriculture (NIFA) highlights many of the outstanding outcomes reported by our land-grant university partners in their 2011 Annual Reports of Accomplishments and Results. The summarized outcomes in this report have been carefully selected to be representative of the excellence displayed by the nation's land-grant universities and what they accomplished in 2011 with dollars from the four major research and extension formula grant funds: Hatch, Evans-Allen, Smith-Lever 3(b)&(c), and 1890 Extension Institutions.

The formula grant process works through the long-standing partnership between USDA and the land-grant university (LGU) system. NIFA identifies national priorities for these programs, but the allocation of funding to these priorities is decided by each individual university. These formula grants also work in concert with the competitively awarded grants in the Agriculture and Food Research Initiative (AFRI) to address important problems. The competitive grants process is specifically designed to attract the best proposals related to an agency-identified topic of high importance. Funding is then awarded to those proposals of highest relevance and quality. In contrast, the formula grants process is designed to allow the state land-grant universities the flexibility to define their own high-priority and rapidly emerging issues. Funding is able to be allocated quickly by the states to subjects they deem most important. These formula funds are, therefore, often used for activities that are not well supported by the competitive process and that are specific to particular states (such as programs targeted to the regional or local level, very long-term research, seed money to initiate new lines of research, and supporting research and extension capacity).

The outcomes in this report are grouped according to the four USDA Strategic Goals:

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

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

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

Goal 4: Ensure that all of America's Children Have Access to Safe, Nutritious, and Balanced Meals.

The outcomes highlighted in support of these goals include examples of cost-benefit ratios, dollars saved, revenue generation, increases in yield, best management practices developed and used, new and value-added products developed and used, as well as a myriad of increases in knowledge and changes in action and behavior.

Overall, this documentation demonstrates the link between the outcomes from the Annual Report of Accomplishments to the USDA goals while also helping tell the national story of how formula

funds are supporting important agricultural research and extension activities in all four regions of the fifty states and territories. Many of the outcomes from this summary document have been used in annual NIFA reporting activities, such as portfolio reviews and the budget process. These outcomes show the continued importance of the four major formula grants to the both NIFA and USDA Goals. They also provide the agency and its land-grant partners the information needed to examine the questions of balance and direction as they move forward as a unified system.

Background Information & Definitions

The Plan of Work reporting system is designed to accommodate the states' ability to report by various combinations of 1862 LGU and 1890 LGU institutions, including both research and extension entities. In 2010, some states have chosen to keep all of their 1862 LGU (and 1890 LGU, where applicable) research and extension reporting separate. In these cases, the outcomes reported, some of which are included in this document, are a result of *only* 1862 Research (Hatch), 1862 Extension (Smith-Lever 3b&c), 1890 Research (Evans-Allen), or 1890 Extension funding. Other states, meanwhile, have chosen to combine their research and extension reporting within their 1862 and 1890 institutions, and still others have chosen to combine all of their 1862 and 1890 reporting into one document. In these cases, outcomes reported are most often a result of multiple funding lines. Subsequently, this document contains many outcomes that can be attributed to more than one of the four funding types that make up the Plan of Work system.

LGU: Land Grant University; an institution with which NIFA has a partnership and obligation to provide research and extension funding as written by federal law.

Hatch Act (1862 Research): Hatch funds are used to support continuing agricultural research at institutions eligible to receive funds under the Act approved July 2, 1862 (12 Stat. 503, as amended) (—1862 Land-Grant Institutions), as well as State agricultural experiment stations. Funds appropriated under this section are used to conduct original and other researches, investigations, and experiments bearing directly on and contributing to the establishment and maintenance of a permanent and effective agricultural industry of the United States.

Evans-Allen Act (1890 Research): Evans-Allen funds are authorized under section 1445 of the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (NARETPA) and are used to support continuing agricultural research at colleges eligible to receive funds under the Act of August 30, 1890 (26 Stat. 417–419, as amended; 7 U.S.C. 321–326 and 328) (—1890 Land-Grant Institutions), including Tuskegee University and West Virginia State University. Funds appropriated under this section are used for expenses of conducting agricultural research, printing, disseminating the results of such research, administrative planning and direction, and purchase and rental of land and the construction, acquisition, alteration, or repair of buildings necessary for conducting agricultural research.

Smith-Lever 3(b)&(c) (1862 Extension): Smith-Lever 3(b)&(c) funds are used by institutions eligible to receive funds under the Act of July 2, 1862 (12 Stat. 503, as amended)) (—1862 Land-Grant Institutions) for the development of practical applications of research knowledge and giving of instruction and practical demonstrations of existing or improved practices or technologies in agriculture, uses of solar energy with respect to agriculture, home economics, and rural energy, and imparting information on communities through demonstrations, publications, and otherwise and for the necessary printing and distribution of information in connection with the communities.

1890 Extension Funds: These funds are authorized under section 1444 of the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (NARETPA) and are used to support continuing agricultural and forestry extension activities at colleges eligible to receive funds under the Act of August 30, 1890 (26 Stat. 417–419, as amended; 7 U.S.C. 321–326 and 328) (—1890 Land-Grant Institutions), including Tuskegee University and West Virginia State University. Funds appropriated under this section are used for expenses of conducting extension programs and activities.

Summary of Expenditures

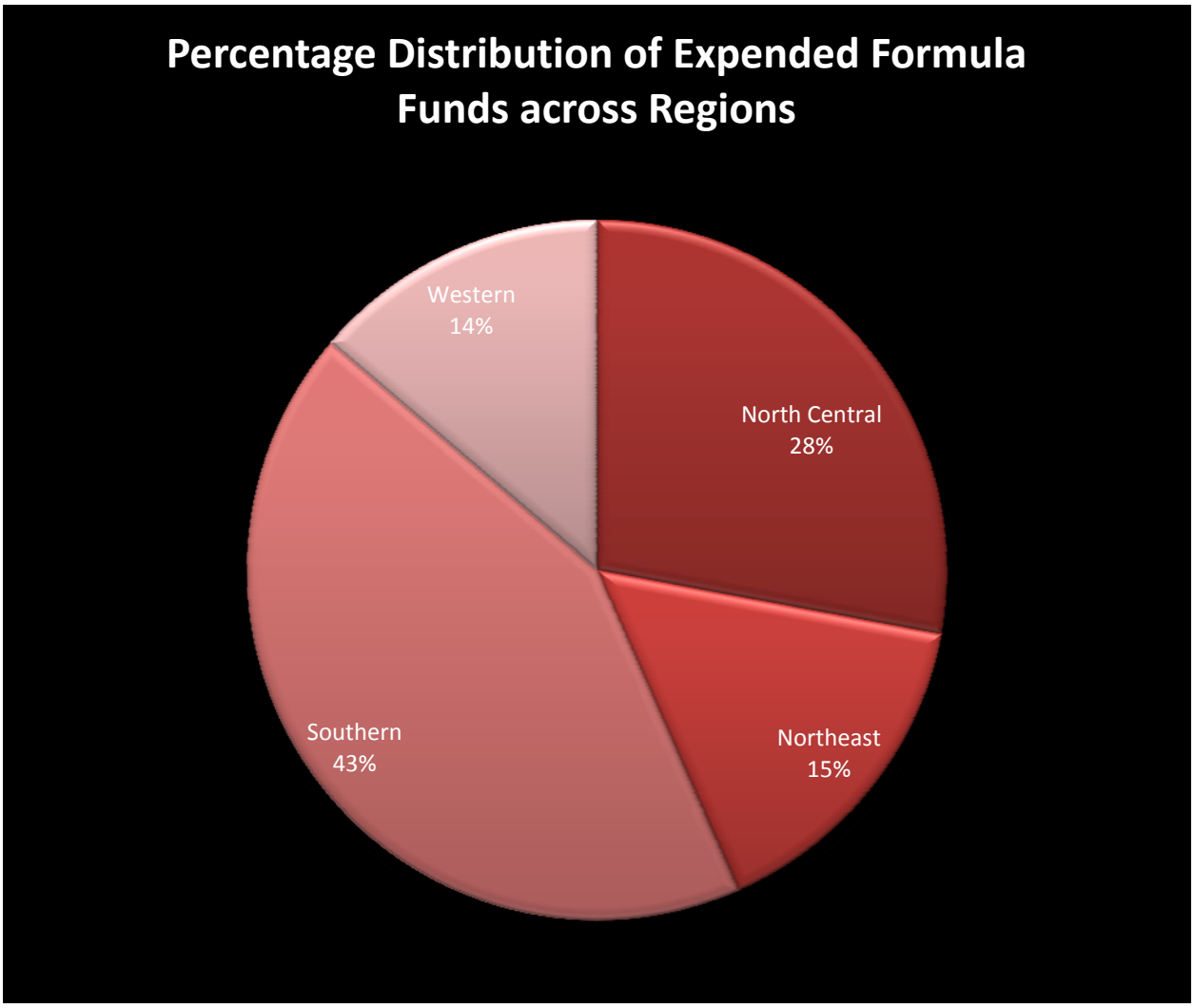
A total of $530,566,432 was reported expended from the formula grant funds in 2011 on various planned programs in the 2011 Annual Report of Accomplishments and Results.

