2011 North Carolina A&T State University Extension and North Carolina State University Research and Extension Combined Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

North Carolinians are the beneficiaries of an array of research and extension efforts designed to better their lives and to make their state a better place in which to live. These efforts are administered by two entities: the North Carolina Agricultural Research Service (NCARS) and North Carolina Cooperative Extension (NCCE). This report documents 2011 research and extension programs in North Carolina.

NORTH CAROLINA AGRICULTURAL RESEARCH SERVICE (NCARS)

North Carolina State University (NCSU) is North Carolina's 1862 land grant university and is the principal state agency for research in agriculture, life sciences and forestry. NCARS, located within the College of Agriculture and Life Sciences (CALS), provides the research foundation for educational activities within academics and extension. NCARS collaborates with the following NCSU colleges: Agriculture and Life Sciences; Natural Resources; Physical and Mathematical Sciences; Engineering; Veterinary Medicine.

NCARS coordinates research in 18 departments and on the N.C. Research Campus at Kannapolis, N.C. NCARS also works in partnership with the NCCE Service and the CALS Academic Programs office.

In FY 2011 NCARS personnel included tenured and tenure-track research faculty accounting for approximately 200 research FTE, most on shared appointments with Academic Programs or NCCE. In NCARS, 368 faculty, 634 researchers and 490 technicians and support staff conduct basic and applied research involving 386 projects, of which 23 are multistate. These projects support more than 70 commodities as well as many related agribusinesses and life science industries. Altogether, this includes 90 official commodity groups and agricultural industry associations.

NORTH CAROLINA COOPERATIVE EXTENSION (NCCE)

CALS at NCSU and the School of Agriculture and Environmental Sciences (SAES) at North Carolina A&T State University (NC A&T) work collaboratively to provide educational opportunities that are relevant and responsive to the needs of individuals, communities, counties and the state. At the heart of this partnership is North Carolina Cooperative Extension.

NCCE partners with communities to deliver education and technology that enrich the lives, land and economy of North Carolinians. To address ever-changing needs, the organization operates under a dynamic long-range plan of work, a plan that changes as circumstances dictate. The plan encompasses nine major goals (+ five NIFA program areas) that focus on concerns statewide. Each goal has several objectives with impact indicators that are designed to operate interdependently among the 14 goals, allowing Extension to provide multi-faceted responses to meet complex needs. To achieve the plan's objectives, specialists at the state's two land grant universities work hand-in-hand with field faculty serving all 100 North Carolina counties and the Eastern Band of the Cherokee Indians. Programs at NC A&T are targeted largely at limited-resource audiences.

The work of Cooperative Extension professionals is coordinated with the efforts of NCARS. About 75 of the 381 Extension faculty within CALS have joint appointments with NCARS. In addition to this alliance

with research faculty, Extension benefits from the input of a statewide system of lay advisers who represent the state's diverse population. Stakeholder input undergirds all of Extension's efforts, as it did and continues to do in planning and implementing the five-year AREERA Plan of Work. To ensure that underserved and underrepresented audiences are among those included in program development and implementation, Cooperative Extension established a civil rights plan that features computer monitoring of program participation by gender and race, including goals and plans for assuring that all persons have equal access to any Extension organized group. A permanent Diversity Task Force monitors programs, suggests policy and develops and conducts training for the organization. Funding for Extension programs is provided by Smith-Lever appropriations, state and county funds, plus public and private grants.

This report reflects impacts of the joint educational programming efforts of the N.C. Cooperative Extension Service of NCSU and the Cooperative Extension Program of NC A&T. This report also updates and highlights accomplishments and impacts of research conducted through the North Carolina Agricultural Research Service, emphasizing high-priority areas in agriculture and life sciences for North Carolina now and in the near future. The research and extension programs documented here are helping North Carolina's population of more than nine million citizens address critical challenges facing them today and in the future. Additional North Carolina Cooperative Extension program accomplishments and success stories can be found at http://www.ces.ncsu.edu/AboutCES/ and http://www.ag.ncat.edu/extension/.

PLANNED PROGRAM OVERVIEWS

PLANT PRODUCTION SYSTEMS AND HEALTH

North Carolina has a strong and diverse agricultural economy that has become more diverse in recent years as consumer preferences change and new market opportunities arise. To remain competitive in the national and global agricultural economy and take advantage of local marketing opportunities, growers are adopting more efficient production practices and are open to new opportunities. In addition to traditional crops, North Carolina growers produce specialty crops, including medicinal herbs, specialty melons, heirloom fruits and vegetables, hops, caneberries, oriental pears, various crops for the state's growing ethnic populations and grapes for wine and nutraceutical properties. The green industry continues to be an important part of the state's agricultural sector, and consumer demand for organically and locally produced fruits and vegetables continues to rise. While this diversification has been good for North Carolina growers, it has placed demands on NCARS to develop and deliver information on sustainable programs for the production, protection (from pests and pathogens), harvest, storage and marketing of these commodities. Although the target audience for this research is North Carolina growers, research and Extension programs have regional, national and international impact.

NCARS scientists are investigating ways to more efficiently use water, fertilizer and other inputs and to improve yield and quality. We are also using molecular tools and conventional plant breeding techniques to develop new varieties with improved yield, quality and ability to withstand stresses such as drought, freeze injury and pests. To assist growers in taking advantage of new opportunities and challenges, Extension programs, workshops and field tests/demonstrations are conducted at the county, regional and state levels to inform growers about alternative income sources, including commercialization of native species and the production of various ornamentals, fruit crops and vegetables, organic production methods, marketing strategies and risk management, and agri-tourism. These activities draw audiences of all types and levels of experience, including new producers and existing producers, and large-scale, limited-resource and part-time producers.

Research and Extension activities are creating new opportunities to increase profitability of existing crops and to take advantage of local, national and international markets. Following are examples of these activities within each knowledge area.

Plant Genome, Genetics and Genetics Mechanisms

Several soybean cyst nematode genes that are responsible for parasitism were identified, and research indicated how these genes can be used to protect soybean plants from the nematode using RNAi technology.

Quantitative resistance to Southern leaf blight disease in maize was resolved in about 50 sequence variants. This was the first demonstration of large-scale, high-resolution whole-genome association analysis for plant disease resistance. Genome association connected with Southern leaf blight disease will allow advances in breeding for resistance to the disease. Success will allow the production of high-yielding resistant cultivars for U.S. production.

Plant Genetic Resources

An NCARS team sequenced the genome of the turf pathogen Sclerotinia homoeocarpa. This fungus is by far the most important turf pathogen worldwide, and the availability of genome data will dramatically accelerate research on host specificity, population dynamics and fungicide resistance.

Plant Product Quality and Utility

NCARS, with support of the North Carolina Peanut Growers Association, Cooperative Extension field faculty and peanut farmers, developed information and visual tools to assist peanut growers in determining when to dig peanut. North Carolina peanut growers used this information to increase annual income by $5.2 million through timelier digging.

NCARS engineers and biologists are collaborating with industry partners to seek solutions to difficult technical problems in producing algal oils and converting them into liquid transportation fuels. which offers tremendous economic and environmental impact by reducing the transportation sector's reliance on fossil fuels without impacting food and fiber production.

To assist area growers in navigating the path toward organic certification, NCA&T Cooperative Extension designed and offered a class series on certified organic vegetable production for new and transitioning growers. The class covered organic soils, insect, disease and weed management strategies, with an emphasis on effectively translating such practical on-farm techniques into required farm plans and field records.

Plant Management Systems

The NCSU Micropropagation and Repository Unit was awarded a National Clean Plant Network grant to serve as a major repository of berry varieties for the Eastern United States. This unit is a the primary source of planting material for North Carolina sweet potatoes, ornamental sweet potatoes, strawberries and other crops.

NC A&T Cooperative Extension provided at least 10 demonstrations, field days and workshops involving high tunnel production. High tunnels help extend the growing season to allow for marketable high value products outside of the normal season, resulting in higher sales prices.

The Cotton Insect Corner website http://ipm.ncsu.edu/cotton/insectcorner/, which is provided by NCARS faculty, contains information on all aspects of cotton insect management. Based on the number of Goggle searches for various cotton-related terms, this is most visible such cotton information program in the United States.

Basic Plant Biology

The plant vacuole is a storage compartment for proteins, hormones, metabolites and ions. Membrane proteins of the vacuole transport all of the metabolites and ions that regulate cellular homeostasis. NCARS scientists identified small molecules that inhibit the delivery of specific membrane

proteins to the vacuole. An understanding of the mechanisms of delivery of membrane proteins to the vacuole is important to the development of improved plants with high nutritional value and improved tolerance to environmental stress.

NCARS scientists generated transgenic Arabidopsis plants with alterations in one of the key signaling pathways. These plants have altered sensitivity to environmental stresses including gravity, drought and defense responses to pathogens. Results suggest that dampening basal signaling alters stress responses. Transgenic tomato plants have been generated and are being analyzed for drought stress and response to phosphate limitation.

Insects, Mites and Other Arthropods Affecting Plants

NCARS researchers developed new insect management practices that are saving North Carolina sweet potato growers nearly a quarter of a million dollars annually while also reducing the amount and impact of pesticides released into the environment.

Control of codling moth became more challenging when populations developed resistance to several commonly used insecticides. NCSU conducted a research and extension program from 2007 to 2011 to develop and implement reduced-risk pest management programs for apple insects, with specific attention paid to the codling moth.

Pathogens and Nematodes Affecting Plants

Depending on the location, peanut leaf spot and Sclerotinia advisories provided by NCSU resulted in a savings of one to three fungicide sprays compared to calendar programs in 2011. Programs such as this encourage growers to reduce fungicide use in calendar spray programs, guard against the development of fungicide resistance, and integrate host resistance with chemical disease control.

NCSU provides soybean growers with weekly reports of the presence or absence of Asiatic Soybean Rust. These reports are based on sentinel plots in 22 North Carolina counties. The reports allow growers to make informed management decisions concerning the likelihood of an infestation and plan for control measures if needed.

Weeds Affecting Plants

Glyphosate-resistant weeds are widespread in North Carolina. NCARS scientists are working closely with county agents and producers to develop strategies to manage this and other problems.

Integrated Pest Management Systems

The Southern Region IPM Center at NCSU established a cucurbit downy mildew IPM PIPE (Pest Information Platform for Extension and Education) to provide information on this disease. Information on pathogen biology and the spatio-temporal progress of the disease has been incorporated with atmospheric transport models to forecast disease outbreak risk and the need for fungicide application. This system provides near real-time flexibility in decision-making for the in-season management of the disease.

NCARS faculty developed the Peanut IPM decision aid and a peanut website and taught users how to navigate the program. This decision aid helps users calculate the estimated cost of managing and risks of developing pests (seven diseases, two arthropods and three nematode species).

The first peer reviewed and published studies of yield and profit impact of routinely applying fungicides to wheat showed that routine fungicide applications in the Southeast result in an increase in profit for the grower only about 34 percent of the time. These studies indicate there is no economic benefit to this practice and no reason to take the risk to human health and the environment.

ECONOMIC SYSTEMS

Research and Extension programs promote sustainable economic development, responsible management of financial assets, and help families become more financially secure. Following are representative initiatives and results.

A program has been developed that outlines a process to successfully transfer a family-owned business, such as a farm, to the next generation. This will be increasingly important to the agricultural community as the present generation of farmers retires. It is estimated that over the next 20 years, nearly $20 trillion of wealth will be transferred to succeeding generations.

In recent years legislation substantially expanded the scope and coverage of federally-subsidized crop insurance and provided incentives for the development of new insurance plans. This has resulted in a wide range of new crop insurance programs with unique risk issues. Research addressed issues relating to the modeling of crop yield and revenue risks used in federally-subsidized crop insurance programs. Accurate actuarial models are essential because errors will result in inaccurate insurance premium rates and substantial distortions in the program. The role of accurate premium rates in U.S. crop insurance programs is critical. Errors could result in taxpayer losses and could substantially diminish the usefulness of these programs as risk management tools for farmers.

By statute many states including North Carolina must calculate the dollar value of benefits associated with policies aimed at improving water quality. A method was needed that allows state-level analysts to perform these calculations in a rigorous but accessible way. We designed and transferred via a workshop a protocol that packages methods for valuing water quality improvements into a user-friendly spread sheet tool. Our workshop was attended by water quality managers from North Carolina, Georgia, Massachusetts, Vermont and Virginia. Feedback from participants and EPA staff suggests this protocol will be used as part of the policy process in several southeastern states, including North Carolina.

Through 2011, 605 farmers have participated in the Farmers Adopting Computer Technology Program and 28 counties have partnered with NC A&T and the community college system to provide the training. The program distributed 183 refurbished computers. The program helps farmers develop computer skills to better manage their operations.

An economic model of pork packer behavior was developed to test for the economic effects of banning packer-owned livestock. The model accounts for the effects of market power and cost efficiencies in procuring hogs from the spot market through contracts and through company-owned sources. The results indicate that independent hog producers, pork packers and consumers would all lose significantly if company-owned hogs were banned. The total annual amount saved by independent producers from not banning packer-owned hogs ranges between $46.7 to $184.1 million; pork packers would save between $430.8 and $711.4 million; and consumers would be better off by between $123.8 and $779.3 million. The U.S. Department of Justice and USDA have considered antitrust action against meatpackers to improve the welfare of independent producers. This study indicates that the group the antitrust action would attempt to help -- independent producers -- would be worse off.

NC A&T Cooperative Extension worked with farmers on graphic design for marketing, helping the farmers make their own signs. This training allowed small farmers to effectively promote themselves. Ten minority owned farm businesses reported a collective increase in sales of $12,000.

NATURAL RESOURCES AND ENVIRONMENT

North Carolina's natural resources include streams, lakes, rivers, wetlands, estuaries, forests and aquifers, while the state also has unique habitats in the mountains, foothills and coastal regions. Research and Extension efforts promote environmental protection and sustainable resource management. Water quality and availability, air quality, species diversity, wetland and stream preservation and restoration, and

habitat enhancement are all topics of interest and activity.

Extension efforts were focused on teaching adults and youth to manage natural resources effectively while maintaining local environmental quality. These efforts resulted in 19,027 program participants increasing knowledge of natural resource and environmental conservation, while 7,975 youth and adults increased knowledge of natural resources environmental issues. In addition, 669 individuals were certified or recertified as pesticide applicators and 2,429 individuals were certified to implement and maintain best management practices.

As a result of Extension programs, 642 program participants implemented community-based action projects for environmental protection, 489 landowners implemented agriculture and forestry best management practices, with 104,283 acres under best management practices, and
318 farmers and landowners implemented nutrient management plans on 85,060 acres.

Faculty members developed a comprehensive education program to improve stream restoration. This program includes a series of River Course workshops in which professionals learn about stream assessment, design, construction and monitoring. NCSU provides leadership for the biennial Southeast Stream Restoration Conference. More than 60 grant-funded projects across the state demonstrate and evaluate stream restoration practices in a variety of watershed conditions.

Research efforts were focused on developing and evaluating innovative technological and management approaches for protecting and restoring quality natural resources.

The near stream zone, including the riparian and the hyporheic zones (sediment below streams), has long been recognized for its important and natural role in removing nitrate as groundwater enters streams. Until now, there was no easy way of studying nitrate dissipation at the near stream zone during hydrological events because this requires the ability to measure the rapidly changing quality of water at several places at the same time. NCARS researchers developed an instrument that allows them to study nitrate dissipation at the near stream zone during hydrological events by measuring the rapidly changing quality of water at several places at a time. This tool allows for the first time the investigation of fast-occurring processes for an array of water sources. It may be applied for the investigation of nitrate dissipation dynamics not only at the near stream zone but for any study or experiments for which high time resolution data are needed.