The breakdown of expenditures among fund/institution type is as follows:

Smith-Lever 3(b)&(c) (1862 Ext)	$243,750,704
Hatch (1862 Res)	$204,255,124
Evans-Allen (1890 Res)	$48,113,439
1890 Extension	$34,447,164

The breakdown of expenditures among regions is as follows:

North Central	$147,478,380
Northeast	$82,138,932
Southern	$227,845,410
Western	$73,103,709



Note: An effort has been made to include a balanced number of outcomes from the four regions in this document. However, this document is only a summary and is not meant to be representative of all outcomes resulting from total expenditures across the four regions. This summary does not purport to be the only resource for the outstanding research and extension work that is done at all LGUs. For more detailed information about Plan of Work outcomes, please email the POW staff at NIFA at pow@usda.gov.

Outcomes Supporting USDA Strategic Goal 1

Assist Rural Communities to Create Prosperity so they are Self-Sustaining, Repopulating, and Economically Thriving.

NIFA Strategic Objective 2.1: Provide research, education, and extension to expand domestic market opportunities
NIFA Strategic Objective 2.2: Provide research, education, and extension to increase the efficiency of agricultural production and marketing systems
NIFA Strategic Objective 2.3: Provide risk management and financial tools to farmers and ranchers
NIFA Strategic Objective 3.1: Expand economic opportunities in rural America by providing research, education, and extension to create opportunities for growth
NIFA Strategic Objective 3.2: Provide research, education, and extension to improve the quality of life in rural areas
NIFA Strategic Objective 4.2: Develop and deliver research, education, and extension to reduce the number and severity of agricultural pest and disease outbreaks

North Dakota farmers seek to develop new biofuel industries in the state and diversify their cropping operations while producing fuel with a lower carbon footprint. An energy beet development program has embarked on a $1,000,000 project on which project leaders and collaborators have finalized the work plans and expect to finalize the technological pathway and begin construction of a commercial plant in 2013. This plant will require 30,000 acres of energy beets providing growers with a $200 net income premium over competing crops. Each plant is expected to create 25 new jobs in rural communities. Positive encouragement and private funding support for the project has been received from MonDak sugarbeet growers, Syngenta, Beta Seed, Garrison Diversion, ND Irrigation Association, Green Vision, Great River Energy, Amity, and AgCountry Farm Credit Services.

The objectives of a wheat breeding project at Colorado State University are to develop wheat cultivars and germplasm having desirable agronomic, disease and insect resistance, and end-use quality characteristics and to conduct research to improve understanding of genetic and environmental factors that affect wheat yield and end-use quality in Colorado. In 2011, various new cultivars have shown improvements such as higher grain yield, exceptional milling and bread baking quality, and a second gene for higher tolerance to the imazamox herbicide. Since inception of the program, average wheat grain yields in Colorado have more than doubled, with at least 50% of this increase attributed to improved cultivars. Estimates of economic returns in Colorado from CSU-developed wheat varieties were approximately $43 million for the 2011 crop alone. These estimates include yield increases resulting from improved CSU varieties ($29 million), marketing benefits resulting from CSU varieties with enhanced end-use quality ($9 million), and yield-protection resulting from adoption of CSU varieties carrying herbicide tolerance traits for winter annual grassy weed control ($5 million).

LSU AgCenter faculty have developed programs to address persistent poverty conditions in rural Louisiana through the Louisiana Center for Rural Initiatives (LCRI). LCRI faculty collaborated with the LA Division of Administration, Office of Information Technology to provide broadband Internet education reaching 300 people in its first six months across 18 rural parishes primarily in the Louisiana Delta region. These communities are now better educated about the regional and local economic development opportunities of broadband and have improved strategic planning through the Stronger Economies Together (SET) program. Additionally, the SET project has been implemented statewide and has played a key role in assisting economic development districts with much needed strategic planning, ensuring that rural communities in LA are better equipped to plan for and respond to further economic development challenges.

Concentrated animal feeding operations (CAFOs) are an important economic force in rural areas bringing an estimated 1.1 billion annually to northwest Missouri alone. However, odor from these facilities has a significant negative impact on neighboring property owners and residents. University of Missouri researchers are working to develop effective biofilters that producers can use to filter out and break down compounds that create pungent odors. In addition, a computer model has been developed that allows large producers to inexpensively estimate the extent of their emission problem, based on simple information about their operation. Development of technologies that reduce the negative externalities of concentrated animal feeding operations will allow rural regions in northwest Missouri to benefit from this source of economic opportunity without sacrificing air quality.

Estrus synchronization and artificial insemination are technologies that enable beef producers to access superior genetics for growth and product quality. Adoption of these technologies can increase ranch productivity, ranch profitability, and product quality, thereby increasing the quality of a protein source reaching the consumer. A two day symposium on Applied Reproductive Strategies in Beef Cattle was conducted in Boise, ID. Post program surveys indicated that over 70% of attendees would adopt a new estrus synchronization protocol or a management practice to increase reproductive efficiency. Respondents estimated that information from the program would add $20-$30 value to each calf. Based on the survey, it is estimated that ranches represented at the symposium owned 60,000 to 80,000 cows. Based on a $20 increase in value for 60,000 calves, the economic impact of this program was $1.2 million.

Researchers at Oregon State University examined an innovative approach in which farmers incorporate wetlands into their crop rotations by flooding fields for a limited time, draining them, and planting again; this can enhance farm viability and promote conservation on agricultural lands. The researchers then developed a dynamic optimization model and simulation framework which relates conservation activities and land use changes to farm profits and water bird habitats to rigorously evaluate wetland rotation programs. The model also allows for the comparison of outcomes from wetland rotation programs and traditional agri-environmental programs along

various dimensions, including farm profits, wildlife habitat, and cost-effectiveness, thus providing insight into the program's impact on the cost of meeting farm prosperity and habitat conservation goals, thereby promoting rural economic development and enhancing rural quality of life.

Small businesses in rural areas tend to struggle to establish a market presence and compete in today's economy. In 2011, Oklahoma State University Extension agents used the e-commerce program to provide training to over 230 small businesses on how to plan, effectively set up, and promote their websites, which can help address these issues. Overall, 13 workshops were conducted, serving a total of 154 participants. After the training, 95% of respondents planned on increasing their web efforts, and 93% indicated that they would be changing the way they marketed their website. Further analysis of collected data and existing research suggests that the improved advertising offered by a website can increase small business sales anywhere from 20% to over 200%. With average sales of $150,000 (which was the average displayed in a small business report by Mississippi State in 2007) this implies that the e-commerce program increased the revenue of small businesses in Oklahoma by between $7.1M and $71.0M as a result of the trainings and workshops held.

Energy costs in most rural communities in Alaska are prohibitively expensive, often causing rural families to choose between warmth and other basic necessities. Researchers at the University of Alaska are moving forward with research in biofuels and biomass with the goal to offset some of these high-energy costs. Grass species evaluated were smooth bromegrass, hairgrass, wheatgrass, tufted hairgrass, slender wheatgrass, Siberian wildrye, and reed canarygrass. Woody species evaluated were Salix alaxensis, Populus balsamifera, S. alaxensis. Novel processing of native small diameter biomass by pyrolysis and gasification is helping guide the continuous development of second-generation technologies focused on undervalued wood resources in Alaska, with the broader impacts affecting the nation as a whole. This research is key to addressing fundamental biofuel questions with regards to uses of AK biomass in nontraditional value added products using small-diameter trees in rural Alaska and potentially throughout the country.

Growers in the agricultural nonfood sector produce bedding plants, flowers, landscape ornamentals, sports turf and forage. They face many of the same growing challenges as food producers, including a short growing season. Cooperative Extension Service agents in Alaska provided support to peony growers with site visits, soil analysis interpretation, weed management and grower consultations using information from University of Alaska researchers. As a direct result of AFES research and CES grower support, there are an estimated 50,000 peony roots in the ground and two dozen commercial growers. The peony growers association reports that in 2011, 10,000 cut stems worth $40,000 were sold and shipped to 10 states, Canada and Japan. Peony production is now estimated at between $1 million and $2 million by 2015.

A research project at the University of Illinois is based on the hypothesis that artificial selection on regulatory sequence variants could aid plant breeding efforts to improve crop productivity. Recent technological advances in high-throughput DNA sequencing and the availability of the complete maize genome provide the means to deeply sequence transcriptomes and to digitally count the number of transcripts. The overall objective of this project is to identify DNA sequence variants in regulatory regions of the maize genome, and the knowledge gained will be used to develop allele-specific DNA markers located in regulatory regions of the maize genome. Together with the new insights into the molecular basis of dominance, epistasis, and heterosis, these DNA markers will enable us to design more efficient and innovative marker-assisted breeding strategies. We also envision that isolation and modification of the found regulatory DNA sequences will open the door to pioneering biotechnology approaches for increasing crop productivity.

Molecular markers can be an aid to plant breeding and can efficiently exploit wild related species as gene sources for improvement of cultivated strawberries and mints, which will then aid in the ultimate production of superior varieties that will benefit growers and consumers. At the University of New Hampshire, new plant germplasm resources, including hybrids and breeding populations continue to be developed. Researchers collaborated on the sequencing and assembly of the first strawberry genome, and they are collaborating to use this sequence to design a microarray chip for rapid genotyping of hybrid plants. A participatory breeding experiment carried out by UNH researchers in collaboration with a local grower allowed them to make superior plant selections on the grower's field site. This research has the potential to improve strawberry and other cultivated food crops and ultimately improve profits for growers while delivering better products to consumers.

There is a need for developing improved peanut genotypes that are higher yielding and more diseased and insect resistant. Improved nutritional varieties would include higher protein levels by alleviation of plant DNA that causes allergens. The peanut is relatively easily accessible and a less-expensive source of vegetable protein, and its improvement will significantly help in the global war against hunger and poverty. The pace for developing these improved genotypes has been accelerated through the use of modern techniques, such as those used in the Biotechnology Program by researchers at Langston University. During 2011 the Biotechnology Program continued printing peanut gene clones on microarrays chips with subsequent processing for probe analysis. Most importantly, all gene Expressed Sequence Tag (EST) clones that were developed from the peanut were fully sequenced during this year. Additionally, collaborative activities between Langston University and the Chinese Beijing Center for Physical and Chemical Analysis resulted in strengthening mutual research infrastructure and outreach activities that led to the first sequencing of the whole peanut plant genome ESTs.

Barley is an important component of heart-healthy whole grain diets because it supplies beta-glucan. All current barley varieties with high beta-glucan are spring habit, and these varieties have waxy starch. Fall-sown varieties have agronomic advantages but must have low temperature tolerance (LTT). Vernalization sensitivity (VS) is associated with higher levels of LTT. To rapidly develop fall-sown varieties with LTT and higher grain beta-glucan, researchers at Oregon State University used marker-assisted selection (MAS) to establish genome-wide association mapping, and the results contributed new information to the body of knowledge regarding barley nutritional and physiological properties. This will be essential in developing fall-sown food barley varieties, which would provide improved nutritional benefits to consumers.

Precision agriculture adoption in Alabama continues to increase with technology being implemented on nearly 70% of the croppable land. Research projects led by Auburn University, Alabama A&M University and Tuskegee University have indicated an estimated 10% reduction on applied nutrients and pesticides when Alabama farmers adopt these modern tools. This reduction has led to enhancing environmental stewardship at the farm level while providing savings to Alabama farmers. In 2011, Alabama farmers saved over $22,000,000 on inputs through the adoption of guidance systems, variable-rate technology and automatic section controls.

Irrigation initiation and termination timings have been questioned since irrigation was introduced into cotton production in Arkansas. A four year study at the University of Arkansas evaluated the importance of irrigation timing and termination for maximized cotton yields and profitability. Results from the four year study indicated that the most critical period for irrigation to be initiated is one week prior to bloom in order to maintain the highest level of yield potential. This timing will be most significant in years that experience higher than average heat and drought during the month of June. Average cotton yields over the four year period were increased 80lbs lint per acre when irrigation was initiated one week prior to bloom. In 2011, the yield increase resulted in a $80/acre increase in profitability.

Extension specialists in Florida held a district wide Continuing Education Training for Restricted Pesticide holders of private, public, and commercial licenses. The course was offered via interactive videoconference; 120 individuals participated at eleven county Extension offices. A total of 40 surveys were returned. Of the respondents,
82% reported gaining and better understanding of applying the correct amount of pesticides and an additional 58% reported having taken the training in order to take and pass the FDACS private applicator exam. By having pesticide certification, applicators can increase their annual earning capability by $6,400. Based on 23 certifications for this particular training, this equals $147,200 increased income annually.

Pest are an issue for peanut, cotton and soybean crops in the panhandle of Florida. Based on information disseminated by Extension agents in Florida, producers were able to identify and control pests based on Extension- recommended thresholds on 80% of peanut and cotton and soybean acreage (64,527 acres) in Santa Rosa, Okaloosa and Escambia Counties. These actions represent a significant cost savings, as just one pesticide application resulted in savings of $774,324 ($12 per acre) in pesticide costs.

The Purdue Management Academy was developed to provide Indiana agricultural producers with strategic risk management tools to be competitive in a volatile agriculture industry; the program provides information on labor, production, price, legal, and financial risk management. Over 67% of recent participants shared they would change the way they operate their farm operations immediately after the academy. Six months later, participants shared that they were already implementing standard operating procedures for difficult tasks on the farms so that each employee understood how to perform the task in the same manner. The specific goals and planning being done afforded better communication with the community and potential landlords. They also estimated these new ideas or tools helped them to increase their farm income up to $20,000 and helped them to reduced expenses.

Beef producers have been facing continually rising feed costs and feed cost represents 50 to 80% of the cost of production for livestock producers. Thus, tools to lower feed cost while meeting nutritional requirements have been needed. In a partnership with Iowa State University, researchers at Kansas State University made BRANDS, a beef ration formulation package, available to all extension agents in Kansas with a livestock interest. Trainings conducted increased Extension agent comfort level in using this tool to help beef producers lower their feed cost with prudent, effective supplementation programs and forage management systems. BRANDS has now been used with beef producers to lower their feed costs and to examine alternative ingredients. As examples, several producers were able to incorporate wet DDGS into their operation to save $1,200 and $10,000 on their feed costs. BRANDS has provided a significant tool for agents, specialists, and veterinarians to make a direct financial impact on the businesses of beef producers.

Commercial Horticulture (CH) baseline programs and reactive programs are highly relevant to the crop producers of Alabama. In 2011 Alabama Regional Extension Agents conducted meetings and trainings that were attended by over 8,800 participants that included conventional fruit and vegetable farmers, organic and naturally grown family farmers, low resource farmers, new and beginning farmers , hoop house producers, and crop advisors. The large number of meetings and participation in them indicates high relevance of our Commercial Horticulture programs. Over 90% of audiences that come to Extension meetings indicate strong preference to continuation of their training. The CH Team members also provided about 300 on-site consultations to rural and urban farms as an invaluable service. Extension surveys conducted by

regional extension agents and specialists suggest a minimum impact of $8 to 10 million on fruit & vegetable industry. More in-depth impact assessment instruments are under development by Extension teams at Auburn University and Alabama A&M University.