Researchers conducted research and obtained a patent on a continuous-flow struvite crystallizer for removing phosphorus from waste water and concentrating it in a product (struvite) that has value as a feed ingredient for animals or as a slow-release fertilizer, especially for horticultural or golf course turf applications. Struvite contains ammonia, phosphate and magnesium. The initial application was with anaerobic lagoon liquid and showed a 50% to 80% removal of total phosphorus. A recent project has demonstrated similar removal efficiencies with covered digester effluent. The doctoral graduate who helped develop the technology has formed a company that licensed the technology from NCSU and is developing applications of the technology on dairies, swine farms, food processing wastewater treatment units and municipal wastewater treatment plants.

Three new sensor-based irrigation technologies were developed to maintain turfgrass quality for both warm-season and cool-season turfgrasses. In addition, TIMS Turfgrass Irrigation Management Software was developed. These efforts are helping reduce demand for water from urban water supply systems.

Methods have been developed for large-scale deployment of field border habitat using both organic and conventional approaches. Ongoing studies are examining the value of these habitats for insect pest and weed suppression, pollinator enhancement and farmland wildlife. An existing CRP program (CP33) has been modified to allow either organic or conventional growers the option of incorporating field border

habitats on their farms to enhance beneficial insects as well as farmland wildlife.

Research is focusing on creating stressor-specific indices to diagnose the causes of ecological impairment in streams. Scientists developed a life cycle bioassay using a mayfly. This will allow researchers to better utilize resident macroinvertebrate communities to diagnose the causes of ecological impairment in streams.

ANIMALS AND THEIR SYSTEMS, PRODUCTION AND HEALTH

North Carolina ranks second nationally in swine production and boasts impressive numbers of poultry, chickens as well as turkeys, beef and dairy cattle, meat goats and aquaculture. NCARS scientists focus their research on reproduction, nutrition, genetic improvement, growth and development and disease and parasite prevention and control. In addition, many animal management systems are being developed and explored in waste management, forage management, hatchery management, feed and water systems, litter and bedding and breeding stock selection. Following are examples of representative research and extension efforts.

Intermittent heating of incubating chicken eggs from days 7 to 16 produced birds that had lower metabolic rates, improved heat loss and decreased stress at market age. Intermittent heating from days 16 to 18 produced birds that had 1% more breast muscle and less abdominal fat at market age. In both approaches, changes in incubation conditions did not adversely affect hatchability and quality of the hatched chicks. Together, these developments could represent a $45 million annual benefit to the poultry industry. The information developed from these trials is used to develop educational materials used in the NCSU Hatchery Management Workshop as well as other educational efforts in the state and nation. Research is focusing on initial incubation temperatures and how eggs attain incubation temperature.

Research on in ovo feeding has the potential to greatly increase the efficiency and economical competitiveness of the poultry industry. Moreover, knowledge gained from in ovo feeding research has resulted in changes in hatchery management and breeder nutrition to enhance the survival of broilers and chicks.

As poultry feed costs rise due to market constraints on energy resources, the need to improve energy and protein utilization efficiency is more critical to the sustainability and competitiveness of the poultry industry than ever before. Research indicates that dietary inclusion of enzymes can potentially reduce feed costs by at least $15 per ton while moderately improving growth performance.

The efficacy of various mycotoxin binders to attenuate the toxicity of mycotoxins was determined in a series of trials conducted in collaboration with large North Carolina hog producers as well as companies in allied industry. More precise information on the impact of low level mycotoxins on health and performance was determined. This research prompted changes in feed manufacturing practices that improved productivity and pig health.

Data from a series of trials conducted in commercial pork production facilities to document the impact of piglet size at birth on subsequent survival, growth and feed efficiency were used to model a software tool to be used in management decisions. North Carolina pork producers, who produce over 13 million pigs annually, have adopted this decision tool in their production system and are currently evaluating a change in their production goals and contracts to focus on size and quality of piglet as opposed to large litter size.

Studies were conducted that showed that chromium supplementation of beef cows improved reproduction, especially in young cows. The percentage of cows that became pregnant during the breeding period was increased from 78% to 93% for cows five years of age or younger. Safety and efficacy studies also were conducted that resulted in the Food and Drug Administration allowing chromium

propionate to be used in cattle diets as a source of supplemental chromium.

The identification of chromosomal regions associated with growth, bone density, breast yield, fatness and many other carcass and metabolic traits in two novel broiler cross reference populations was completed. The development of this resource population and the identification of DNA markers associated with several traits, including growth and bone mineralization, will provide molecular tests that can be used by producers to improve the growth rate or bone integrity of future poultry stocks.

Research showed that the inclusion of large particles of corn in broiler feed to stimulate gizzard function reduced the negative effects of various anti-nutritional factors and improved broiler digestive efficiency, reduced fecal nitrogen waste and improved feed efficiency while improving environmental sustainability.

Acute enteric disease of turkey poults is a major cause of morbidity and mortality. Research indicates that enteric viruses are able to disrupt host defenses, especially in very young animals. This research is beginning to elucidate the specific cellular changes that occur in the intestine and lead to the development of clinical diarrhea.

NC A&T Cooperative Extension helped farmers participate in a cooperative cattle sale held at the stockyard in Bertie County once a month. By selling in tractor trailer load lots, these small producers were able to receive about five cents per pound above what they would have received by selling at a local auction. The result was several thousand dollars of increased profit and a reduced selling commission, putting more dollars in the producers' pockets.

Researchers investigated the levels of bioaerosols released from a large poultry layer facility in North Carolina that is typical of similar facilities throughout the U.S. At the investigated farm, bacterial concentrations were measured at the housing units as well as at four locations at the north, south, east, and west farm boundaries. Data will be used to develop mathematical models for airborne microbial contaminant dispersion in the environment. Initial results demonstrate that airborne microbial contaminants are released from animal farms.

The animal research programs at NCSU and NC A&T are enhanced by an extensive outreach component that disseminates the most recent research-based information to producers throughout North Carolina. Field and campus-based faculty conduct trainings, workshops, demonstrations, field days, conferences and one-on-one consultation for producers and consumers. Information is further distributed through distance education, hard-copy and electronic newsletters, radio and television programs, press releases, trade journals, scientific journals and popular press articles. NC A&T is further dedicated to the continuation of pasture-based production systems, aquaculture and the use of alternative breeds of livestock.

AGRICULTURAL, NATURAL RESOURCE AND BIOLOGICAL ENGINEERING

Research and extension programs focus on agricultural air quality, agricultural energy conservation, alternative energy sources and engineered waste management systems. Many research projects have direct outreach components, increasing the effectiveness of these projects.

A novel technology of alkaline pretreatment of switchgrass at ambient temperature has been developed. This new pretreatment technology provides almost the same efficiency of sugar and ethanol yields from switchgrass as current high-temperature chemical pretreatment technologies. However, energy consumption of the pretreatment technology is much lower than the current chemical pretreatments, thus lowering the overall cost of fuel ethanol production from lignocellulosic biomass. This new technology has been proven successful on switchgrass and can be applied to other lignocellulosic materials such as

agricultural residues.

Various studies of efficient and environmentally friendly bioconversion processes that use regional feedstocks such as agricultural residues, switchgrass, miscanthus, cottonseed, soybean, sweetpotatoes and sugarbeets are underway. A study of the effectiveness of ozonolysis on subsequent sugar generation through enzymatic hydrolysis of miscanthus continued.

An environmentally friendly sustainable approach that uses immobilized lipase-producing fungal cells for conversion of oil to biodiesel is being studied as an alternative to conventional biodiesel production processes. Sugarbeets are being studied for their potential as substrates for production of biodegradable plastics via fermentation. The techniques being investigated for both fuels and chemicals aim at reducing process costs and toxic waste generation and allow utilization of low-cost feedstocks like grasses that require minimal input for growth.

RTK-GPS with automatic steering has been employed to guide digger-shaker-inverters while plowing peanuts from the ground at harvest time, thus improving digger performance and reducing harvest losses.

Swine waste management practices and technology developed through N.C. State research are helping reduce the loss of nutrients from land application fields to nearby streams, reducing the risk of eutrophication and the impact of nutrient enrichment of rivers, lakes and estuaries. The best of the technologies that were developed and tested are now being implemented on the first new swine farms to be constructed in the state in over 10 years. This expansion will bring new employment and economic opportunity to rural regions of the state.

FOOD PRODUCTION SYSTEMS: DEVELOPMENT, PROCESSING, QUALITY AND SAFETY

Food production systems link farmers and other agricultural producers with consumers. Following are representative efforts in this area.

NCSU in cooperation with other state agencies has developed various support tools to assist existing and aspiring farmstead cheese producers to speed the learning curve and access expertise in areas of quality, regulations, sanitation, processing, packaging and business start-up. Short courses have been developed to assist would-be producers considering farmstead operations in avoiding pitfalls, practical fact gathering and determining financial requirements.

New plant varieties will help keep N.C. producers competitive and profitable. Released in 2011 were NCO2-8331 (oat); NCO3-2421 (oat); NC Burton (soybean); NC Tinius (soybean); NC 714 (tomato); and Mountain Majesty (tomato). Ornamental releases included: Weigela-Sunset; Pearlbush-Blizzard; butterfly bush-Purple Haze and Miss Molly; and three ornamental sweet potatoes.

The sensory service center provides specialized sensory services to companies while teaching students industrially relevant skills. Specialized sensory tests are conducted for university projects and companies (>20 annually) on a variety of food products and project objectives. Students (>10 annually) are trained to conduct industrially relevant tests and have the opportunity to interface with future employers. The value of these tools and findings to the food industry has been estimated at more than $5 million per year.

HUMAN NUTRITION AND HEALTH

The nutrition and health program promoted optimum nutrition and health through diet and lifestyle in all North Carolinians regardless of gender, income, age or race/ethnicity. Education programs addressing diet, health and chronic disease prevention and were offered. Programs offered included Give Your Heart a Healthy Beat; Project Eat Right: Add to Life Program; Color Me Healthy; Eat Smart, Move More, Weigh Less; Dining with Diabetes; SyberShop; Women Living Healthy - Women Living Well; Workable Wellness

and Families Eating Smart and Moving More; Cook Smart. Eat Smart; and Steps to Health.

Programs were provided in congregate nutrition sites, senior centers, schools, churches, government buildings, businesses, daycare centers, work sites and outdoors. Various methods were employed, including the Internet, computers, direct mail, media, one-on-one contact and public meetings. Research projects continue to seek scientific discoveries that will enhance the quality of living for the state and nation. Audiences reached included children, adults and the elderly, day care workers, hospital employees, housing authorities, Head Start, Red Cross, food banks, daycare home providers, food stamp and WIC recipients and community coalitions. These programs attracted more than 140,000 participants.

Child care providers who attended training increased their knowledge of nutrition and physical activity in children. Child care providers participating in training increased the level of nutrition education taught in the preschool classroom as well as the amount of physical activity for the children. One way this was achieved was by using the Color Me Healthy curriculum, a program on healthy eating and physical activity designed for the preschool classroom. This curriculum has been shown to be an effective tool at increasing nutrition knowledge, fruit and vegetable recognition and willingness to try new foods.

EFNEP (Expanded Food and Nutrition Education Program) enrolled 5,086 families in 2011, while 15,889 participants took part in 4-H EFNEP. The following data were compiled from pre and post evaluation surveys administered to participants. Completing the series of lessons improved nutrition, food behavior and food safety practices. As a result of EFNEP participation 76% improved in one or more food safety practices, 90% improved in one or more food resource management practices, 41% of participants increased their amount of physical activity, 57% increased fruit consumption, 53% increased vegetable consumption and 55% increased consumption of calcium rich foods.

Eat Smart, Move More, Weigh Less (ESMMWL) is a weight-management program that uses research-based strategies for weight loss-weight maintenance. This 15-week program informs, empowers and motivates participants to live mindfully as they make choices about eating and physical activity.

FAMILIES AND COMMUNITIES

Families and communities continue to face challenges. Economic concerns, military deployments, substance abuse, family violence and job losses all place enormous stress on the family unit and in turn on community resources. As a basic unit of society, it is essential that families have access to information and education that assist them in addressing the real-life challenges that they face every day.

In response to the needs of families and communities, NCSU and N.C. A&T faculty and county based field faculty working with NCCE are teaching the skills and helping to provide the tools that families need to endure the current economic and social climate. Educational outreach efforts addressing family resource management, budgeting and record keeping, debt reduction, retirement planning, foreclosure prevention and credit management address the economic challenges facing families. Program efforts yielded the following results.

- 2,080 individuals and families developed a household budget.
- 1,278 developed a household record-keeping system.
- A significant number of individuals and families developed other financial management skills, including 3,153 who use cost comparison skills.
- 520 individuals acquired the skills and discipline to pay their bills on time.
- Four Individual Development Account (IDA) participants purchased homes.
- 11,575 individuals budgeted their basic monthly expenses.
- 13 individuals and families used strategies to prevent home foreclosure.

Outreach programs addressing quality time, parenting practices, child development, importance of fathers and discipline have been designed to help parents develop effective and positive parenting skills.

Program efforts yielded the following results.

- 1,150 parents adopted appropriate guidance/supervision practices.
- 335 fathers increased involvement with their children at home, in school and in the community.
- 1,296 parents adopted appropriate disciplinary practices.
- 1,747 parents used positive parenting practices
- 182 incarcerated parents implemented strategies for staying involved in their children's lives.
- 657 court-mandated and agency referred parents consistently used positive parenting strategies.

YOUTH DEVELOPMENT

NCSU faculty and staff are engaged in a wide array of Extension and research-related projects that promote 4-H positive youth development. Major initiatives include health and well-being, K-12 (School to Work success), volunteerism and leadership development (Citizen Leaders). 4-H youth development programs provide youth a pathway to view learning as relevant to the world around them, to connect with their communities and to become concerned and contributing members of the global economy.

We live in a new economy powered by technology, fueled by information and driven by knowledge. In 2011, 34,997 youth increased their knowledge of career pathways, while 1,429 youth applied, obtained employment and/or participated in job shadowing, internship, or service learning programs.

The health and well being of North Carolina youth has changed significantly in the past decade. As a result of 4-H Youth Development programs, 10,031 youth increased their daily consumption of fruit and vegetables by at least one cup in 2011, while 12,320 youth increased their daily physical activity. In addition, 7,037 youth reduced their amount of screen time.

NC A&T's Discover Agriculture Program provided science and math education for third grade students. In 2011, 2,350 youth and 165 adults participated, touring the NC A&T Farm and learning how science, math and agriculture result in the production of food.

SUSTAINABLE ENERGY

Rising energy prices, heavy dependence on foreign oil and growing concern for the environment have resulted in increasingly aggressive nationwide research into alternative and sustainable energy sources. North Carolina is uniquely positioned to be a major player in biofuel production because of its abundant biomass resources and workforce capacity. The Environmental Review Commission of the North Carolina General Assembly has produced a strategic plan that calls for 10 percent of liquid fuels sold in the state to come from biofuels grown and produced in North Carolina by 2017.

Various studies of efficient and environmentally friendly bioconversion processes that use regional feedstocks such as agricultural residues, switchgrass, miscanthus, cottonseed, soybean, sweet potatoes and sugarbeets are underway. A study of the effectiveness of ozonolysis on subsequent sugar generation through enzymatic hydrolysis of miscanthus continued.

A study of the use of ultrasonication to pretreat switchgrass to produce cellulosic ethanol was initiated. An environmentally friendly sustainable approach that uses immobilized lipase-producing fungal cells for conversion of oil to biodiesel is still being studied as an alternative to conventional biodiesel production processes that require hazardous chemical mixtures of acids/bases and organic solvents. Sugarbeets are being studied for their potential as substrates for production of biodegradable plastics via fermentation.

Beginning in the fall of 2009, canola was planted along North Carolina highway rights-of-way in four counties across the state. These canola crops were established to determine yield potential and management strategies that are required to produce oilseeds in soils that are highly compacted and have

little top soil. Canola was harvested in May 2010 and followed by sunflower and safflower plots. Canola was again planted in October 2010. The canola harvested in May 2010 was crushed and the oil converted to 150 gallons of biodiesel that was used in an NC DOT fleet truck. A GIS model has been developed that helps identify and select highway right-of-way areas in the state that could be used to support oilseed production. Thus far this study has shown it is possible to produce oilseeds in rights-of-way at costs similar to current mowing operations. Additionally, based on the observed crop yields, it is estimated that over 1.5 million gallons of biodiesel could be produced from state-owned highway rights-of-way to fuel state vehicles.

A 2-year study began in November 2010 to quantify the cost benefits of using a transpired solar wall in combination with positive pressure ventilation to heat pig nursery and turkey brooder barns. Energy use, environmental parameters and animal performance data are being collected in test barns for comparison with adjacent, identical control barns without the transpired solar wall. An analysis of the data will help quantify the cost-benefits of using a transpired solar wall with a positive pressure ventilation system in pig nurseries and turkey brooder barns in North Carolina. This study will not only quantify the benefits in terms of energy savings but also air quality and pig performance.

Conventional bioethanol production involves the use of acids and bases for pretreatment and hydrolysis of lignocellulosic biomass. Although effective, these processes result in large amounts of toxic waste water, which require significant downstream treatment, which, in turn, increases the overall cost of bioethanol production. Research is focusing on the use of solid catalysts for pretreatment and hydrolysis.

Agricultural crop residues and dedicated biomass crops contain complex carbohydrates including cellulose and hemicellulose that can be converted to high value products (e.g., food products, pharmaceuticals, biochemicals, biopolymers and biofuels). Biological processes and products that improve system efficiency and economic impact are being designed and developed to investigate the biotechnological potential of North Carolina commodities (e.g., sorghums, industrial sweet potatoes, grasses, cotton, wood, duckweed). Efforts are also being made to integrate the use of energy-related biomass into farming operations to enhance sustainability and reduce costs. Harvest and handling methods, gasification, enzymatic conversion of biomass materials to functional sugars, and anaerobic fermentation technology are being explored for potential impact in this area. Industrial scale production, harvest and fermentation of sweet sorghum for ethanol have been successfully demonstrated with greater than 80% conversion of available sugars to ethanol. And enzymatic conversion and fermentation parameters to effectively convert white- and purple-flesh industrial sweet potatoes to fermentable sugars and ethanol have been defined on a laboratory scale. Initial estimates indicate that 700 gallons of ethanol/acre of sweet potatoes can be achieved.

Achievement of North Carolina's goal to grow and produce 10% of the state's liquid fuels by 2017 will likely require the use of both traditional and new cropping systems throughout the state. Limited research has been conducted in the U.S., particularly in the southeastern states, regarding the sustainability of many of the proposed new-use bioenergy crops, such as switchgrass and giant miscanthus. Specifically, very limited data have been reported on the effects of these biofuel cropping systems on soil biochemical and physical properties. Initial research is evaluating the performance of many of these crops in North Carolina, developing production practices and recommendations, breeding and developing improved varieties, and improving efficiency of bioprocessing and cellulosic ethanol conversion. Researchers and extension personnel have conducted preliminary studies investigating the agronomic characteristics and nutrient demand for potential bioenergy crop species. Studies are comparing soil nutrient status, nutrient uptake and cycling, and yield of multiple bioenergy crop species. We have shown that particular species, including giant miscanthus and switchgrass, are viable options for biomass crops in multiple locations throughout North Carolina. We have also collected data that will ultimately lead to development of nutrient recommendations for these crops.

The E-Conservation Energy Education Program teaches citizens to save energy, lower homeowner energy utility costs, and protect North Carolina's environment by reducing pollution and greenhouse gas emissions. E-Conservation reaches and teaches consumers to be proactive in reducing their home energy consumption and in saving money through no- and low-cost energy efficiency measures, behavioral changes and home retrofits.

Cooperative Extension agents across the state provide direct services to citizens by conducting outreach workshops; disseminating materials such as fact sheets, newsletters and consumer energy kits; partnering with local utilities and municipalities to maximize energy resources; offering energy audits, and assisting in the overall evaluation of the program.

The E-Conservation program provides professional home energy audits for consumers. Between June 2009 and March 2011, 239 energy audits were completed across the state by NC HERS raters. As of June 1, 2011, 82 homeowners had completed six-month follow up interviews. Of these homeowners, 84% (69) made at least one low/no cost change to save energy. The average amount spent on low-cost changes was $90. Of the 82 homeowners, 28% (23) made one high-cost change, 23% (19) made two to four high cost changes, and 4% (3) made five or more high cost changes. The average amount spent on high cost improvements was $1,420. Homeowners were asked to report on their changes in comfort, energy use, and energy costs, and 70% reported an increase in home comfort; 81% indicated a decrease in energy, and 65% indicated a decrease in energy cost.

CLIMATE CHANGE

While the long-term impact of climate change is still largely unknown, research has shown that atmospheric concentrations of greenhouse gases such as CO_2, CH_4, O_3 and N_2O are increasing. Research is needed to determine what type of plant responses can be expected from these changes. Climate change may alter weather patterns, temperatures and rainfall, which, in turn, may have an impact on weeds, pests and disease. The prevalence of weeds, pests and disease as well as changes in rainfall and temperature obviously will have an impact on agriculture.

Following are representative examples of research and extension programs that involve climate change.

Research on the combined effects of elevated CO_2 and O_3 on soybean, cotton, rice, wheat, clover and peanut shows that the promotion of growth and yield by CO_2 enrichment can be attributed in part to the alleviation of damage from tropospheric O_3. Yields from crops grown in clean air were much less stimulated by elevated CO_2 compared with plants grown in ambient air or in air with added O_3. Our studies have shown that plant responses to $CO_2$and O_3 are concentration-dependent and tend to counteract each other. The effects of elevated CO_2 on plant growth and yield are modified by O_3, but the interaction has yet to be fully evaluated. This has important implications for our understanding of plant productivity responses to elevated CO_2 and our ability to predict changes in the future.

In addition to determining the effects of elevated $CO_2$and O_3 on crop production, we are studying the effects of these gases on plant-soil interactions. We are conducting research on the effects of O_3 and elevated CO_2 on plant-mediated changed in soil quality, carbon and nitrogen dynamics. Elevated atmospheric CO_2 increases biomass inputs to soils and may contribute to increased carbon sequestration, while O_3 has the opposite effect. A long-term experiment is being conducted to determine if soil carbon sequestration and soil N dynamics are affected by elevated CO_2 and O_3 in a soybean-wheat no-till cropping system. Results to date show that elevated CO_2 increases soil respiration and decomposition rates, which results in no significant increase in soil C content. Increased soil N inputs from N_2-fixing soybean plants are likely stimulating microbial decomposition processes. Elevated O_3 has no detectable effect on these relationships. We conclude that soil C sequestration may be little enhanced by elevated CO_2 in agroecosystems utilizing N_2-fixing crops, although yields from these crops should be stimulated by

about 15%.

We are assessing the impact of climate change, land use and population change on water quantity, water quality (measured as turbidity), and potential flooding. We have developed two ecosystem models to assess stress impacts on water quantity and quality. We are examining potential changes in stream water turbidity using multiple linear regression relationships between measured stream water turbidity, 24-hour precipitation events, land cover (amount of agricultural land), and the impacts of 10-, 25-, 50-, and 100-year 24-hour rainfall events, with specific concern for aquatic wildlife and habitat stability. These relationships can then be used as a conceptual framework to examine how increases in precipitation intensity, as driven by climate change, may impact water quality at more frequent intervals. We are combining climate change scenarios, population projections, anthropogenic water demand and use data, and land use/land cover data to examine potential changes in water quantity across the study area. This research indicates that changes in land use associated with population growth are more likely to have negative implications for aquatic biodiversity than the impacts of climate change on 24-hour stream turbidity across the study region. Climate change may temporarily increase stream turbidity, but the steep topography (where intensive agriculture is uncommon) and heavy forest cover within the study basins greatly assist in minimizing long-term stream turbidity and negative biodiversity impacts. Water stress for both humans and aquatic species may increase depending upon the rates of climate and population change. The Mississippi River basin (primarily its western regions) will see the least amount of water stress, while the Tennessee River basin is projected to experience the greatest and most frequent occurrences of water stress.

An agricultural air quality research team is investigating various aspects of air emissions associated with animal feeding operations (AFOs), specifically poultry operations. Specific activities include measurement and monitoring of emissions of air pollutants from commercial scale AFO facilities; modeling generation and volatilization of ammonia from broiler litter; farm-scale evaluation of ozonation technology for mitigating ammonia and pathogens in broiler houses; and characterizing the spatial and temporal variations in the physical, chemical and biological properties of aerosols emitted from AFO facilities. As a result of this work, we have characterized the spatial and temporal variations in $PM_{2.5}$/PM_{10}mass concentration, chemical composition and biological nature between source and downwind areas. We have also identified key factors influencing air emissions and quality in animal production facilities and surrounding environments. This work has also provided baseline emissions of particulate matter, ammonia, hydrogen sulfide, carbon dioxide, and volatile organic compounds (VOCs) from high-rise egg production systems. This information is being used by the Environmental Protection Agency to produce a non-biased assessment of AFO air emissions standards. In addition, we have developed a mechanistic emission model to estimate ammonia emission fluxes from broiler litter under different growing conditions. This effort led to development of innovative mitigation and management strategies for improvement of air quality, animal performance and animal well-being to enhance the sustainability of animal agriculture.

FOOD SAFETY

Multiple research and educational outreach programs are being conducted that fit under the broad umbrella of improving the quality, safety, security and nutrition of food products produced in North Carolina. An important aspect of this plan of work is the transfer of technology and knowledge to our stakeholders and clientele. Following are short descriptions of representative activities.

Despite food safety communication efforts by many sectors, foodborne illness remains a significant health issue in the U.S. It is estimated that up to 70% of illnesses come from food handlers making behavioral mistakes. Since 2009, 20 food safety infosheets containing stories of outbreaks and focusing on the factors most likely to lead to a foodborne illness were distributed to an estimated 10,000 subscribers and readers through various online methods, including a relaunched www.foodsafetyinfosheets.comwebsite. Additionally, three direct subscribers were known to send infosheets to all of their organization's outlets--a total of 1,350 sites and 300 support associates (an

food handlers received these publications). Food safety infosheets have been shown to be effective in positively affecting the food-handling practices of the target audience.

The resurgence of local foods and home canning is good news for both the health of North Carolinians and the economic health of the state. However, self-reported practices of home food preservers indicate that science-based methods are often not followed. Extension agents have conducted home food preservation workshops, resulting in 2,927 participants increasing their knowledge in one or more food preservation techniques

Food acids can be used to kill bacteria that may be present on ready-to-eat (uncooked) foods, including the E. coli and Salmonella strains that have been involved in recent foodborne disease outbreaks. For acidic foods that are not heat processed, including some pickled vegetables and related products, manufacturers must file a process with FDA that shows sufficient acid is present to kill disease causing bacteria. Depending on conditions, up to six-day holding times are required to allow acid killing. Recently, we found that the lack of oxygen in sealed jars used for pickled vegetables and juice products aids the survival of bacteria in acid solutions. This finding prompted further study of acids under oxygen-free conditions. In conducting research to address this issue, we have shown that there is a large difference (over 100 fold) in the rates at which different food acids kill E. coli in sealed jars with no oxygen present. Some food acids, including commonly used food preservatives, were found to be much more efficient at killing E. coli than acetic acid, which is used in most pickled vegetables and other acidic foods. Further work will be needed to understand how these different acids work to kill bacteria. However, application of these results may allow manufactures to significantly reduce the required holding times for acid killing of bacteria during the production of acidified foods.

In 2011, the USDA-NIFA Food Virology Collaborative (NoroCORE) was established. Funded by the National Institute of Food and Agriculture, this 5-year, $25 million project is spearheaded by Dr. Lee-Ann Jaykus of NCSU, with the participation of 17 other institutions representing the academic, government, and industrial sectors. The long-term goal of this project is to reduce the burden of food borne illness associated with virus contamination. The NoroCORE team will take an integrated, multi-disciplinary approach to develop improved tools, skills and capacity to study NoV and use these findings to understand risk and develop methods to reduce virus contamination along the farm-to-fork continuum. The team will engage in six major activities: develop improved methods to study NoV; develop sensitive, rapid and commercializable, detection methods; collect and analyze data to aid in estimating disease burden and risk; develop commercial methods to prevent contamination and/or inactivate NoV if present in foods; translate research findings into practices that will reach important stakeholders (food industry, consumers, regulators); and develop a professional network to support collaboration and increased capacity for work in food virology.

Acidified Good Manufacturing Practice (GMP) and Better Process Control School (BPCS) workshops are required for operating supervisors of aseptic and conventionally canned processing and packaging systems in food processing establishments. These workshops qualify individuals to be commercial operators of plants producing aseptic and conventionally canned foods to meet the requirements of the umbrella GMP, the specific GMP for acidified foods and the specific GMP for Low Acid Canned Foods. An NCSU faculty member co-instructed or coordinated these workshops.

N.C. MarketReady, multidisciplinary effort of NCCE that provides educational resources to help NC agriculture be more profitable, has compiled valuable resources and materials on A Fresh Produce Safety web portal (http://www.ncsu.edu/enterprises/ncfreshproducesafety). This website contains information on produce traceability, postharvest quality, cost share opportunities and Good Agricultural Practices (GAPs). N.C. MarketReady programs are designed to enhance and integrate farmers' skills and knowledge in five key focus areas: agricultural enterprise and business skills development; fresh produce safety; horticultural production skills education; and strengthening markets.

GLOBAL FOOD SECURITY AND HUNGER

The NCSU Micropropagation and Repository Unit is the primary source of planting material for NC sweet potato growers. This unit supports growers by providing virus-free, true-to-type seed stock. Among the sweet potato cultivars the Micropropagation and Repository Unit works with is Covington, which was developed through the N.C. State sweet potato breeding program and is now grown on more than 85% of the North Carolina acreage planted to sweet potatoes. This micropropagation unit is also a source for ornamental sweet potatoes, strawberries and other berry crops.

The NC A&T Agroforestry Program includes workshops, field days and demonstrations. In collaboration with the 1890 Agroforestry Consortium, an Agroforestry Working Manual was developed that aims to educate small farmers and private woodland owners on how to develop productive and sustainable family farms and woodlands. In 2011, eight educational events were held with over 180 minority participants impacting over 800 acres. At least 10 minority landowners implemented a new agroforestry practice.