Weeds are a major source of yield loss for growers in Michigan and in the North Central Region. It is estimated that losses due to weeds left uncontrolled exceed $7.5 billion in the United States. Research was undertaken at Michigan State University to help define management strategies, identify effective practices for weed control, and identify fundamental factors in cultural and chemical weed control, compositions, and life cycles. Testing was done to better understand new herbicide effects and better application strategies for herbicides used on blueberries, which has helped growers incorporate new herbicides into their management plans and to more effectively use older ones. With good weed control, growers can realize a 10-20% increase in marketable yield, representing a $10 million to $20 million per year boost to the state's economy.

Research at both Kentucky State and the University of Kentucky has been conducted to investigate best practices that can increase small-scale farming profits. Kentucky State is also investigating direct, restaurant, and retail marketing of aquaculture products that small-scale farms can produce. The potential impact of this project will increase marketing and direct sales, and indicate the types of products in high demand, the willingness-to-pay for these products, and the potential of targeting underserved ethnic consumer groups. As one example, Kentucky State University researchers estimate that the use of soybean meal and distiller's dried grains (DDGS) reduced feed costs for producers between $50-350/ton of feed. This result helps create new markets for soybean meal and DDGS as Kentucky-produced ingredients.

Researchers at the University of Florida have found that pregnancy rates of 55% or greater resulting from artificial insemination technologies in postpartum beef cows are now consistently achievable. Prior to adoption of any new technology, producers require confidence that the technology will not fail. Generally, that confidence is met when producers have witnessed success in other cattle operations. Together with traditional Extension dissemination methods, University of Florida faculty will ensure future involvement of producers in research programs to demonstrate success of these reproductive management practices and initiate an increase in adoption of artificial insemination technologies. Ultimately, this program will has resulted in and will continue to support enhanced working relationships among producers, extension specialists, and veterinarians and an increase in profit for beef operations resulting from improvements in reproductive management.

At Louisiana State University, aquaculture production efforts have focused on refinement of crawfish management strategies, nutritional requirements for alligator and finfish production, technologies necessary for commercially viable marine baitfish culture, and techniques for improving spawning and production practices for various aquatic species. Findings have been extended to practitioners and scientists via publications, individual contacts, Web-based resources, and producer meetings conducted by Extension Sea Grant agents and fisheries specialists. Average adoption of 10 of the 12 targeted recommended practices was over 50%. Adoption of more efficient harvesting and management practices continues to decrease expenses

for many of Louisiana's 1,200-plus crawfish farms by up to 20% while further increasing production in the $168 million industry. Lowering feed costs through improved formulations and feed conversion rates will provide direct benefits for the state's $28 million alligator industry. As an overall result, the $416 million aquaculture industry in Louisiana will become more sustainable and profitable as a result of these efforts.

With the increase in acreage and increasing number of producers that are growing corn (many for the first time), there is a great need to educate county agents and producers how to grow high yielding profitable corn. The Arkansas Corn Research Verification program serves as an educational tool to educate county agents and producers about up-to-date management practices for growing corn in Arkansas. The program takes Arkansas generated research and demonstrates it on a whole field basis. In 2011, following University of Arkansas corn production recommendations for hybrid selection, fertility management, weed and insect control, and irrigation management, corn producers in the verification program were able to reach maximum yields. Yields in the verification program averaged over 180 bu/acre, where the state average corn yield was 142 bu/acre. Thus, with proper irrigation and management, verification fields yielded 38 bu/acre more than state average fields, which results in a $247/acre gain in gross revenue compared to state average fields. This shows that Arkansas corn producers can grow high yielding profitable corn following University of Arkansas Cooperative Extension Service recommendations.

University of California Cooperative Extension initiated and coordinated meetings between scientists from California Department of Water Resources, University of Baja California, and the state of Baja California to install and calibrate two CIMIS weather stations in the Mexicali Valley. Additionally, UC scientists developed bilingual computer programs and publications that are used to educate growers in the Imperial Valley and Mexicali, Mexico region about how they can improve water use efficiency and increase the availability of Colorado River water to urban areas in Southern California and northern Baja California. The additional weather stations and irrigation scheduling programs help growers in both Baja California and Southern California conserve water. Growers in California extensively used evapotranspiration information from University of California, and it is estimated that growers saved approximately $64.7 million per year in water and energy savings by using irrigation strategies recommended by these programs. In addition to water savings, reduction in agricultural water use also reduces fertilizer usage and surface and ground water pollution. In light of these data, these best management practices to conserve water and improve irrigation efficiency were included in Regional Water Quality Control Board - Region 7 Silt/Sedimentation TMDL standards.

Increased profits for the beef producers can be achieved through a higher percentage of cows calving during a more concentrated time frame and earlier in the calving period, as well as an improvement in genetics resulting from use of high accuracy, genetically proven, superior sires. Research programs in 2011 at the University of Florida were aimed developing cow-calf

production systems which reduce unit cost of production while still producing high quality beef that meets the demands of today's consumer; developing and integrating reproductive management technologies into management systems. A significant impact from such programs shows that it costs $0.75 to $1.50 per day to raise one post-weaned calf, and 70% of that cost is feed related. In addition, a calf is usually backgrounded for 90 to 120 days. If a supplement during the backgrounding period does not exceed $0.05 per day yet results in a 7% to 8% reduction in feed with no reduction in performance, then cattle producers will save between $3.65 to $9.24 per head during the backgrounding phase (90 to 120 days) or $1.9 to $7.0 million savings to the state of Florida cattle industry each year.

The mission of the National Plant Diagnostic Network (NPDN) is to enhance national agricultural security by quickly and accurately detecting high priority pests and pathogens. UD Plant Diagnostic Clinic accomplishments and impacts as part of the NPDN during 2010-2011 were many. Over 750 samples were processed and over 130 First Detectors have been trained for the state of Delaware. Of note, a new leafspot of soybean was identified as soybean vein necrosis. A pest alert was issued and information placed in the NPDN National Newsletter. Other states then were able to follow Delaware's lead to confirm soybean vein necrosis virus, resulting in significant savings from potentially damaged crops.

Nearly 500 home gardeners, Master Gardeners, and other volunteers in a dozen Maine counties collectively logged 5,890 hours through UMaine Extension's Maine Harvest for Hunger Program to grow and glean fresh fruits and vegetables and donate them to needy individuals and families in Maine. During the 2011 growing season the Maine Harvest for Hunger Program donated nearly 290,000 pounds of produce - over 145 tons - to food pantries, shelters, or charitable organizations around the state. The value of the produce was over $490,000 based on a market sales price averaging $1.69 per pound. Many recipients were able to take advantage of cooking and gardening lessons offered as a component of the Program that will allow them to be more self-reliant and healthier in the future.

Outcomes Supporting USDA Strategic Goal 2

Ensure our National Forests and Private Working Lands are Conserved, Restored, and Made More Resilient to Climate Change, While Enhancing Our Water Resources.

NIFA Strategic Objective 6.1: Ensure clean, abundant water and clean, healthy air
NIFA Strategic Objective 6.2: Enhance soil quality to maintain productive working lands
NIFA Strategic Objective 6.3: Protect, enhance, and manage forests and rangelands
NIFA Strategic Objective 6.4: Protect and enhance wildlife habitat to benefit desired, at-risk, and declining species

The Missouri River flood of 2011 greatly impacted farmers, agribusiness professionals, landowners and other citizens living or farming along the river. Clients in IA, NE, SD, MO and KS needed to remove debris and sediment, then apply new and unfamiliar practices to protect the environment and restore the productivity of the hundreds of thousands of acres impacted by the flood. Regional land grant university experts needed to partner with other agencies to develop and deliver information to anxious clients to meet these needs. Iowa State University experts held two flood webinars jointly with University of Nebraska staff. Over 500 clients (landowners, farmers, agribusiness, and service agency staff) attended. Four new publications were created to address recovery, and thousands of copies of these and existing publications were distributed to clients. This group of clients represented over 1 million acres of affected land. Seventy-four percent of clients who attended the meetings improved their knowledge and implementation of environmentally safe sediment and debris management while 55% of clients implemented environmentally and agronomically sound flooded soil syndrome management strategies. Additionally, 55% of clients either planted or intend to plant cover crops to protect soil from erosion. Clients indicated the value of the information of the webinars was $18.1 million dollars.