An NCARS researcher identified several genes in the soybean cyst nematode responsible for parasitism. In addition, this research showed how these genes can be used to protect soybean plants from the nematode using RNAi technology. Agreements to commercialize the technology have been reached with Pioneer HiBred International that may result in incorporation of this resistance into future soybean cultivars. Research is currently underway to extend this concept to protect other crops from other nematodes. The soybean cyst nematode is the most damaging pathogen of soybeans grown in the U.S., with yield losses from the nematode approaching a billion dollars per year, including significant soybean losses in North Carolina.

NCARS scientists generated genetically modified model plants (Arabidopsis) that are more tolerant to heat and high light stress. This research was funded by NASA and is part of efforts to develop a bioregenerative life support system essential for long-term space missions. However, these transgenic plants provide a model for developing food crops for growth both in space and under stressful conditions on earth.

An integrated educational program on pasture-raised livestock production was developed, including eight farmer-owned demonstration sites. Over 50 events such as farm tours, grower's schools, field days, workshops and conferences have been conducted for extension field staff and farmer training. A marketing cooperative selling almost $1 million worth of hogs a year, currently around $33,000/member, was developed and has grown from 5 to 30 members since 2007 and is still expanding. At least three new markets have been established.

An interdisciplinary team conducted a series of feed utilization studies to help beef cattle producers reduce input costs. Young bulls and heifers have been tested with regard to feed utilization. Highly efficient animals have been use as seedstock in research herds to create new generations of animals that will improve feed utilization.

Data from a series of trials conducted in commercial pork production facilities to document the impact of piglet size at birth on subsequent survival, growth and feed efficiency were used to model a software tool to be used in management decisions. North Carolina pork producers, who produce over 13 million pigs annually, have adopted this decision tool in their production system and are currently evaluating a change in their production goals and contracts to focus on size and quality of piglet as opposed to large litter size.

CHILDHOOD OBESITY

Educational programs addressing diet, health, and chronic disease prevention are offered to children

of diverse income levels, age groups, genders and/or cultural backgrounds across the state. Programs offered include Give Your Heart A Healthy Beat; Project Eat Right: Add to Life Program; Color Me Healthy; Moving Towards a Healthier You; Dining with Diabetes; SyberShop; Women Living Healthy and Women Living Well; and Families Eating Smart and Moving More. Programs are held in many different settings, including congregate nutrition sites, senior centers, schools, churches, government buildings, businesses, daycare centers, work sites and outdoors. Various methods are employed, including using the Internet, computers, mailed materials, media, one-on-one contact and public meetings. Following are descriptions of projects that are representative of work being done in this area.

An informal working group in NCCE was created to plan a vision for building the capacity of agents to facilitate school gardens throughout the state. Faculty at NCSU and NC A&T collaborated with field faculty from Guilford County, N.C., to deliver three regional training workshops to agents across disciplines (agriculture, 4-H and Family and Consumer Sciences), master gardeners, 4-H volunteer leaders and teachers. These workshops were designed to increase conceptual understanding of school gardens. As a result of the school garden training, participants developed a heightened awareness and skill set around the dynamics of youth gardens, from inception, programming within the garden context and sustainability. The trainings built interest, enthusiasm and understanding about plants, soils and nutrition and prepared participants to support youth and leaders in their community. Working group members collaborated on funding school garden opportunities and were awarded the FoodCorps program, which is a pilot national farm to school and school garden program. FoodCorps provides members who will be placed in communities to work in school garden programs. FoodCorps members will work with local organizations and schools to build and tend school gardens, teach nutrition education from the garden and develop farm-to-cafeteria pathways. FoodCorps provides the human resources to do the work on the ground level and will contribute towards creating statewide models for integrating nutrition and local foods into schools and school gardens.

Low-income households have a higher prevalence of health conditions related to poor nutrition. While obesity rates have doubled in children over the last two decades, they have increased the most among those in the lowest income levels, especially African American and Mexican American children. NCSU's SNAP-Ed program Steps to Health provides education to older adults in congregate nutrition sites, third graders in low-income schools and to kindergarten children in one county (pilot program). Cooperative Extension agents use interactive teaching methods including lectures, discussions, video games, worksheets, sing-a-longs, cooking demonstrations and taste testing to increase the impact and knowledge retention of the nutrition lessons taught. Parents and guardians of the kindergarten and third graders were invited to attend the classroom sessions and were sent a weekly nutrition educational handout with recipes related to the classroom sessions.

Food habits developed at an early age form the foundation for food preferences that continue into adulthood. If dietary habits are poor, the stage is set for the development of chronic, debilitating diseases such as heart disease, diabetes and certain cancers later in life. In North Carolina, 20 Nutrition Program assistants work with the youth component of the Expanded Food and Nutrition Education Program (4-H EFNEP). A series of classes are delivered over a six weeks period to program participants ages 5 to 19. Nutrition and food safety education using hands on food preparation and moving activities are provided via 4-H clubs, in after school settings, at school as an enrichment to the curriculum, at community and neighborhood centers, through day camps and workshops. In 2011, 18,892 youth graduated from 4-H EFNEP. Data from the Nutrition Education Evaluation Reporting System (NEERS) are used to measure food practices and dietary improvements for youth. Four impact indicators were used at entry and upon 4-H EFNEP graduation. Results based upon these data show that 78% of the youth reported eating a variety of foods; 87% increased their nutrition knowledge; 94% increased their ability to select low-cost, nutritious foods; and 46% reported improved practices in food preparation and safety.

Faith communities are prime locations to gather families for education about nutrition and physical

activity. The Faithful Families Eating Smart and Moving More program is designed to assist faith community families attain the knowledge, skills and attitudes needed to reduce food insecurity in the home. It teaches families to use the food obtained from various assistance programs efficiently and to ensure the prudent use of all resources so that nutritionally sound diets can be consumed on a consistent basis. Faithful Families targets families with children up to age 18. A curriculum titled Faithful Families Eating Smart and Moving More was created with faith-based questions to use in faith communities. This curriculum provides basic knowledge about nutrition and physical activity. Data from graduates show behavior change among a high percentage.

Many limited-resource families struggle with food resource management, food security, meeting the nutritional needs of their family, and keeping food safe and nutritionally sound. Llimited-resource families are also at greater risk of chronic diseases associated with poor nutrition. EFNEP (Expanded Food and Nutrition Education Program) participants learn how to provide nutritious, safe meals for their families on limited budgets. EFNEP also targets key behaviors to reduce the risk of overweight and obesity. Nutrition Program assistants responsible for delivery of EFNEP to adult audiencesdelivered the program to 4,613 families in 2011. As a result, 92% of participants were enrolled in at least one or more food assistance programs; 98% exhibited a positive change in any food group at exit (bread, fruit, vegetable, milk and meat); 88% of graduating participants showed improvements in one or more food resource management practices; 78% showed improvement in one or more food safety practices; 93% used food labels more often to make food choices; 54% increased consumption of calcium-rich foods; 50% increased vegetable consumption; 56% increased fruit consumption; 48% of participants increased physical activity; and 54% increased meals consumed as a family. There were also substantial improvements in the intake of food to meet the recommendations of MyPyramid.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	400.0	41.0	425.0	0.0
Actual	381.0	68.0	434.0	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- External University Panel
- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel
- Expert Peer Review

2. Brief Explanation

The NC Cooperative Extension system has an advisory leadership council for the state and for each of the 100 counties and the Cherokee Indian Reservation. The advisory system is a partner in reviewing program development, including program planning, implementation and assessment. Stakeholder input is

provided throughout the program development process. Advisory system members represent geographical, cultural, ethnic and economic diversity. In addition, counties have committees charged with program review, needs assessment and environmental scanning collaboration and marketing. Committees provide program input for commodities, issues and ongoing program needs. The state advisory council meets quarterly, while county committees meet at least annually. This system is monitored to assure that stakeholders provide program input.

The statewide advisory council provides programmatic inputs, review and guidance for the overall NC Cooperative Extension program functions. This system ensures that programs are reviewed and needs assessed on a continuous basis, but no less than once every two years. Stakeholder input produces continuous program review, allowing for adjustments as local needs change. To ensure stakeholder input, the organization implements an environmental scan in each county and for the Eastern Band of the Cherokee Nation every other year. Scans are conducted by a diverse group of extension employees, volunteers, clientele, commodity groups and county residents. Scans provide information on needs, issues, trends, and emerging issues.

The Extension Program at NC A&T State University is guided by citizens who make up the Strategic Planning Council, which includes community leaders, agency and organization representatives and individuals representing non-governmental organizations. The council meets three times annually. One joint meeting is held annually with the State Advisory Council. Networking and collaboration between the State Advisory Council and the Strategic Planning Council is facilitated by chairs of both advisory groups and two members who serve on both councils.

Stakeholder input related to research is achieved through interaction with 90 North Carolina commodity and agricultural industry associations. A College of Agriculture and Life Sciences (CALS) administrator is appointed as liaison for each association and attends at least one association meeting annually. During these meetings, information is gathered through formal presentations and informal conversations. In addition, the college employs a Director of Commodity Relations, who reports directly to the Dean and coordinates liaison activity. This individual also works with any association that has a need or concern relative to college programs, particularly if it might involve any state or federal legislation having a direct effect on research activities within NCARS. Groups and organizations assist in program reviews as well as advocate for NCARS by promoting agricultural and life science research. Many CALS departments have formal advisory groups with stakeholder members that meet on a regular basis to provide input and guidance into the department's research programs. In addition, there are 15 formal centers within the college with industry advisory boards that meet at least twice per year, adding additionalstakeholders providing research input and direction.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of selected individuals from the general public

Brief explanation.

Cooperative Extension uses mailed, electronic/web and telephone surveys; one-on-one interviews, focus groups, and community forums to collect stakeholder input for a needs assessment and program prioritization process. The North Carolina Agricultural Research Service (NCARS) is committed to seeking, receiving and using input from all stakeholder groups, including under-represented groups and the general public. A significant portion of input from individuals comes from interactions of research scientists with county-based Extension personnel, producers, industry and other agribusiness representatives. Approximately 100 research faculty also have Extension appointments. These faculty are the primary day-to-day link between agribusiness, county extension centers and NCARS. Because their research and extension activities are directed toward the development-implementation of new knowledge and technology, they are constantly relating industry needs and suggestions to other researchers, whose emphasis is the discovery phase. These faculty interact with county Extension personnel in such a way that input from individual consumers is also communicated to NCARS administration and faculty.

Stakeholder input is also received through numerous associations. NCARS interacts with 90 commodity and agricultural industry associations. A College of Agriculture and Life Sciences administrator is appointed liaison for each association and attends at least one meeting or conference annually. During these meetings, information related to industry sector needs and concerns is obtained through formal presentations and informal conversations with attendees. In addition, the college employs a Director of Commodity Relations, who coordinates liaison activity. This individual is also responsible for working with any association that has a need or concern relative to college programs. Of the **90** state agricultural industry associations, **24** provide research funding. In these cases, association boards give NCARS information on high priority research to be used in the requests for proposals, and the board decides which proposals to fund. This targeted stakeholder input has a direct effect on research. NCARS leadership team interacts deliberately and frequently with the North Carolina Agricultural Foundation, N.C. Farm Bureau Federation, N.C. State Grange, N.C. Carolina Department of Agriculture and Consumer Services, N.C. Agribusiness Council and other organizations that provide insight on research needs and priorities. These groups assist in program reviews and advocate for NCARS by promoting agricultural and life science research. Many College of Agriculture and Life Sciences departments have advisory groups that meet on a regular basis to provide input and guidance into the department's research programs. In addition, there are 15 formal centers within the college with industry advisory boards that meet at least twice per year, adding additional stakeholders providing input and direction. NCARS receives support from college-based foundations, which also provide input. NCARS administration meets with foundation research and extension committees each fall to discuss priority areas for research and extension activity. In late winter, these committees meet again to select and approve research and extension projects for funding, providing another opportunity for input on program priorities.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments

Brief explanation.

As indicated in the POW regarding stakeholder input, a very deliberate initiative is continuously underway by Research and Extension to meet, listen, involve and interact with any and all stakeholders, whether traditional or non-traditional. Such efforts continue in a highly proactive manner as indicated by the 22,438 citizens of North Carolina involved in a recent needs assessment process. Also, commodity association members and representatives, county commissioners, state legislators and many other leaders and policy makers both at the local and statewide levels have varying influence and interactions regarding program direction, issues identification, budgets and their priorities, staffing and developing plans of actions. This is an on-going function that is ingrained in the program planning and implementation for both research and extension in North Carolina. It is our intent to involve and serve the citizens of this state in the most effective ways possible to enhance the quality of their lives and economic well-being.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

Brief explanation.

Cooperative Extension used mailed surveys, electronic/web surveys, telephone surveys, one on one interviews, focus groups, and community forums to collect stakeholder inputs for the needs assessment and program prioritization process. The North Carolina Agricultural Research Service (NCARS) is committed to seeking, receiving and using input from all stakeholder groups, including under-represented groups and the general public. A significant portion of the input from individuals throughout the state comes from interactions of research scientists with county-based Extension personnel and directly with producers, industry and other agribusiness representatives. Approximately 100 research faculty also have Extension appointments. These faculty are the primary day-to-day communication link between agribusiness, county extension centers and NCARS. Because their research and extension activities are directed toward the development-implementation phase of new knowledge and technology, they are constantly relating industry needs and suggestions to other researchers, whose emphasis is more in the discovery phase. In addition, these faculty interact with county Extension personnel in such a way that input from individual consumers is also effectively communicated to NCARS administration and faculty.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- In the Staff Hiring Process

- In the Action Plans
- To Set Priorities

Brief explanation.

The environmental scanning process entails obtaining both secondary and primary data on key issues of concern, needs and assets in the community. Secondary data are used to assess the analyzed needs (data and statistics) as well as needs identified/prescribed by experts. Primary data was collected by holding meetings, focus groups and/or interviews with key stakeholders such as Extension Advisory Leaders and county government partners. These combined data and input were used to prioritize and target issues, needs and assets that serve to focus, guide and direct Extension programming. For the Agricultural Research Service, stakeholder input is especially utilized in determining research directions as well as for gaining program support and advocacy for NCARS research initiatives. For example, the commodity association boards give NCARS information on high priority research areas to be used in requests for proposals, and the board decides which proposals to fund. This is the most targeted type of stakeholder input, having a direct effect on research activities within NCARS. Also, leaders in the North Carolina Agricultural Foundation, N.C. Farm Bureau Federation, N.C. State Grange, North Carolina Department of Agriculture and Consumer Services, the N.C. Agribusiness Council and numerous other allied organizations not only provide insight on research needs and priorities but assist in program reviews as well as advocate for NCARS by promoting the importance of agricultural and life science research.