Recent interest in the development of small-scale enterprises, the use of non-timber size trees (small trees) and other woody biomass resources, and the national interest in bioenergy are creating new opportunities in California. However, decision makers at the community level often lack the knowledge and expertise to realistically evaluate these opportunities. Extension agents at the University of California undertook a project to organize local workshops throughout the state that focus on the opportunities and challenges of working with the non-timber and woody biomass resources and provided information on how to evaluate technology and to assess the feasibility of options that are appropriate for the location. Specifically, workshops provided information on the Forest Service 2011 Hazardous Fuels Woody Biomass Grants program. As a result of direct technical assistance provided to small business clientele during FY 2011, three companies were awarded federal grants totaling about $550,000. Over the past four years, the technical assistance to companies helped them acquire a total of 18 federal grants worth more than $4.5 million.

The Working Lands Alliance in Connecticut is a coalition that is directed by a steering committee which includes 2 Extension Educators. Among its supporters are more than 600 individuals and 200 businesses and organizations that include farmers, conservationists, anti-

hunger groups, planners and local food enthusiasts. This coalition has joined together in an effort to halt the loss of Connecticut's remaining farmland. WLA worked closely with partners to ensure that funding provided through the state's Community Investment Act, a law requiring a deed-recording fee be assessed on all property sold or transferred with the proceeds going to a fund for farmland preservation, open space preservation, historic preservation, tourism and affordable housing was not diverted for competing state budget needs. As a result of the educational work done by the WLA Extension Educators, more than $35 million was distributed in grants and loans that was further leveraged by an additional $76 million. Funds were used for the Connecticut State Department of Agriculture's Farm Enhancement Program, a program that helps Connecticut farms diversify and expand through cost-sharing grants.

In 2011, the Master Naturalist program led by Extension agents in Minnesota trained over 1,000 volunteers and instructors; 840 (84 percent) are currently active. The volunteers have thus far committed 121,144 hours of service over the past five years to protect the environment. According to the Independent Sector, this volunteerism is valued at $2,481,136. Service projects by Minnesota's Master Naturalists have included lake and stream monitoring, eradication of invasive species, lake shore restoration, clearing trails, emerald ash borer monitoring, teaching nature courses, planting trees and leading hikes.

The impacts of climate change on Washington State could be significant, with mountain snow melting earlier in the season resulting in spring flooding and low stream flows during the summer and fall months. As a result, new plant and animal pests and diseases are likely to emerge, while some areas may have a longer effective growing season and new opportunities for land managers. Program implementation led by Extension specialists at Washington State University utilized local, regional, statewide, and multistate efforts in a coordinated effort that involved workshops, clinics, seminars, print and electronic publications, mass media, social networks, volunteer-based 'train the trainer' programs, and other methods to disseminate research-based knowledge and other relevant information to target audiences. Eighty-five percent of program participants demonstrated increased knowledge and awareness of climate change and the associated issues impacting our state and communities. This knowledge included basic climate change models and their associated predictions, along with steps to adapt to future changes and mitigate trends that are predicted by WSU researchers.

Safe use of agricultural pesticides by certified applicators, both private and commercial, requires continuous updating on the appropriate application techniques and rates to safeguard Iowa's environment. Iowa State University Extension provided this kind of current education in 2011 to ensure responsible storage, handling, transport and application of pesticides across Iowa. A total of 15,995 private applicators and 9,315 commercial applicators were trained and certified on pesticide safety topics including: understanding groundwater flow mechanisms, responding to emergencies, an atrazine update, phytotoxicity, and proper pest identification and management. As a result of pesticide certification training, 100% of clients/applicators are storing, handling, transporting and applying pesticides in a safe manner, which benefits the citizens of Iowa and the environment. In addition, the training directly results in jobs retained or created, so 9,315 commercial applicators were able to obtain jobs or continue working in their current pesticide application positions because they are certified. At an average salary of $45,000 per year, this equated to new and retained employment worth $420 million.

Current climate models assume that vegetation will soak up much of the extra carbon dioxide we put into the air from fossil fuel burning. A joint research project with the University of Wisconsin and University of Minnesota studied 13 plant species common in U.S. Midwestern states. The researchers added extra carbon dioxide to the plants' environment to discover how, in the higher carbon dioxide world of global warming, the plants would respond. The results suggest that plants' capacity to absorb extra carbon from the atmosphere as carbon dioxide levels rise may be less than expected, implying that today's carbon cycle models are likely underpredicting the pace of increase of future carbon dioxide levels, and therefore the pace of climate change. This research has major implications for models of future climate change mitigation and adaptation strategies.

Researchers at Cornell University and the New York Agricultural Experiment Station identified the management techniques most likely to result in the healthiest forest structure and composition fifty years from now. If, for example, owners plant 60 red oak trees per acre, it is projected their abundance would increase by 35% by 2060 instead of declining by eight percent. This recommendation will help landowners understand the best ways to meet key management goals in the face of climate change and insect invasion. Not only that, but the results will identify how managers can extract increased amounts of fuel in an accelerating biomass market without compromising the ability of their forests to sustain both wood production and biotic diversity into the foreseeable future. This information was disseminated through cooperative extension to reach stakeholders using 15 public workshops attended by about 450 people.

An Extension program at Pennsylvania State University delivers science-based and applied options for municipalities and communities to improve natural resource management at a local level that has tangible value to local residents and results in improved ecosystem services that result in local improvements while addressing broader ecological and economic challenges related to climate change. In partnership with municipal, state, and federal agencies, the program delivers a suite of educational offerings including: face-to-face technical assistance (consulting), workshops across the Commonwealth, webinars, and extension materials developed by the program (e.g. Managing Natural Resources: A Guide for Municipal Commissions) made available through newsletters, list serves, press releases, and other social/popular methods. Ninety percent of contacts made through the above methods and who were evaluated identified that they had increased their knowledge and skills related to planning and managing community natural resources. These same respondents indicated intent to implement sustainable management and maintenance practices for community forests and indicated an overall appreciation for the ecosystem services provided by improved urban forests.

As state resources become more limited, it is also important to look to other sources of labor to help maintain the natural spaces and help run environmental education programs. The South

Carolina Master Naturalist and Master Wildlifer Programs aim to address both of these issues. The formation of a statewide corps of volunteers providing education, outreach and service dedicated to the beneficial management of natural resources and natural areas within communities is one aim of the program. In 2011, the Master Wildlifer course had a major impact on improving lands for wildlife and other natural resources. Over 243 people reported enhanced income opportunities from natural resources. Additionally, Master Naturalist volunteers provided 4,327 hours of service, which equates to a value of $77,886 in program support (using an $18 value /hour of volunteer time for South Carolina).

Priorities for the environment-related extension programs run by Washington State University include water quality and non-point water pollution, reduced soil erosion, improvements in range and forestlands, reduced risk of wildfire, and habitat preservation. Program implementation utilized local, regional, statewide, and multistate efforts in a coordinated effort that involved workshops, clinics, seminars, field days, field demonstrations, print and electronic publications, mass media, social networks, webinars, online learning modules, and other methods to disseminate research-based knowledge and other relevant information to targeted audiences. As a result, in 2011, 69% of program participants applied one or more of the principles gained through participation in this program's effort. This impact represents an average across 921 educational events that were assessed for this program area. The overall assessment validates that program participants gained new knowledge and skills important to enhance natural resources and potentially improve water quality, forests and rangeland across the state.

In 2004, a major bottomland hardwood restoration project was installed at the West Tennessee Research and Education Center involving over 51,000 seedlings on 120 acres. A field day was delivered in 2011 to present the results of survival and growth of 10 different bottomland oak species on this site. The field day reached across five agencies, targeting natural resource professionals who advise landowners on bottomland restoration. Collectively, the 60 participants advise on 43,000 acres annually. Of the participants, 100% indicated they had received valuable information from the program, 93% will adopt new practices, and 83% felt financial resources spent on bottomland restoration will be more efficiently used as a result of the program.

Extension personnel at the University of Vermont partnered with the VT Department of Forests, Parks and Recreation to run an eight-week course called Stewardship of the Urban Landscape (SOUL), which prepares participants to become stewards of their community tree resources. A 20 hour internship is completed for certification. In 2011, SOUL participants since 1996 collectively reported that their communities had planted 1,270 trees. These trees will absorb 1,765,300 gallons of rainwater, reducing the stormwater that communities must treat. They will have an economic benefit totaling $63,500. That value doubles when trees reach 8" diameter. Additionally, 1,027 trees have been planted in riparian areas, improving water quality and soil

stabilization along Vermont's waterway, while 717 hazardous trees have been identified and/or removed. The supported green infrastructure is a vital component to sustainable livable communities in Vermont.

Through Washington State University, extension specialists aimed to implement practices for improving range and forestlands, leading to greater biodiversity, reduced wildfire risk, and improved habitat. Extension program implementation in 2011 utilized local, regional, statewide, and multistate efforts in a coordinated effort that involved workshops, clinics, seminars, field days, field demonstrations, print and electronic publications, mass media, social networks, webinars, online learning modules, and other methods to disseminate research-based knowledge and other relevant information to targeted audiences. A comprehensive survey was conducted in 2011 for the program years 2007 through 2011: 652 educational events were delivered to 21,897 participants representing 796,499 acres of forest and range land. In addition to face-to-face assistance, at least 112,000 direct contacts were made to assist clients via email, phone calls, and office visits. Of the 21,897 who attended events, 20,802 families and individuals we surveyed indicated that they had gained new knowledge of management concepts that will help them to improve forest and rangeland health, reduce risks, and protect their financial investments. Nearly 90 percent, or 19,707 of survey respondents have executed at least two new management practices over 80,000 acres.

Homeowners, landscapers, golf course managers, and farmers frequently use fertilizers. In many cases, these chemicals are applied without knowledge of soil quality. The practice of applying fertilizer without knowledge of soil quality can lead to polluted surface and ground water and encourage rapid growth of algae and other invasive aquatic plants. People who own or rent lake-front properties in Connecticut have expressed concern over reduced water quality and the inability to navigate boats in areas where aquatic weed populations are dense. At the request of about 3,900 stakeholders, 4,090 soil tests were performed by the Connecticut Agricultural Experiment Station to determine nitrogen and phosphorous concentrations, acidity, and amounts of organic matter present. Specific results were provided on soil quality, and, as a part of an educational program, written suggestions were made concerning the application of fertilizers and lime to improve soil quality, or a statement was provided that no fertilizers were needed. Analyses revealed that 941 (23% of 4,090 samples) were considered adequate for plant growth and did not require fertilizer applications. These stakeholders learned that they did not need to purchase fertilizers and, collectively saved about $18,820. Another important short-term benefit is less fertilizer leaching into surface and ground water. The long-term benefit is a cleaner environment.

Outcomes Supporting USDA Strategic Goal 3

Help America Promote Agricultural Production and Biotechnology Exports as America Works to Increase Food Security

NIFA Strategic Objective 1.2: Support international economic development and trade capacity building
NIFA Strategic Objective 3.1: Expand economic opportunities in rural America by providing research, education, and extension to create opportunities for growths

The Iowa's Living Roadways Community Visioning Program aims at providing rural Iowans with community enhancement services and is sponsored by the Iowa DOT in partnership with Iowa State University Extension and Trees Forever, and, in 2011, it provided technical landscape and transportation planning assistance to 12 Iowa communities. Design studios worked 11 communities/areas in 2011. The College of Design's Bridge studio designed a sustainable, affordable single-family home for Corning Iowa. In 2011, 12 communities participated in community visioning or community planning programs. Each community received a conceptual design plan, a project feasibility study and assistance in implementation planning. Types of projects completed include roadside plantings, signage or signage improvements, streetscape enhancements, downtown area improvements, parks and other infrastructure improvements such as storm water drainage, welcome centers and historic areas. These projects will aid in ensuring rural Iowans have a stake in continuing to enhance and improve their communities, and hence, their own economic opportunities.

The Global Education Team of the West Virginia University Extension Service (WVUES) seeks to aid West Virginians in becoming globally aware. It is imperative to see and understand that the United States, West Virginia, and its citizens are part of the global dimension and not separate from it. Extension educators have involved clientele in international programs. The International Four-H Youth Exchange (IFYE) program offers community presentations. In addition, WVUES professionals and members of WV 4-H have supported outreach programs in Mexico and Chile. Extension professionals and 4-H members have traveled around the state of WV to present on these projects and cultures and have supported international students and have invited them into the communities to report on their experiences. A survey found that 486 adult community members have changed their perceptions of cultures that are different from their own. As a result they have expanded their ideas for improving their own communities and have encouraged youth to participate in international opportunities.

Many farmers, land owners, and government officials in Virginia consider trade to be at a level outside of their sphere of concerns or influence. Approximately 145 individuals attended a workshop in Virginia to combat this issue. The workshop was aimed at improving the knowledge of entrepreneurs, educators, policy makers, and government officials on the importance of trade, increased opportunities to increase farm and industry jobs through larger exports, and the importance of understanding Virginia's position in the global marketplace. The workshop included a broad spectrum of individuals from farmers to CEOs of Fortune 500 companies and feedback from the workshops was overwhelmingly positive. Survey results indicated that a majority of participants gained knowledge about their role in supporting larger exports in Virginia and understand more about Virginia in the global market place. The impact

of such knowledge is the confidence that farmers, land owners, and government officials now have to exercise their roles in influencing local, national, and international trade.

Research that enhances knowledge and informs risk analysis and management strategies and tactics related to the causes and effects of price, yield, and revenue risk in production agriculture and the costs of alternative strategies is critical to the long-term sustainability of the agrifood industry. At Michigan State University, research to identify high priority areas for research related to Michigan public finance has resulted in the publishing of two papers - Property Taxation, Education Finance Reform and Tax Base Growth (Regional Science and Urban Economics), which highlights the importance of jurisdictional competition in determining the pattern of development in southeast Michigan; and a paper on The Causes and Consequences of Fiscal Stress in Michigan Cities (Regional Science and Urban Economics). These papers will be broadly disseminated and will enhance others' knowledge on management strategies and tactics to positively influencing price, yield, and revenue risk in production agriculture. This can have significant effects on national and international trade and export prices.

Many communities in Iowa are still recovering from severe flooding or tornado damage that created a new set of problems, including housing issues, that local officials and organizations are still addressing. In 2011, 306 municipal professionals were trained at the Iowa State University Extension Office of State and Local Government Programs municipal professionals' certification program. More than 600 city clerks and finance officers attended budget workshops conducted by Extension CED and Iowa League of Cities. Nearly 300 planners and local officials attended planning and zoning workshops held in six locations in the state. Extension CED partnered with the Iowa Finance Authority to develop a statewide housing policy. Extension CED assisted 36 counties in establishing housing trust funds, resulting in grants and leveraged resources totaling nearly $3 million. These resources will be a significant aid in helping rural Iowans recover from previous flooding or tornado damage and enable them to re-establish their communities and economic opportunities.

When businesses are located in communities that are eager to help them succeed, they can benefit from local policies, quality of life, valuable information and attraction of customers to the area, especially rural ones. Community economics programs at the University of Minnesota Extension provide information through multiple workshops to community groups to help them know and grow their retail sector, help businesses stay and grow, use the Internet effectively and consider the implications of public policy decisions. The vast majority of these were workshops offered as part of the Minnesota Intelligent Rural Communities Initiative. A total of 1,199 participants completed evaluations of these workshops; 99% of participants reported learning gains, as measured by comparing average retrospective pre-test scores to average post-test scores across all learning objectives.