Brief Explanation of what you learned from your Stakeholders

Many issues identified as key concerns by North Carolina citizens are addressed by Cooperative Extension programs. Agricultural preservation, sustainability and development and nutrition and health were identified as key issues. Increasing economic opportunity, business development, and developing community leadership were other key issues. Environmental stewardship and natural resource management were identified across the state as well. A continued emphasis and concern about building strong families and developing responsible youth as well as educational opportunities for the state's citizens were all labeled key issues facing North Carolinians. The North Carolina Agricultural Research Service maintains close ties to the 90 state agricultural industry associations, of which 24 provide funding to various research projects annually, usually on a competitive basis. In these cases, the association boards give NCARS information on high-priority research areas to be used in requests for proposals, and boards decide which proposals to fund. This is the most targeted type of stakeholder input, having a direct effect on research activities within NCARS. Many of the departments within the College of Agriculture and Life Sciences have formal advisory groups with stakeholder members that meet on a regular basis to provide input and guidance into the department's research programs. In addition, there are currently 15 formal centers within the college with industry advisory boards that meet at least twice per year, adding additonal stakeholders providing NCARS administrators and scientists input and direction for research programs. NCARS receives support annually from college-based foundations, including the Agricultural Foundation, Tobacco Foundation and the Dairy Foundation. These foundations fund research projects and graduate students on a competitive basis across a wide range of areas. NCARS administration meets with the research and extension committees each fall to discuss priority areas for research activity in all aspects of agricultural production and agribusiness. In late winter, these committees meet again to select and approve research projects for funding, which provides another opportunity for input on research priorities. As greater emphasis is being placed on integrated extension and research efforts, administrators and program personnel hold both research and extension appointments and duties. These personnel continuously interface on decisions for

program prioritization, budgeting and staffing. These efforts help ensure a greater exchange of information from the state's citizens and that all audiences are identified and served to the extent possible given research and extension resources.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
11484540	3576769	7923304	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	7305502	3576800	6398763	0
Actual Matching	7305502	3565300	6398763	0
Actual All Other	34328918	182300	53675253	0
Total Actual Expended	48939922	7324400	66472779	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Plant Production Systems and Health

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	10%	10%	10%	
202	Plant Genetic Resources	10%	10%	10%	
204	Plant Product Quality and Utility (Preharvest)	5%	5%	5%	
205	Plant Management Systems	20%	20%	20%	
206	Basic Plant Biology	10%	10%	15%	
211	Insects, Mites, and Other Arthropods Affecting Plants	10%	10%	10%	
212	Pathogens and Nematodes Affecting Plants	15%	15%	15%	
213	Weeds Affecting Plants	15%	15%	10%	
216	Integrated Pest Management Systems	5%	5%	5%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	102.0	9.0	170.0	0.0
Actual Paid Professional	75.0	7.0	165.0	0.0
Actual Volunteer	19.5	0.0	8.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1146966	414400	1395405	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1146966	413000	1395405	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
5465511	21100	11704750	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Conduct discovery research on plants and plant systems using tools genomics, metabolomics, and proteomics

- Develop improved crop varieties using traditional and genomic approaches
- Introduce/discover new plants for food use and the green industry
- Develop systems for production of plants for biofuels
- Seek new uses for plants and plant byproducts
- Develop production systems for organic farmers
- Develop diagnostic techniques for indigenous and introduced pathogens
- Partner with industry
- Develop sustainable production systems for both large scale and limited resource farmers
- Enhance IPM programs through new techniques and strategies
- Set up applied research/demonstration plots
- Write papers for scientific community
- Prepare publications for grower and homeowner audiences
- Develop web sites to deliver information to grower and homeowner audiences
- Conduct workshops, meetings, and other focused educational programs for farmers, commodity groups, and industry.

2. Brief description of the target audience

- The scientific community
- Regulatory agencies
- Agricultural chemical companies
- Agribusiness
- Commercial and limited resource farmers
- New and Part-time farmers
- Homeowners
- Consultants
- News media
- General public
- Non-governmental organizations
- Other public agency staff

3. How was eXtension used?

Communities of Practice are available in eXtension for an array of field, horticultural and ornamental crops and related areas that provide a resource for producers, handlers, processors and marketers.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	379229	798184	33082	23300

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 26

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	110	376	486

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Studies conducted to identify new germplasm and develop new and improved varieties of crops and ornamentals

Year	Actual
2011	49

Output #2

Output Measure

- Clients to receive plant information via printed publications, fax, e-mails, phone and other contacts via known non-face to face delivery means.

Year	Actual
2011	798184

Output #3

Output Measure

- Educate growers and other clientele through highly focused non-degree credit workshops and other formalized group educational sessions.

Year	Actual
2011	2067

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased Income as a Result of Production of New or Alternative Crops/Enterprises
2	Increased profit through the adoption of improved nutrient management practices
3	Number of releases of germplasm and varieties with improved yield potential and other qualities
4	New techniques and products developed and released that can be commercialized
5	Increased profit through the adoption of new production practices
6	More informed growers through highly focused non-degree credit workshops and other formalized group educational sessions.
7	Increased acreage of organic crops and specialty crops.
8	Number of discoveries of mechanisms that regulate the productivity of plants and the microorganisms that interact with them
9	Increased profit through the adoption of new production practices *and marketing locally*

Outcome #1

1. Outcome Measures

Increased Income as a Result of Production of New or Alternative Crops/Enterprises

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	6532611

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Southern flounder has great promise for aquaculture, with a high market value and unique ability to grow well in fresh water. Wholesale prices for fresh flounder range from $5-$10 per pound so the economic potential for cultured flounder is promising.

What has been done
We have succeeded in the establishment of XX males for use in producing all-female fingerlings. Our research has also established the first commercial-scale data on growout characteristics with a full economic analysis of the results. These accomplishments are fundamental steps in the commercialization of flounder culture and will lead to maximizing the economic viability of flounder farming.

Results
We have assisted in the establishment of the first two private southern flounder hatchery, nursery and growout facilities in the U.S. Current annual production projections for these two facilities are around 200,000 lbs. We see the potential for flounder culture as equal or superior to that of the hybrid striped bass industry, which has enjoyed a growth rate of 20 percent per year for the past 10 years and the achievement of an annual farm-gate value of more than $9 million to North Carolina alone. The economic potential of flounder farming in the United States could reach five-to-10 times the value of the hybrid striped bass industry within the next 10 years.

4. Associated Knowledge Areas

KA Code	Knowledge Area

201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Increased profit through the adoption of improved nutrient management practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	6788942

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Recent research has shown that over 80% of the yield in a wheat crop comes from tillers that produce 30 kernels or more per spike. This work indicates that increasing yield could be achieved by maximizing the number of tillers that develop large numbers of kernels.

What has been done
Applied research projects were conducted to determine the pattern of tiller development, the reasons for tiller decline and when productive tillers are initiated by the wheat plant. These studies showed that tillers only develop once the main plant has three leaves. Slower fall development seriously impacts how quickly tillers are made. Early tillers are much more likely to avoid decline, while late tillers are of little value to the plant and to yield. In fact, over 80% of the yield from wheat comes from fall and early tillers.

Results
We designed a wheat management system based on good fall fertilization to stimulate early tiller development and an emphasis on N applied just before jointing (no earlier). The result was a

dramatic increase in productive tillers and an increase in wheat yield from 65 bushels per acre to 102 bushels per acre (a 37 bushel increase). In 2010-11, over 600,000 acres of wheat were planted in North Carolina with a record average yield of 62 bushels per acre. If we calculate that 37 bushels per acre was attributed to this research and that just a quarter of the producers used this information, this would result in $33.3 million increase in profit.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

Outcome #3

1. Outcome Measures

Number of releases of germplasm and varieties with improved yield potential and other qualities

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	13

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cercis Canadensis, the eastern redbud, is a popular landscape tree. It is a native plant, relatively small in stature and drought tolerant. Considerable genetic diversity exists in redbud but little of this diversity has been exploited through controlled breeding.

What has been done
We have taken advantage of the genetic diversity in redbud to develop novel landscape types through recombination of weeping growth habit, variegated leaf, purple leaf, golden leaf and compact growth habit. A purple leaf selection with upright growth habit and superior drought tolerance compared to existing cultivars was release in 2009 as Cercis Canadensis ?Merlot?, and weeping, purple leaf selection named ?Ruby Falls? was released in 2010. Both were commercially available in 2011.

Results
These new redbud cultivars have been readily accepted in the green industry and provide an economic stimulus for the nursery industry. Development of these new forms will provide consumers with additional landscape options and uses for this versatile native plant. In the year of sales (2011), ?Ruby Falls? and ?Merlot? sold 5,969 and 4,169 units, respectively. Assuming typical wholesale and retail market value, these cultivars generated over $1 million for the industry in their first year of sales. ?Ruby Falls? will be launched and released in Europe in 2012 and in Japan in 2013.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
206	Basic Plant Biology

Outcome #4

1. Outcome Measures

New techniques and products developed and released that can be commercialized

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Recently there has been a huge interest in dried sweet potato chips and meal for use in animal food. Many pets are gluten intolerant, and sweet potatoes are a gluten-free source of carbohydrates. The United States imports approximately 5 million pounds of dried sweet potato product annually from China and Peru. Concerns about contamination and food safety have driven the pet food industry to seek a domestic source of product.

What has been done
During 2011, we demonstrated that misshaped and otherwise off grade sweet potatoes could be sliced and dried in tobacco barns and the material used for animal feed. Approximately 25,000 pounds of fresh sweet potatoes were sliced and dried at Barns Farming Corp. near Spring Hope,

NC. This dried material was then sent to a number of potential users for evaluation. This was the first time appreciable amounts of domestic dried sweet potatoes had been made available to the U.S. market. Much of the dried product was sent to Ralston Purina and IAMS, two of the largest pet food manufacturers. Additional material, including flour made from purple sweet potatoes, was sent to U.S. Commodities Corporation, a food ingredient broker in Minnesota.

Results
The response was so positive that both Barns Farming and W.E. Baily Produce Co. of Chadbourn, NC are making plans to build commercial drying facilities within the next year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

Outcome #5

1. Outcome Measures

Increased profit through the adoption of new production practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	29084078

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
More than 98% of North Carolina?s cotton acreage was planted to Bt cotton varieties resistant to bollworms and tobacco budworms in 2011. The adoption of this technology has reduced late season insecticide use by approximately three fold since. In this low spray environment, however, our complex of boll damaging bug species has shifted from a curiosity to major pest status. Boll

damage from this bug complex is now approximately three times higher than that from bollworms, budworms and other caterpillar pests combined. Bug damage is difficult to assess, and static treatment thresholds have not appeared well correlated with yield loss. Therefore, many cotton fields are either sprayed unnecessarily or not treated when needed.

What has been done

We developed the concept of a ?dynamic threshold,? which based treatment on plant vulnerability to boll damage as a function of week of bloom. A series of 47 threshold evaluation tests, comparing this threshold with those used previously, were conducted in North Carolina, South Carolina and Georgia. The dynamic threshold showed a profit advantage of $7.50 to $30.00 (depending on stink bug levels) compared with the 20% boll damage static threshold previously used in our region. Answering the need for a simple boll assessment tool to introduce the dynamic threshold to producers, agents and cotton scouts, we developed a 3x6-inch plastic Stink Bug Decision Aid field card, which provides 1) an outline of scouting procedures, 2) a table of the thresholds by week of bloom, 3) cutouts for selecting the correct boll size, and 4) color images of internal boll damage.

Results

Eighty one percent of our licensed consultants reported using the stink bug card regularly during the 2011growing season. The card received a mean rating of 8.5 among the users (?useless? was assigned a zero rating and 10 indicated ?extremely useful?). If only 20% of North Carolina?s cotton producers used this device in 2011, given average stink bug levels, the economic return from using the card would have resulted in a profit advantage of more than $13 million over using the previous 20% internal boll damage threshold. Because of the widespread recent adoption of the dynamic threshold among North Carolina?s consultants and producers, this economic advantage would have been far greater if one compared the use of the card (or employing the dynamic threshold without the card) to either automatic calendar sprays or to not spraying in the case of unscouted cotton.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

More informed growers through highly focused non-degree credit workshops and other formalized group educational sessions.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	88365

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Interest in growing hops has increased in recent years, with many farmers now selling their harvests to the 52 craft breweries in the state. As two large craft breweries make plans to build plants in western North Carolina, there is even more interest.

What has been done
Concerned about the number of problems new hops growers could encounter and the lack of information available, a diverse group of agricultural experts came together to assist this new industry. Two small grant projects led by N.C. State University scientists provided one-on-one support to four growers and resulted in adequate soils and fertility information for the N.C. Department of Agriculture and Consumer Services to create a hops code on the state soil test reports and provide fertilizer recommendations. N.C. State scientists also established a short-trellis research hop yard in Raleigh and a high-trellis research hop yard in Mills River. The N.C. Hops Project website was also developed. Hops workshops, field days and festivals have attracted hundreds of people.

Results
There are an estimated 70 small commercial hop yards in North Carolina, with at least another 30 expected to be planted in 2012. Using today?s open market price of $11 per pound for Cascade, a popular variety with craft breweries, a farmer could expect to earn approximately $18,700 from one acre producing 1,700 pounds. With a total potential demand of 185,000 to 370,000 pounds per year, the entire North Carolina hop market could be worth $2 to $4 million. To fill this demand, North Carolina would need from 100 to 200 acres of hops production. It is likely this demand will be filled by many half to 2 acre plantings on smaller farms. We are providing the information these growers need to be successful.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

213 Weeds Affecting Plants

216 Integrated Pest Management Systems

Outcome #7

1. Outcome Measures

Increased acreage of organic crops and specialty crops.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1649

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As recently as 2006, less than 1,000 acres of organic grains were grown in the North Carolina. The large processors in the state -- Braswell Milling, Lindley Mills, Organic Valley and Bay State Milling -- were importing the majority of their grains from out of state. Our efforts have been aimed at providing production and storage information so that North Carolina farmers can supply these markets.

What has been done
We have an active research program on organic grain production covering issues of weed management, fertility and crop management. Graduate student thesis projects have been presented at workshops and published as extension bulletins. We have hosted an average of three extension workshops per year, took a bus load of farmers to tour organic grain farms in Maryland and Pennsylvania, maintain the organic grains website (www.organicgrains.ncsu.edu), and have a quarterly newsletter (http://www.organicgrains.ncsu.edu/Newsletters/December2011.htm).

Results
Organic grain acreage has grown quickly in the state to over 12,000 acres, with North Carolina now the leader in organic acreage in the region. North Carolina?s success has attracted new buyers into the market. Eastern Carolina Soy Processors built a new soy crusher in Hyde County and has filed their organic certification paperwork. Amy?s Kitchen, a national supplier of organic frozen meals, recently bought a facility in Greenville, SC to manufacture frozen burritos. They cited the proximity to North Carolina?s organic farms as a key reason for facility location. The

company has a policy of sourcing locally, and North Carolina is the only southeastern state that could supply the plant with organic corn and soybeans.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #8

1. Outcome Measures

Number of discoveries of mechanisms that regulate the productivity of plants and the microorganisms that interact with them

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	19

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Understanding the complicated interchange between pathogens and their hosts is key to improving treatments for infections and developing preventative strategies. There are many levels at which interactions can be examined, from the molecular to the organismal to whole population. At any level, understanding is built on both biological examination as well as theoretical modeling, and the greatest potential for success lies in bridging the two. Important real-life examples of host-pathogen interactions include plant-parasitic nematodes, which cause annual crop losses exceeding $125 billion worldwide.

What has been done
We have developed a novel approach for identifying interactions between pathogens and their hosts by examining that relationship on a genomics level. In this approach, genetic variations in the pathogen are mapped to gene regulation changes occurring in the host, or vice-versa. Currently, experiments are being performed applying this approach to a plant-parasitic system using the model legume Medicago trucantula infected with the root knot nematode Meloidogyne

hapla. We have applied cutting-edge sequencing technology, identifying approximately 7,000 genetic markers in our lines of M. hapla and profiling full genome expression patterns in both organisms.