Among renewable energy sources, only biomass can provide fuel and electricity in a form and scale that is compatible with existing transportation and power generation infrastructure. However, there is a lack of information on reliable crop production metrics, in particular, switchgrass. Researchers at Iowa State University collected and analyzed data on switchgrass growth, development and yield throughout the 2011 growing season. Analysis showed that switchgrass is best established under a corn canopy, changing the way that Extension agents in

the Midwest now recommend planting switchgrass on previously farmed land. Results were disseminated through the US Dept. of Energy Regional Feedstock Program, resulting in website updates and presentations that increased awareness for about 2000 stakeholders and lawmakers. Results on plant growth and yield were presented at an international conference, three regional conferences and two field days and included in ISU farm publications. Ultimately, the findings have helped farmers make critical production decisions when planting switchgrass.

Volunteers assist Extension faculty and staff to provide nutrition and healthy lifestyle information to members of their communities, especially rural ones. In West Virginia, there are three major sources of volunteers: Community Educational Outreach Service (CEOS) volunteers, 4-H leaders, and Energy Express volunteers. Members of CEOS clubs in WV receive training on a number of topics related to healthy living, citizenship, leadership, and family life on an international scale. There are almost 5000 CEOS members in WV and many of these members train others in their communities after they have first been trained by Extension faculty. In 2011, 471 CEOS leaders trained other CEOS members on topics related to healthy lifestyles, resulting in many of the participants being able to teach and disseminate the international foods program themselves.

In 2010, U.S. soybean farmers exported more than half of all U.S. soybeans. This makes soybeans the top-valued U.S. agricultural export at $21 billion. Current year exports are expected to be even larger. Results of an annual survey of the quality of U.S. commodity and food soybean crops completed by University of Minnesota soybean agronomists were completed and shared with purchasers in Taipei, Taiwan and Tokyo. As a result, international purchasers use the soybean quality survey reports to make their buying decisions.

Outcomes Supporting USDA Strategic Goal 4

Ensure that all of America's Children Have Access to Safe, Nutritious, and Balanced Meals

NIFA Strategic Objective 2.1: Provide research, education, and extension to expand domestic market opportunities
NIFA Strategic Objective 3.2: Provide research, education, and extension to improve the quality of life in rural areas
NIFA Strategic Objective 4.1: Reduce the incidence of food-borne illnesses and contaminants through research, education, and extension
NIFA Strategic Objective 5.1: Ensure access to nutritious food
NIFA Strategic Objective 5.2: Promote healthier eating habits and lifestyles

Educating youth, an under-served group, is a major outreach initiative of Connecticut Agricultural Experiment Station (CAES) scientists. In 2011, CAES scientists participated as judges in science fairs, showed exhibits and gave demonstrations at agricultural fairs and Plant Science Day. They also served as judges in science fairs, displayed exhibits at public events where youth of mixed racial and ethnic backgrounds attended, and gave at least 25 presentations to 374 elementary and high school students and 30 teachers. Significant results of these many interactions were that high school students learned about research on testing different cultivars and about chemical analyses used to ensure food safety and that they gained knowledge about how agriculture impacts food quality and healthy food availability. Post-program feedback showed that was increased interest among students in science and that new knowledge on gardening was incorporated in science programs in elementary schools and helped to reach other students. The expected long-term benefits are a better educated youth population and increased interests in science.

In recent years there has been an increase in food borne disease outbreaks attributed to fresh produce. As a result, federal and state regulatory agencies have published guidance documents recommending the adoption of Good Agricultural Practices (GAP); and retailers are requiring produce suppliers to adopt GAP and submit to third party audits of their operations. The team-based approach to presenting GAP used by Extension faculty at the University of Connecticut - Storrs has provided a cross-cutting effective means to provide producers with the knowledge and tools needed to create effective plans. Eighty-four percent of producers who participated in food safety training reported an increase in their knowledge of safe food handling practices. Fifty percent responded that they gained critical knowledge necessary for writing a GAP safety plan.

Rutgers University researchers engaged graduate students and others in a research project to link genetic variation in bitter taste perception to food preferences, dietary habits and body weight. The long-term goals of this project are to better identify individuals, especially women, who may be at risk for excess weight gain and obesity due to dietary causes. Results showed that those with a non-taster phenotype are less responsive to a range of oral sensations (fats, alcohol, bitterness and pungency) and have increased preferences for foods with these qualities, whereas those with the taster phenotype (medium- or super-tasters) show the opposite responses. The

data collected in the research helps us to understand the specific dietary patterns that promote obesity in young women and identify those who may be at great risk. This work also leads to the development of improved nutrition intervention that can be targeted to an individual's genetic taste background and therefore optimally promote behavior change in that individual. These innovations are expected to improve the health, nutrition and quality of life for residents of New Jersey and the nation.

Extension educators in Maryland teach Food Safety Classes and safe food preservation classes. In 2011 over 9 programs were presented that reached over 219 growers to improve their understanding of Good Agricultural Practices (GAP) and the process for certification. Also, an online food safety course is being used by schools and child-care centers, and research is being conducted to develop a food defense certification program for professional and academic audiences that will increase the number of government and industry personnel who are trained thoroughly in the use of risk analysis tools and methods for food defense. A majority of respondents in UME food safety courses report that they understand food safety concerns, will wash fruits and vegetables before eating and preparing, and intend to store food at the appropriate temperatures.

Extension programming run by Clemson University and South Carolina State University promoted healthy lifestyles and improved the quality and safety of food for the citizens of South Carolina. Extension agents advertised nutrition, health and food safety programs through fairs exhibits, television, radio, and news articles for magazines and newspapers. Radio and television programming featured the availability of fresh fruits and vegetables at farmers markets, ways to improve nutrition and health, and Farm City Week. Nutrition and health displays were presented at local schools. It is estimated that over 1,132,800 persons were reached through these food safety and nutrition media programs.

More than half of all foodborne illnesses are attributed to improper food handling in restaurants. Because almost half of our food dollars are spent on food prepared outside the home, food safety is a top concern among consumers. Therefore, food safety education is a critical prevention component for reducing the risk for foodborne diseases. Food Safety: It's in Your Hands is an accredited food handler's course offered by county Extension agents. The two-hour course focused on reducing cross contamination and time/temperature abuse as well as personal hygiene. This course was also available on-line for on-demand completion. In 2011, 2,395 individuals completed the food handler's program. Upon entry into the program, we assessed their knowledge of targeted food safety concepts via the use of a survey instrument. Mean score was 68. After the program ended, knowledge was assessed, and it was found that the average score had improved to 86, which was a statistically significant increase.

In 2011, Virginia Extension agents conducted food handler training s across the state, including 34 manager certification courses, 24 employee food safety certification sources and 34 general safe food handling and preparation course; over 1,000 direct contacts were made through these courses. Additionally, over 459 restaurants, schools, day care centers, churches, civic groups, public service organizations and other locations sent individuals to VCE to complete food safety training. Of survey respondents from these courses, 97% increased their knowledge of food safety practices, 99% adopted at least one new food safety behavior including, and 95% made

changes to personal hygiene practices. It is conservatively estimated that if one case of foodborne illness is prevented per food handler completing proper food safety training and application through VCE, this translates into a potential annual savings of approximately $2.4 million for the state of Virginia. This savings is calculated from the estimated economic burden of foodborne illness.

Many social and economic barriers exist that lead to obesity, such as limited access to low-cost nutritious foods, poverty, lack of physical exercise, limited experience with preparing, selecting or eating nutritious foods all compound the obesity issue. A prevention plan that includes hands-on education and physical activity is the greatest hope to slow and reverse obesity. Growing Groceries with Families Project run by Extension faculty at Washington State University was a program to increase accessibility and consumption of fresh, locally grown produce via a mentoring program with gardening and nutrition education. This program engaged local farmers markets and community gardens with the goal of increasing low-income families to use more fresh fruit and vegetables in their daily diet. Through the increased interest, popularity and focus on growing and buying local, nutritious foods, the numbers of community and school gardens have rapidly expanded, with 53 additional communities cooperating on the project. In addition, the interest and growth in farmer's or local markets has also greatly expanded. This whole movement has resulted in the demand and interest for future expansion of the junior master gardening training and food safety across the state for teachers, parents, community members and school staff.