Results

This work not only serves as a proof of concept for the novel approach of identifying host-pathogen interactions on a genomics level, but also provides a practical implementation of identifying these interactions in a model plant-pathogenic system.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

Outcome #9

1. Outcome Measures

Increased profit through the adoption of new production practices *and marketing locally*

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

Weather was a factor affecting research and extension programs in 2011, including drought and a hurricane. Above average rainfall late in the season impacted the harvest of late-season crops such as peanuts, cotton, and soybeans. The greatest factor that affected the outcomes was the decline in support from the state, which resulted in a reduction in both research and extension faculty and county extension agents. Also, increased competition for federal funds continues to make it more difficult to maintain programs and initiate new ones.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Research and extension programs provided North Carolina's agricultural sector with new plant varieties and new agricultural enterprises along with more efficient production methods. These programs made North Carolina agriculture more efficient, profitable and competitive.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Economic Systems

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management	30%	30%	30%	
602	Business Management, Finance, and Taxation	25%	25%	25%	
604	Marketing and Distribution Practices	5%	5%	5%	
605	Natural Resource and Environmental Economics	25%	25%	25%	
607	Consumer Economics	15%	15%	15%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	14.0	9.0	10.0	0.0
Actual Paid Professional	10.0	5.0	7.0	0.0
Actual Volunteer	5.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
540607	330300	1437690	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
540607	329300	1437690	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2533680	16800	12059440	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

We plan to conduct a multiplicity of educational programs and utilize applied research projects to enhance the knowledge base of targeted citizens in North Carolina and other designated areas. This will involve conducting programs that organize farm management schools, conduct meetings on topics such as risk management, net profit calculations, tax preparer schools, and conduct feasibility studies that examine the economics of alternative and traditional enterprises. We will conduct Research projects and Extension programs that provide economic decision support for sustainable agricultural commodities and products that feature changing and new technologies, evaluation of alternative incentive-based systems, risk aversion, public policy, rural communities and labor markets.

2. Brief description of the target audience

Agribusiness personnel, tax preparers, financial advisers, limited resource farmers (active, new and potential), farm managers, rural appraisers, supply chain operators, county agents, colleagues, state department of agriculture specialists, and commodity association board members.

3. How was eXtension used?

Agricultural Law and Entrepeneurship are two CoPs in eXtension that provide principles and recommended practices for users in these areas.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6470	2487	1434	3800

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	19	33	52

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Non-degree credit activities conducted focusing on markets, farm and business management

Year	Actual
2011	47

Output #2

Output Measure

- Number of county and area tax preparer schools

Year	Actual
2011	38

Output #3

Output Measure

- Registered attendees at estate planning, legal advice, and financial management schools

Year	Actual
2011	1415

Output #4

Output Measure

- Enrollees for the Natural Resource Leadership Institute year-long training

Year	Actual
2011	20

Output #5

Output Measure

- Integrated Research Projects Conducted

Year	Actual
2011	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Tax preparers gain needed knowledge for return preparation by attending workshops conducted throughout North Carolina.
2	New organic, farmers, and agritourism markets established by individual entrepreneurs
3	Growers Adopting Improved Business Management Practices

Outcome #1

1. Outcome Measures

Tax preparers gain needed knowledge for return preparation by attending workshops conducted throughout North Carolina.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1415

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
North Carolina taxpayers and professional tax preparers need information on tax law changes.

What has been done
Workshops and programs that address various tax issues are held across North Carolina. Among the audiences for these efforts are groups that represent the producers of various agricultural commodities such as the NC Pecan Growers Association, North Carolina Apple Growers, NC Wine Growers, specialty crop producers in Western North Carolina, forestry groups and the North Carolina Christmas Tree Growers. In addition, Income Tax Schools are held for professional tax preparers. The majority of commercial farmers use professional tax preparers, so these schools reach the agricultural community, although indirectly. Special schools address issues such as agricultural, estate and fiduciary taxation.

Results
Two-day Income Tax Schools were attended by 1,415 tax professionals. Approximately 400 people also attended special schools on topics such as agricultural, estate and fiduciary tax issues. Attendees come away from these sessions with a better understanding of tax law and regulations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
607	Consumer Economics

Outcome #2

1. Outcome Measures

New organic, farmers, and agritourism markets established by individual entrepreneurs

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	35

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As recently as 2006, less than 1,000 acres of organic grains were grown in the North Carolina. The large processors in the state -- Braswell Milling, Lindley Mills, Organic Valley and Bay State Milling -- were importing the majority of their grains from out of state. Our efforts have been aimed at providing production and storage information so that North Carolina farmers can supply these markets.

What has been done
We have an active research program on organic grain production covering issues of weed management, fertility and crop management. Graduate student thesis projects have been presented at workshops and published as extension bulletins. We have hosted an average of three extension workshops per year, took a bus load of farmers to tour organic grain farms in Maryland and Pennsylvania, maintain the organic grains website (www.organicgrains.ncsu.edu), and have a quarterly newsletter (http://www.organicgrains.ncsu.edu/Newsletters/December2011.htm).

Results
Organic grain acreage has grown quickly in the state to over 12,000 acres, with North Carolina now the leader in organic acreage in the region. North Carolina?s success has attracted new buyers into the market. Eastern Carolina Soy Processors built a new soy crusher in Hyde County and has filed their organic certification paperwork. Amy?s Kitchen, a national supplier of organic frozen meals, recently bought a facility in Greenville, SC to manufacture frozen burritos. They cited the proximity to North Carolina?s organic farms as a key reason for facility location. The company has a policy of sourcing locally, and North Carolina is the only southeastern state that could supply the plant with organic corn and soybeans.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
607	Consumer Economics

Outcome #3

1. Outcome Measures

Growers Adopting Improved Business Management Practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	25557

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Labor supply uncertainty and rising labor cost are major limiting factors in production for North Carolina tobacco farmers. As a result, many farmers are considering purchasing labor-saving equipment.

What has been done
Farm level data were collected by survey on type of machinery, equipment, use of H2-A, number of workers, acreage of crops grown and reasons for adopting or not adopting labor saving strategies. More detailed information on equipment investment and labor costs was then collected by personal interviews. The investment and cost of production data have been used to develop two model North Carolina tobacco farms with detailed crop budgets, balance sheets and income statements. The financial information was used in FINPACK to compare various labor saving strategies, and three tobacco enterprise budgets were developed from personal interviews with tobacco farmers.

Results

The results of this study will be used by tobacco growers to increase farm profits by better managing labor and improving equipment buying decisions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

The highly volatile commodities market, rising input costs, and the economic downturn have required that every business management efficiency be exercised in record keeping, production and financial management to meet the demanding challenges faced in the survival of farm units. Further, commodity prices that reached levels almost previously unknown have resulted in the need for highly informed decision making regarding enterprise mix and allocation of resources. Of course, ever advancing technologies have led to the need for increased computer competencies as well as other technological innovations, such as precision farming and the resultant need for accurate decision making regarding the use of such technologies and the exercise of keen marketing skills.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Research and extension programs helped North Carolina's agricultural community

better understand the financial underpinnings of the agricultural economy, helping to make North Carolina agriculture more efficient, profitable and competitive.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Natural Resources and Environment

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	30%	30%	30%	
111	Conservation and Efficient Use of Water	10%	10%	10%	
112	Watershed Protection and Management	15%	15%	15%	
133	Pollution Prevention and Mitigation	30%	30%	30%	
141	Air Resource Protection and Management	15%	15%	15%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	46.0	2.0	22.0	0.0
Actual Paid Professional	38.0	1.0	15.0	0.0
Actual Volunteer	15.5	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
591745	103100	198739	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
591745	102700	198739	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2773352	5300	1667036	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities will be focused on understanding the processes and situations that create pollution problems from agricultural production (including animal operations, field activities and processing). With that information in hand, improved management and technological solutions will be proposed and evaluated. Technology transfer will be accomplished through demonstrations, workshops and publications by Cooperative Extension in concert with the researchers involved.

2. Brief description of the target audience

Agricultural producers, environmental and other governmental agencies (action and regulatory), news media, the general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	50003	51489	11524	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	6	26	32

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Waste Management Certification Programs

Year	Actual
2011	94

Output #2

Output Measure

- Number of Research Projects Completed on Environmental/Natural Resource Issues

Year	Actual
2011	9

Output #3

Output Measure

- Number of non-degree credit environmental activities conducted

Year	Actual
2011	441

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number farms first utilizing precision application technologies
2	Number of farms implementing additional best management practices for animal waste management
3	Number of urban households/small farms with low-literacy individuals implementing and/or adopting best management practices to enhance water quality.
4	Number of Waste Management Certifications Gained or Maintained
5	Number of acres where proper waste analysis was used for proper land application

Outcome #1

1. Outcome Measures

Number farms first utilizing precision application technologies

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	587

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Educating farmers about optimum fertilizer management and production practices such as precision agriculture and alternatives to inorganic fertilizers such as legumes and manures improves farm profitability and reduces the likelihood of runoff of nitrogen, phosphorus and sediments from fields.

What has been done
Scientists have collaborated with producers to develop fertilizer rate and timing recommendations for conventionally produced agronomic crops as well as certified organic production systems. These include studies to evaluate the nutrient availability coefficients used to estimate N and P supplied to cotton, corn and wheat by poultry litter and manure sources and evaluating legume cover crop productivity and feasibility in intensively managed corn/soybean rotations. A research publication describes the nitrogen, phosphorus, and liming effects of three different poultry manure sources. Efforts are ongoing to promote calibration of fertilizer and litter spreaders and more intensive management of water control structures.

Results
These efforts should result in both crop yield and water quality benefits. Collaborations with the North Carolina Department of Agriculture and Consumer Services are enhancing the professional development of extension agents and supporting agriculture by resolving crop yield limitations due to nutrient deficiency. In 2011, 587 North Carolina farms first used precision application technology.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #2

1. Outcome Measures

Number of farms implementing additional best management practices for animal waste management

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2367

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Excess nutrient runoff from animal waste operations has been identified as a major contributing factor to eutrophication of fresh and salt water systems in North Carolina, which has substantial negative impact.

What has been done
Courses for wastewater system operators are offered at the Lake Wheeler Road Land Application Training and Demonstration Unit and across the state. A 1-week wastewater operators school is offered once per year and a wastewater irrigation system design course has been offered. Training on animal waste issues is available to producers and livestock associations through coordination with local county extension agents and area specialized agents. Technical assistance has been provided to the North Carolina Department of Environment and Natural Resources on timely waste management issues. Technical input on animal waste issues is also provided via the SB 1217 inter-agency committee on animal waste management, and relevant extension bulletins have been developed.

Results
Wastewater system operators are provided the education and training they need to obtain or retain operators' licenses. Education and training helps operators keep in compliance with regulations and maintain environmental quality while ensuring that animal production systems or

industrial processes continue. Soil scientists and engineers receive training in the design of wastewater systems. The North Carolina Department of Environment and Natural Resources is provided with technical information upon which to formulate policy and regulations concerning animal waste management. In 2011, 2,367 farms implemented additional best management practices for animal waste management.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management

Outcome #3

1. Outcome Measures

Number of urban households/small farms with low-literacy individuals implementing and/or adopting best management practices to enhance water quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Homeowners in urban settings as well as rural families often are unaware of the impact of over fertilization and inappropriate use of pesticides on ground and surface water. Reducing chemical and fertilizer misuse in these settings will have a major positive impact on local and statewide water quality.

What has been done
4-H and general public meetings have been held to educate non-agricultural and low-literacy audiences as to what they can do to improve water quality and reduce the use of common fertilizers and pesticides used around the house.

Results
Over application of fertilizer and other chemicals is being reduced as a result of educational efforts. Information on the number of urban households and small farms where low-literacy individuals live that implemented and/or adopted best management practices to enhance water quality in 2010 was unavailable. However, an indication of the impact of programs in this area may be gained from other statistics for the year. For example, 30,091 program participants increased their knowledge of natural resource and environmental conservation; 1,140 landowners implemented agriculture and forestry best management practices; and 256 stream protection practices were implemented.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #4

1. Outcome Measures

Number of Waste Management Certifications Gained or Maintained

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	5146

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Individuals responsible for various waste management activities are required by the state to be trained and certified.

What has been done
Extension provides education and certification testing for individuals involved with waste management activities.

Results
In 2011, 5,146 waste management certifications were gained or maintained.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management

Outcome #5

1. Outcome Measures

Number of acres where proper waste analysis was used for proper land application

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	469992

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nitrate-nitrogen leached through drainage systems elevates nitrogen (N) concentrations in ground and surface waters, contaminating drinking water supplies and causing eutrophication and hypoxia in surface waters. The development and application of drainage water management practices that reduce off-site environmental impacts is vital to achieve sustainable crop production on drained lands.

What has been done
Research has shown that drainage systems can be controlled or managed to reduce N losses to surface waters by 25 to 50 percent, depending on soils and conditions. This controlled drainage practice also conserves water and increases yields.

Results

Controlled drainage has been accepted by the State of North Carolina as one of three Best Management Practices for reducing N and phosphorus (P) loads to surface waters. State and federal cost share programs were established to promote the use of the practice for reduction of nutrient losses in drainage waters. Recent field research has shown that controlled drainage, when managed according to established guidelines, increased corn and soybean yields by an average of 8 to 10 percent on two lower coastal plains sites. The models developed in this research are being used to analyze and develop guidelines for the application of controlled drainage and related water management systems in other states and countries and to develop more effective methods of land treatment of wastewaters on drained soils. In 2011, 207 North Carolina farms implemented improved nutrient management practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Warmer than usual temperatures combined with a severe drought throughout the growing season stressed both animal and crop production systems and also stressed aquatic and terrestrial wildlife habitat. Forest fires, wild fires, fish kills and reservoir depletion all took their toll on North Carolina's natural resources and environment. The second half of the year saw higher input costs, continued credit issues and reduced government funding, all of which negatively affected producers, program deliverers and the general public in a number of ways. Even with these challenges, farm commodity prices generally were strong and helped the financial condition of farmers who experienced a successful cropping season. The exception was a major hurricane in the fall that devastated crops, dwellings and many businesses in eastern North Carolina.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Research and extension programs helped protect North Carolina's environment by showing North Carolinians how to dispose of waste in more environmentally sustainable ways and through programs that protect the environment, such as stream restoration.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Animals and Their Systems, Production and Health

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	20%	20%	20%	
302	Nutrient Utilization in Animals	20%	20%	20%	
303	Genetic Improvement of Animals	17%	17%	17%	
307	Animal Management Systems	18%	18%	18%	
311	Animal Diseases	10%	10%	10%	
312	External Parasites and Pests of Animals	5%	5%	5%	
313	Internal Parasites in Animals	5%	5%	5%	
315	Animal Welfare/Well-Being and Protection	5%	5%	5%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	56.0	3.0	120.0	0.0
Actual Paid Professional	45.0	2.0	88.0	0.0
Actual Volunteer	26.4	0.0	6.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
569829	319900	930270	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
569829	318800	930270	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2670635	16300	7803167	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

This plan of work includes broad and extensive research and extension programs. NC Agricultural Research Service scientists will conduct research projects to study methods to improve the efficiency of animal production. Research will focus on methods to improve reproductive performance, nutrient utilization and genetic influence on growth and reproduction. Scientists will also work to improve animal management systems, decrease the incidence of animal diseases and parasites (external and internal) and improve the management of animal and agricultural pests. Species and commodity groups included in this plan of work are also very broad and include poultry such as turkeys, broiler chickens and table-egg chickens. The plan of work also includes swine, fish such as flounder, and cattle such as beef and dairy, and numerous pests such as house flies. Research will include many phases of commodity production such as meat and dairy goats, chicken breeders (both broiler and table egg birds), commercial broilers (commercial refers to those animals produced for meat), breeder turkeys, commercial turkeys, swine breeders, commercial swine, all phases of aquaculture and beef and dairy production. Disciplines that will be involved include nutrition, physiology, reproductive physiology, genetics, virology, bacteriology, microbiology, mycology, entomology, and many animal management systems such as grazing and forage management programs, hatchery management, feeding and drinking water systems, litter and bedding management, lighting programs, and breeder selection and management. A very important part of this plan of work is to transfer technology and knowledge to our stake-holders and clientele. Therefore, an extensive outreach effort through Cooperative Extension will be conducted by field and campus based faculty who are based on-site as well as being located across the state and based in local communities. Stake-holders and clientele will be directly engaged in many ways including workshops, conferences, discussion groups, one-on-one teaching, demonstrations, field days, short-courses, continuing education classes, and scientific meetings. Indirect methods to reach stake-holders and clientele will include long-distance education, newsletters, web sites, newspaper releases, television and radio programs, trade journals, scientific journals, and popular press articles. Participants and programs will be evaluated at least annually for success, progress, and effectiveness. Special educational programs focused on limited resource farmers will continue to be a priority for NC A&T focused Extension efforts in pasture based production systems, aquaculture and alternative breeds.

2. Brief description of the target audience

The target audience will be primarily aquaculture, poultry, livestock producers, small-scale limited resource, beginning and underserved growers and agribusiness personnel in North Carolina. However, since North Carolina producers are some of the best in the world, ultimately, producers and agribusiness personnel across the country and around the world will be the primary audience. In addition, the audience will include personnel in other state and federal agencies, local, state and federal politicians, and other stakeholders including the general public.

3. How was eXtension used?

A wide array of animal systems CoPs exist in eXtension, providing a valuable resource for production practices, animal health and management, and marketing.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	160000	230000	42000	45000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 1

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	11	107	204

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Highly focused non-degree credit group training activities to be conducted

Year	Actual
2011	622

Output #2

Output Measure

- Relevant and impacts focused research projects to be conducted
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Local, Area, Regional, and State Conferences to be Conducted

Year	Actual
2011	0

Output #4

Output Measure

- Local, Area, Regional, and State Educational Tours to be Conducted

Year	Actual
2011	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Additional income gained by animal producers improved planning, marketing, and financial practices
2	Net income increased by producers improving animal husbandry practices
3	Number of animal producers adopting improved animal husbandry practices
4	Number Livestock Producers Adopting and Applying Improved Planning and Financial Management Practices

Outcome #1

1. Outcome Measures

Additional income gained by animal producers improved planning, marketing, and financial practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	5921218

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Dairy farm numbers in North Carolina have decreased over time, and the volume of fluid milk produced in North Carolina is currently less than half of the amount consumed by the people of North Carolina.

What has been done
The North Carolina Dairy Advantage Program provides information and recommendations to help potential dairy farmers develop a plan to enter the business, new North Carolina dairy farmers succeed and existing North Carolina dairy farmers expand their herds or reinvest in their facilities in order to improve their profitability. In 2011, this program provided data for a new dairy farm family in Snow Hill, NC, for milking herd rations and feeding management plans. This farm added a dairy to diversify its agricultural enterprises as a risk management strategy and began shipping milk from approximately 100 Jersey cows in October 2011. The program assisted two existing dairy farms as they expanded and built new facilities (Orange and Randolph counties). One farm plans to grow from within the herd (20 cows added in 2011) and the other will be buying cows in 2012. North Carolina Dairy Advantage is currently providing resources for seven farm families that are considering building dairies and 18 that are investigating expanding their herds or developing value-added opportunities to improve their profitability.

Results
Approximately 300 milking cows were added to the North Carolina state herd from new dairies opened in 2011 that were assisted by Dairy Advantage. Overall, USDA reported a 1,000 cow increase in total milking cows in North Carolina in 2011 (the total went from 44,000 (2010) to 45,000 cows (2011). Total milk production also increased from 862 million pounds (2010) to 903 million pounds (2011). These increases in both milk production and cow numbers represent the

first increases in these statistics in North Carolina in several decades.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
307	Animal Management Systems
311	Animal Diseases
312	External Parasites and Pests of Animals
313	Internal Parasites in Animals
315	Animal Welfare/Well-Being and Protection

Outcome #2

1. Outcome Measures

Net income increased by producers improving animal husbandry practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	3081488

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Chromium is an essential trace mineral for humans that functions by enhancing the action of insulin. Until recently, it has been assumed that cattle diets contain adequate chromium to meet animal requirements. Therefore, chromium supplementation of cattle diets would not be necessary.

What has been done
Studies were conducted that showed that chromium supplementation of beef cows improved

reproduction, especially in young cows. The percentage of cows that became pregnant during the breeding period was increased from 78% to 93% for cows five years of age or younger. Safety and efficacy studies also were conducted that resulted in the Food and Drug Administration allowing permission for chromium propionate to be used in cattle diets as a source of supplemental chromium.

Results

Low reproductive performance is a major problem in many beef and dairy operations. Improving reproduction by supplementing with chromium should greatly increase the profitability of cattle operations. However, chromium supplementation of cattle diets has only been permitted by FDA since July 2009, so it is still too early to determine the impact that this will have on the economics of cattle production.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
307	Animal Management Systems
311	Animal Diseases
312	External Parasites and Pests of Animals
313	Internal Parasites in Animals
315	Animal Welfare/Well-Being and Protection

Outcome #3

1. Outcome Measures

Number of animal producers adopting improved animal husbandry practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	6167

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In recent years, cattlemen in North Carolina have found that in a global economy it takes more resources and better utilization of technology to successfully compete. Recent emphasis on quality cattle led cattle producers to seek better genetics to infuse into their cattle herds. Artificial insemination is a technology that allows cattle producers, large or small, to access some of the best genetics in the world.

What has been done
Extension personal from North Carolina State University have put together artificial insemination (AI) clinics to train personnel to inseminate beef cattle. Four clinics where held at various locations around North Carolina. Producers were certified as AI technicians as well as trained in genetic selection, basic reproduction, body condition scoring and general nutrition to improve reproductive success.

Results
Four Clinics (Shelby, Plymouth, Clinton and Smithfield) were held across North Carolina during 2011. Fifty seven producers were trained and certified in artificial insemination. These producers represent over 2,345 head of cattle. It would be expected that those trained would also engage in AI for a fee off their farms, which would include other producers in the area. In the Clinton clinic, several military personnel were trained and will use the training to instruct cattle producers around the world. Survey results show that the participants thought the clinics were very informative and met their needs. Participants rated overall quality of the clinics as 95% very satisfied and 5% satisfied. The percent increase in knowledge gained from attending the clinic was over 80% in all areas of instruction (ranged from 81.6% to 87.9%). Several participants have reported back as successfully performing AI in their own herd as well as in their neighbor?s herds.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
307	Animal Management Systems
311	Animal Diseases
312	External Parasites and Pests of Animals
313	Internal Parasites in Animals
315	Animal Welfare/Well-Being and Protection

Outcome #4

1. Outcome Measures

Number Livestock Producers Adopting and Applying Improved Planning and Financial Management Practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	6354

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
For 40 years, Dairy Records Management Systems (DRMS) provided accounting services for the majority of its member DHIA service affiliates. During this period, DRMS developers produced customized software for general ledger, accounts payable, accounts receivable, payroll, tax filing and other related services for these cooperatives of dairy farmers. However, it became clear that commercially available software services could deliver comparable quality at a reasonable cost and less risk. Additionally, such a transition would free DRMS developers to work on dairy-specific software that would directly benefit producers.

What has been done
In 2010 and 2011, DRMS worked with the service affiliate managers to identify their specific accounting and payroll needs. Then DRMS developed specifications, interviewed vendors, tested vendor software, developed RFPs, selected vendors (one each for payroll and accounting), implemented data conversions, transitioned each service affiliate?s records, trained each staff and completed the transition.

Results
Within a year, records for all nine service affiliates have been converted and the satisfaction level is high. With the new accounting software, managers can customize reports and retrieve information that previously had not been available. Since the conversion, an additional service affiliate has adopted the service and another one is considering its adoption. Additionally, one developer has diverted attention to dairy related development projects and markedly reduced his time and effort for accounting.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
307	Animal Management Systems
311	Animal Diseases

312 External Parasites and Pests of Animals

315 Animal Welfare/Well-Being and Protection

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

The following factors affected North Carolina animal agriculture to some degree, even though the impact may be difficult to determine. Increases in commodity prices, the declining economy, changes in program funding, public policy changes, new rules and regulations, public priorities, competing programs, and population increases (especially along the I-85 corridor) all impacted farmers' abilities to remain sustainable. Most of these impacts have been negative, especially increased population and the economy (fuel prices in particular). Our farmers will face continuous challenges to remain profitable and sustainable.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Research and extension programs focused on animal husbandry, nutrition and management. These programs were designed to make North Carolina's animal agriculture more efficient, profitable and competitive while also protect the environment.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Agricultural, Natural Resource, and Biological Engineering

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation	10%	10%	10%	
401	Structures, Facilities, and General Purpose Farm Supplies	5%	5%	5%	
402	Engineering Systems and Equipment	20%	20%	20%	
403	Waste Disposal, Recycling, and Reuse	15%	15%	15%	
404	Instrumentation and Control Systems	15%	15%	15%	
405	Drainage and Irrigation Systems and Facilities	5%	5%	5%	
503	Quality Maintenance in Storing and Marketing Food Products	10%	10%	10%	
511	New and Improved Non-Food Products and Processes	15%	15%	15%	
512	Quality Maintenance in Storing and Marketing Non-Food Products	5%	5%	5%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	19.0	1.0	12.0	0.0
Actual Paid Professional	12.0	0.0	6.0	0.0
Actual Volunteer	2.0	0.0	2.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1037381	0	97256	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1037381	0	97256	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
4861926	0	815790	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and Extension activities will focus on applying and adapting knowledge gained from basic research to agricultural production systems and natural resource pollution prevention. Both "soft" engineering (e.g. unit process engineering) and "hard engineering" (e.g., machines, hardware and sensors and controls) will be a part of the Research and Extension activity. Technology transfer will be achieved through workshops, demonstrations and field days, and publications.

2. Brief description of the target audience

The target audience will be: agricultural producers, manufacturers of agricultural machinery and food processing and storage equipment, state agencies, watershed stakeholders, and the general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	12000	20000	1400	4000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 3

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	12	30	42

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Research Projects Completed in Agricultural, Biological and Natural Resource Engineering

Year	Actual
2011	28

Output #2

Output Measure

- Number of Workshops and Trainings Completed in Agricultural, Biological and Natural Resource Engineering

Year	Actual
2011	102

Output #3

Output Measure

- Relevant Non-degree credit group activities completed

Year	Actual
2011	102

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of growers implementing stream protection practices e.g. buffers, fencing, etc.
2	Number of stormwater systems installing BMPs
3	Number of farms adopting use of biofuels
4	Number of growers implementing improved irrigation and drainage systems

Outcome #1

1. Outcome Measures

Number of growers implementing stream protection practices e.g. buffers, fencing, etc.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	256

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Stream restoration is an important watershed management practice that improves water quality and aquatic habitat in many North Carolina watersheds. Causes of stream impairment include land use changes affecting stormwater runoff, removal of riparian vegetation and channel straightening or other modifications. Many state and federal agencies provide funding for restoration projects, requiring that effective restoration planning, design and construction practices be implemented.

What has been done
NC State University faculty developed a comprehensive education program to improve the practice of stream restoration. This program includes a series of River Course workshops in which over 5,000 professionals have learned about stream assessment, design, construction and monitoring. NC State University also provides leadership for the biennial Southeast Stream Restoration Conference, attended by over 500 practitioners, government officials and academics. Numerous grant-funded projects across the state are use to demonstrate and evaluate stream restoration practices in a variety of watershed conditions.

Results
The quality of stream restoration projects has improved as professionals have gained increased understanding of stream restoration principles and applications. Funding for projects has increased as resource agencies determine that previous projects are successful in meeting water quality and habitat goals. Ecosystem mitigation policies have been adjusted based on outcomes of this program to meet restoration goals. During 2011, approximately 25 miles of stream were restored.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities

Outcome #2

1. Outcome Measures

Number of stormwater systems installing BMPs

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Treatment of urban storm water runoff has become a primary concern to local leaders throughout North Carolina. A series of state and national rules impact more than 150 North Carolina communities. Each of these regulations require communities to implement stormwater education programs in addition to requiring new and innovative practices be used to clean stormwater runoff.

What has been done
More than 100 stormwater demonstration sites have been established throughout North Carolina. Monitoring and evaluation of several of these sites has shown the effectiveness of certain stormwater practices and provided data from which to develop new design recommendations and publications.

Results

State regulatory agencies have used research results to develop North Carolina design standards for bioretention cells, level spreaders, storm water treatment wetlands, permeable pavement, green roofs, water harvesting systems and combinations of these practices called Low Impact Development. Research findings have also been shared with the design and maintenance community through more than 150 workshops across North Carolina. In 2011, 10 stormwater control practices were installed at demonstration sites. These included level spreader and vegetated filter strip systems, water harvesting systems, a stormwater wetland and permeable paving.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities

Outcome #3

1. Outcome Measures

Number of farms adopting use of biofuels

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of growers implementing improved irrigation and drainage systems

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	738

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Irrigation related water use is increasing in the state of North Carolina. With increasing use, it is important that sound water management principles be applied in order to optimize yield and to conserve and protect water resources. Commodity prices and the desire to shift to more locally grown grain as a feed source for animal agriculture have increased the demand for irrigation to improve yields. Additionally, emerging technologies such as subsurface drip irrigation, which have the potential for better water use efficiencies and which growers have expressed interest in, have had minimal testing under North Carolina soils. Water management in urban areas is becoming increasingly important, and with increasing competition for and development of water resources, sound planning and management are required. Drought accounts for 25% of economic loss in the North Carolina green industry, so drought mitigation though efficient use of existing water supplies is essential. Technical support is necessary for communities to make sound decisions in urban water management.

What has been done

Irrigation and water management presentations have been made to growers and certified crop advisors through requests by county extension agents and to conference and workshop attendees. An applied research project on a grower?s farm is monitoring and controlling a subsurface drip irrigation system so that additional guidance may be developed. A series of extension publications on subsurface drip irrigation has been developed for North Carolina growers. The annual irrigation society conference provides education opportunities and credits for irrigation professionals. Contacts have been made with industry representatives. Conversation with and education of local water conservation officers is ongoing. Two current applied research projects have brought smart irrigation technology into residential settings and educated local water conservation officials. Nearly 200 licensed irrigation contractors have received recertification hours directly from NC State in the first 2.5 years of the certification requirement, and trainings provided by NC State through the auspices of other green industry organizations have reached hundreds more.