Over the past decade, the number of Americans who have been diagnosed with diabetes has increased by 61 percent, and it is expected to more than double by 2050. Added to this alarming picture is that the Center for Disease Control reports that one out of three children who were born in 2000 will be diagnosed with diabetes during their lifetime. The Dining with Diabetes program run through Extension offices at Pennsylvania State University enhances knowledge to empower individuals to self-manage diabetes. Through nutrition education and information about important health numbers, participants applied new facts and meal strategies to improve their health. The program reached 1,180 adults in 52 counties. Data from the program indicated that participants experienced statistically significant decreases in A1C, blood pressures, waist circumference, and triglycerides. Participant's responses showed that 96% plan to use heart healthy cooking oil, 95% increased their knowledge of how to decrease sodium, 98% have a greater understanding of their role of fiber, and 85% have increased understanding of the role of calcium in the diet.

With the passage of The Food Safety Modernization Act (FSMA) and the impending release of the FDA produce safety regulation early in 2012, farmers are concerned about mandatory food safety requirements. A primary concern is to get smaller, more diversified farms with limited resources in compliance. This is being reflected in the attendance figures and number of requests that Cornell Cooperative Extension educators have had and are continuing to receive to conduct food safety workshops. In 2011, 6 sets of 2-day food safety trainings were conducted across the state, with a total of 128 people attend representing 68 farms. As a result of the trainings, over 95% began to write their own individual farm food safety plan, with 50- 75% completing their plans prior to the growing season. About 20-35% underwent and passed a 3rd-party audit and received USDA-GAPs certification or a similar 3rd-party certification from another certifying

organization within one year. These workshops help prepare farms for an audit, showing them where their risks are and how to reduce them. Therefore the farms can keep their markets and even expand into others.

To promote a greater understanding of food safety knowledge and intended behavior among youth, a computer education game (Ninja Kitchen) was developed in collaboration with New Mexico State University and implemented and field tested in two states (NJ and TX). Middle schoolers' knowledge of cross-contamination prevention, danger zone, and safe cooking temperatures for meat/fish/poultry increased significantly after playing the game. In addition, their attitude toward the importance of food safety, food safety self-efficacy, and intended behaviors associated with the danger zone increased significantly. Middle schoolers reporting always washing hands before preparing food and washing fresh produce before consumption also increased significantly. Thus, this computer game increased food safety knowledge and cognitions and could be a valuable resource for food safety education in middle schoolers.

Farmers in Connecticut wanted to reduce pesticide costs and worker exposure to these chemicals and desired to have marketable crops that are in public demand. Media reporters recognized the public's interest in having a cleaner environment and, likewise, sought new knowledge on managing crop systems so that this information can be transferred to a diverse group of stakeholders. Thus, scientists at the Connecticut Agricultural Experiments Station gave 773 talks and interviews to media personnel who could then transfer such information. A survey of resulting articles found that nearly all (86%) reporters accurately transferred new findings in written form to stakeholders (farmers). For example, one newspaper reporter learned that vegetable amaranth, an annual native to central Mexico, grows well in CT. This plant, high in calcium, magnesium, iron, protein, and vitamins A, B, and C, is used in soups, and has good yields (3.2 to 3.5 lbs/plant). At $0.99 per pound, there is a potential crop value of $33,541/acre in CT. There are very few pest problems associated with this plant. The long-term benefits will include greater profits for growers, less pesticide use on farms, farmland preservation, and a source of locally grown, nutritious food for consumers.

The StrongWomen program at Pennsylvania State University trains community site leaders who teach classes at the local level. The program combines safe, simple, and effective strength training and nutrition education to help women and men maintain significant muscle mass, gain bone strength prevent bone loss, and consume healthy foods. The program is built on 15+ years of scientific research at Tufts University. Data from 1,372 participants in 2011 showed that 43% increased their intake in 1 to 3 categories of healthy foods and 24% increased their intake of nutritious food/nutrients in 4 to 6 categories. Food categories include increasing fruit and vegetable consumption, eating more whole grains and fibers, and consuming more calcium and vitamin D. Of the 229 continuing participants with a follow-up bone density test since beginning the program, 81.7% reported their bone density had increased or stayed the same, significantly reversing a typical aging decline in bone density.

Disease agents such as listeria can cause widespread havoc on ready-to-eat foods, while mold on cheese can cause allergic reactions and respiratory problems. Researchers at the New York Agricultural Experiment Station and Cornell University looked at whether they could combine an alternative to thermal processing of ready-to-eat foods, pulsed-light technology, with natural

protectants against listeria and mold on ready-to-eat meat and dairy products. They looked at this technology being used against listeria and mold growth. For listeria, the newly developed treatment showed no significant listeria over 28 days of refrigerated storage. For mold, pulsed light treatment reduced molding by 33-40%. These findings and the recommendations we provide, once incorporated into industry standards, will lead to safer, more nutritious food and longer shelf life, saving money (including healthcare costs) for consumers and the food industry both, while protecting invaluable industry reputations.

Nearly $150 billion per year is now being spent to treat obesity-related medical conditions. Mobilizing rural communities to prevent childhood obesity was a focus of the Wisconsin Cooperative Extension system in 2011. An advisory committee is now working with colleagues in the 6 other states compiling an inventory of materials for a best practices web site, and developing a multi-state assessment tool packet for communities to assess readiness and needs before and after extension programs targeting childhood obesity. In 2011, 212 adults participated in healthy living programs, such as the 8-week Crawford County on the Move, Raising Healthy Eaters to encourage healthy eating habits, Active Play for Child Care Centers, and Family Health Fiestas. All participants in Raising Healthy Eaters reported they learned how to better handle choosey eaters and could provide healthier choices for family meals and snacks. All child care providers indicated they used at least two ideas gained in the Active Play training.

Extension programming at West Virginia State University was aimed at helping limited resource families improve their knowledge, skills, and attitudes to nutrition and healthy lifestyles. WVSU extension specialists used curricula developed by other land grants partners: the youth curriculum was Show Me Nutrition by the University of Missouri, and the adult was Cent$ible Nutrition from University of Wyoming. Post program survey results showed that nearly all teens learned to weigh their options and make healthy lifestyle choices and participated in hands-on activities that relate to things that interest preteens and teens, such as appearance and fitting in with their peers. The Cent$ible Nutrition Program (CNP) for adults provided a series of hands-on lessons in which participants were able to improve knowledge, skills, and attitudes on nutrition and health through cooking classes, presentations, field trips, and yoga classes.

Nutrition education interventions were conducted by Extension faculty at the University of the District of Columbia with 2,458 children, 2-5 years of age in child daycare, preschool, and head start programs. Educators conducted hands-on nutrition education, cooking, and tasting activities with the children which included 1,104 nutrition workshops and food activities and train-the trainer (teachers) and parent workshops to enforce key messages taught in the classroom so that they will duplicate the same messages at home. The program used a pre and posttest retrospective survey at the end of each school year to measure the amount of knowledge and behavior change seen in children throughout the school year and participation in the program. Results revealed an average of 92% consuming more fruit, low fat or fat free dairy products, and more whole grains. Results also showed that 87% of teachers now offer healthier food snacks to children during the school day and made reminders to families to bring in healthy snacks for school parties.

The recent discovery that human milk contains bioactive components, including the appetite-regulating peptides leptin and ghrelin, also provides an attractive mechanism that may explain

why infants who are exclusively breastfed consume fewer calories than infants who are given infant formula, and are leaner at 8 to 11 months of age. Work in the Nutrition and Exercise Laboratory at the University of Wyoming has focused on determining whether the appetite suppressing peptides leptin, peptide YY (PYY) and glucogon like peptide 1 (GLP-1) are present in human milk and whether their concentrations change across a single feeding along with milk fat, which is known to be lower in foremilk and higher in hindmilk. It was found that leptin composition of the milk varied considerably among individual mothers and was higher in those who were overweight or obese compared to those who were normal weight. These results could have significant impacts on traditional knowledge concerning the benefits of breastfeeding based on the health of the mother and how the amounts of appetite-regulating peptides infants consume could influence them later in life.