Results

Growers have been given information to evaluate their irrigation options and to efficiently manage their water resources. Extension bulletins on subsurface drip irrigation based upon local applied research will allow growers to make more informed decisions on the application of this technology to their cropping systems. Agricultural groups and state agencies have received technical input to help them formulate options and guide policy makers in recent water legislation. Local urban officials are turning to NC State for answers to questions regarding adoption of ?smart? irrigation technology as a way to conserve water in the urban landscape. In 2011, 738 growers implemented improved irrigation and drainage systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Research and extension programs focused on areas such as urban stormwater and irrigation water management and stream restoration were designed to help protect North Carolina's environment while also aiding the state's agricultural industry.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Food Production Systems: Development, Processing, Quality, and Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies	20%	20%	20%	
502	New and Improved Food Products	15%	15%	15%	
503	Quality Maintenance in Storing and Marketing Food Products	10%	10%	10%	
504	Home and Commercial Food Service	5%	5%	5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	10%	10%	10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	40%	40%	40%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	54.0	0.0	63.0	0.0
Actual Paid Professional	40.0	1.0	54.0	0.0
Actual Volunteer	4.0	0.0	2.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
840133	62100	483136	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
840133	61900	483136	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
3937476	3200	4054577	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Multiple research and educational outreach programs will be conducted that fit under the broad umbrella of improving the quality, safety, security, and nutrition of food products produced in North Carolina. Specific research projects will identify effective nutritional control strategies for replacement of growth-promoting antibiotics for improving gut function and reducing intestinal colonization and shedding of Salmonella; assessing the incidence, populations, serotypes, genotypes, and antibiotic susceptibility of Salmonella and Campylobacter fecal isolates as a function of farm, bird age, season, management practices, and strategic processing of commercial broiler, turkey, and layer farms; assessing novel antimicrobial strategies for use in reducing foodborne pathogens and biofilm formation on food processing contact surfaces; employing the antimicrobial properties of eggshell membranes for reducing the heat resistance of foodborne pathogens; development of Salmonella-specific inhibitory nanoparticles for preventing intestinal colonization; development of alternative layer molting diets for reducing the risk of Salmonella contamination of shell eggs; characterization of Campylobacter respiratory chain genes for use in developing rational drugs for controlling infection of food animals; conduct ecotoxicological studies to identify chemical pollutant sources that contaminate aquatic human foods; development of a high hydrostatic pressure system for reducing toxigenic histamine-forming bacteria in scombroid fish and vacuum and MAP packaged fresh tuna; develop a more efficient means of producing a high-gelling protein isolate from underutilized fish species and other meat sources that could replace surimi manufacture and improve the quality, sensory and yield characteristics of new and existing muscle food products; development of a Vienna sausage product without casings via an in-tube focused microwave field heating technology; improving the texture and yield of canned/pouched Albacore tuna by controlling precook proteolysis and injection of a tuna-derived protein isolate; application of continuous flow processing of foods and biomaterials using advanced focused microwave technology; and development and testing of tools, methods and devices for rapid sterilization and production of high quality vegetable and fruit purees. A very important aspect of this plan of work is to transfer technology and knowledge to our stakeholders and clientele. Therefore, an extensive outreach effort will involved campus and field faculty located in local communities. Direct outreach efforts will include engaging stake-holders in workshops, conferences, discussion groups, one-on-one teaching, demonstrations, field trials, short courses, continuing education classes, and scientific meetings. Indirect methods will include internet sites and courses, newsletters, press releases, television and radio interviews and programming, trade journals, scientific journals and popular press articles. Participants and programs will be evaluated at least annually for success, progress, and impact.

2. Brief description of the target audience

Primary food producers, food processors, foodservice operators, county extension agents, state and federal regulatory agencies, commodity associations, news media and consumers. The primary audience

will be in North Carolina but will also extend to audiences in other states (state and federal agencies, local, state and federal politicians and other stakeholders).

3. How was eXtension used?

Food Safety CoP provides useful information to assist handlers, processors and users to handle food safely in many settings.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3000	6400	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 1

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	4	85	89

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Highly focused non-degree credit group training activities to be conducted

Year	Actual
2011	544

Output #2

Output Measure

- Relevant and impacts focused research projects to be conducted

Year	Actual
2011	46

Output #3

Output Measure

- Local, area, regional and state conferences to be conducted

Year	Actual
2011	44

Output #4

Output Measure

- Number of firms adopting quality and safety strategies

Year	Actual
2011	167

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of program participants who successfully pass the food safety certification examination.
2	Number of participants completing National Seafood HACCP Alliance Education and other food safety HACCP workshops
3	Number of companies adopting new technologies
4	Number of new companies in food manufacturing
5	Number of food industry companies undergoing equipment and food safety audits

Outcome #1

1. Outcome Measures

Number of program participants who successfully pass the food safety certification examination.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1106

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Despite food safety communication efforts by many sectors, foodborne illness remains a significant health issue in the U.S. It is estimated that up to 70% of illnesses come from food handlers making behavioral mistakes.

What has been done
Food safety certification courses offered through organizations such as the International HACCP Alliance and National Seafood HACCP Alliance were conducted for food manufacturing firms and state and federal regulatory personnel.

Results
Knowledge of biological, chemical and physical risks associated with agricultural products and processes employed in manufacturing and production systems has increased. Certification of course participants fulfills state and federal regulatory requirements in a number of food areas, such as acidified food products, seafood, meat and poultry products. In addition, compliance of firms increased and safety of food improved through participation in courses. In 2011, 1,106 food service employees received ServSafe program certification, while 196 program participants completed National Seafood HACCP Alliance education and other food safety HACCP workshops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Number of participants completing National Seafood HACCP Alliance Education and other food safety HACCP workshops

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	196

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Foodborne illnesses account for 128,000 hospitalizations and 3,000 deaths annually in the United States. Efforts to reduce human illnesses by the U.S. Food and Drug Administration mandate a risk-based preventive approach on the principles of Hazard Analysis Critical Control Point (HACCP) inspections.

What has been done
North Carolina Cooperative Extension and Sea Grant specialists along with NC Food and Drug Protection and NC Shellfish Sanitation investigators provide education and training workshops for industry and regulatory personnel.

Results
In 2011, four seafood HACCP workshops were organized with 30 participants receiving their AFDO certificates of course completion. This brings the total number of individuals trained in North Carolina on seafood HACCP principles to 939 since 1997, with over 26,000 trained nationwide through efforts of the National Seafood HACCP Alliance. Impacts are compliance with state and federal seafood safety requirements, increased knowledge of seafood safety and reduced risks for consumers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

Outcome #3

1. Outcome Measures

Number of companies adopting new technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	38

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Aquaculture is an expanding sector in agribusiness around the globe. All aquaculture industries require tank based hatchery, nursery and in some cases growout facilities. The majority of these facilities grow freshwater species. Aquaculture offers agribusinesses opportunities to expand and diversify farming operations across North Carolina. The key to success in this sector is the implementation of cutting edge yet proven facility design. These designs must well thought-out such that the facilities are neither under designed, where they will not meet production goals, nor overdesigned, where the cost of production would be too high.

What has been done
The North Carolina Fish Barn project, located on the North Carolina State University campus, has created technology that has assisted the development of an environmentally friendly aquaculture industry in North Carolina. More recently, the research being conducted at the Fish Barn has been expanded to western North Carolina at the CALS LaPaz project and to the east at the Marine Aquaculture Research Center (MARC) near Marshallberg, NC. In these projects, research

is being conducted to expand opportunities to new species for culture in North Carolina. While the LaPaz project has focused on the production of sturgeon for caviar, the work at the MARC facility has focused on developing technology to reduce the impact of aquaculture on coastal North Carolina.

Results

In 2011, the NC State aquaculture program helped to design and oversaw the successful implementation and startup of a new aquaculture facility near Marshallberg, NC. The facility is housed in a 27,000 square foot building and currently consists of four aquaculture systems comprising a total of 20 large tanks. The facility builds upon the 20-plus years of technology development at the Fish Barn, LaPaz project and MARC facility. The recirculating aquaculture technology is state-of-the-art as is the waste treatment system associated with the building. This project is growing sturgeon in association with the LaPaz project.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #4

1. Outcome Measures

Number of new companies in food manufacturing

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Many pets are gluten intolerant and sweet potatoes are a gluten-free source of carbohydrates. The United States imports approximately 5 million pounds of dried sweet potato product per year from China and Peru for use in pet foods. Concerns about contamination and food safety have driven the pet food industry to seek a domestic source of product.

What has been done

In 2011, we demonstrated that misshaped and otherwise off grade sweet potatoes could be sliced and dried in tobacco barns and the material used for animal feed. In late June, approximately 25,000 pounds of fresh sweet potatoes were sliced and dried at Barns Farming Corp. near Spring Hope, NC. This dried material was then sent to a number of potential users for evaluation. This was the first time appreciable amounts of domestic dried sweet potatoes had been made available to the US market. Much of the dried product was sent to Ralston Purina and IAMS, two of the largest pet food manufacturers. Additional material, including flour made from purple sweet potatoes, was sent to U.S. Commodities Corporation, a food ingredient broker in Minnesota.

Results

The response was so positive that both Barnes Farming and W.E. Baily Produce Co. of Chadbourn, NC are making plans to build commercial drying facilities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #5

1. Outcome Measures

Number of food industry companies undergoing equipment and food safety audits

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Educational and applied research efforts have targeted specific industries and operations affected by illnesses associated with food and animal products. New and revised food policies and further need for process and product validation studies are expected. Many of these studies are likely to involve state research and extension personnel.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Research and extension programs focused on food safety and new technologies and uses for agricultural products. These efforts were designed to protect North Carolinians and make the state's agricultural sector more efficient, profitable and competitive.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Human Nutrition and Health

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
702	Requirements and Function of Nutrients and Other Food Components	15%	15%	15%	
703	Nutrition Education and Behavior	25%	25%	25%	
721	Insects and Other Pests Affecting Humans	10%	10%	10%	
724	Healthy Lifestyle	50%	50%	50%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	35.0	2.5	17.0	0.0
Actual Paid Professional	24.0	8.0	10.0	0.0
Actual Volunteer	62.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
540607	199800	109941	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
540607	199200	109941	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2533680	10200	922192	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The Nutrition and Health program will promote optimum nutrition and health through diet and lifestyle in all North Carolinians regardless of gender, income, age, or race/ethnicity. Education programs addressing diet, healthy, and chronic disease prevention will be offered to North Carolinians of diverse income levels, age groups, genders, and/or cultural backgrounds across the state. Programs offered will include Give Your Heart A Healthy Beat, Project Eat Right: Add to Life Program, Color Me Healthy, Moving Towards a Healthier You, Dining with Diabetes, SyberShop, and Families Eating Smart and Moving More. Programs will be held in many different settings including congregate nutrition sites, senior centers, schools, churches, government buildings, businesses, daycare centers, work sites and outdoors. Various methods will be employed including using the Internet, computers, mailed materials, media, one-on-one contact, and public meeting. Research projects will continue or be undertaken to seek scientific discoveries that will enhance the quality of living for the states' and nation's human population.

2. Brief description of the target audience

Audiences reached included children, adults and the elderly, day care workers, hospital employees, housing authorities, Head Start, Red Cross, food banks, daycare home providers, food stamp and WIC recepients and community coalitions. No time is more important than childhood to promote healthy eating and health practices. Children in North Carolina do not consume enough fruits or vegetables and have diets that are low in fiber and higher in fat than recommended. Children in North Carolina need quality nutrition education to help positively influence their food choices. For nutrition education efforts to be effective they must also include parents and care givers. Helping families make informed decisions about their nutrition will help ensure that North Carolina's children grow to reach their full mental and physical potential. Overweight in children in North Carolina continues to rise. Treatment of overweight and obesity is difficult. Preventing overweight and obesity in children is essential to address this issue. Demographic changes in North Carolina's population continue to impact nutrition and health issues. The fastest growing age group in the state is the 65 years-and-over segment. The elderly run disproportionate risks of malnutrition and poverty as well as poor overall health status. In fact, over 85% of older adults suffer from chronic diseases and could benefit from dietary intervention. The general nutrition needs of the well elderly must be addressed; however, the needs of the elderly for prevention of malnutrition and chronic disease actually begin much earlier in life. Programs addressed to young adults and the middle-aged consumers will continue to impact the health of the population as it "ages." Women are employed in greater numbers, and many of them are among the ranks of the working poor. Over 80% of women who had school-aged children were working outside the home; 67% of women with youngest child under six years were in the labor force. For working parents with very limited resources, lack of after-school and summer programs for youth are a major concern.

3. How was eXtension used?

The Families Food and Fitness CoP of eXtenion offers frequently asked questions, articles, online learning activities, and interactive tools on families, food and fitness topics

The Families Food and Fitness Community of Practice's vision is to become a source of research-based information for families as they work to eat smart, move more and achieve a healthy weight.

The Families Food and Fitness Community of Practice provides education and skills to help families make informed decisions about healthy eating and physical activity by providing them with evidence (science/research) - based information and learning opportunities through eXtension.

Families Food and Fitness is organized around three goals for the Community of Interest:

- Improve diets;
- Increase physical activity; and

- Maintain body weight in a healthy range and avoid excess weight gain.

Initially, the content of the website will be focused on six key behaviors that have been identified in the literature to be associated with maintaining and achieving a healthy body weight:

1. Move More Everyday
2. Tame the Tube
3. Control Portion Size
4. Enjoy More Fruits and Vegetables
5. Prepare More Meals at Home
6. Re-Think Your Drink

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	250000	600000	70000	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	12	4	16

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Non-degree credit group activities conducted on Foods and Nutrition Education

Year	Actual
2011	4708

Output #2

Output Measure

- Targeted audiences participate in workshops on food and nutrition

Year	Actual
2011	67258

Output #3

Output Measure

- Conduct research projects on vectors, their influences on human health and their control.

Year	Actual
2011	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Program participants increase knowledge that will promote a healthier diet
2	Program participants increase skills that will promote a healthier diet
3	Educational program participants make one or more positive dietary change
4	Program participants decrease body weight.
5	Program participants decrease blood pressure.
6	Program participants increase physical activity.
7	Program participants increase their fruit and vegetable consumption by at least one serving.
8	Research projects produce findings that can and will have an impact on the knowledge of and control of vectors that impact human health and safety.

Outcome #1

1. Outcome Measures

Program participants increase knowledge that will promote a healthier diet

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	81246

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The importance of promoting nutrition and wellness throughout life has been clearly established. Dietary factors are associated with five of the 10 leading causes of death in North Carolina and the United States. Programs that provide consumers with research-based information on healthy eating are imperative to increase their knowledge of the importance of making changes in their dietary patterns to optimize health. Further, consumers need knowledge as to how to go about making these changes based on their lifestyle and environments.

What has been done
NC Cooperative Extension has used multiple delivery strategies to increase the knowledge of participants in healthy eating. Agents have conducted workshops and demonstrations in a variety of settings, including after school, faith community, work site, and others. Media were used to effectively disseminate a clear message about healthy eating to even more citizens.

Results
More than 81,000 North Carolinians who participated in programs conducted by NC Cooperative Extension increased knowledge of how to promote a healthy diet. While knowledge does not indicate behavior change, it is a step in moving toward lifestyle changes in diet that promote optimal health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior

724 Healthy Lifestyle

Outcome #2

1. Outcome Measures

Program participants increase skills that will promote a healthier diet

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	41536

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The importance of promoting nutrition and wellness throughout life has been clearly established. Dietary factors are associated with five of the 10 leading causes of death in North Carolina and the United States. Programs that provide consumers with research-based information on healthy eating are imperative to increase their knowledge of the importance of making changes in their dietary patterns to optimize health. Further, consumers need knowledge as to how to go about making these changes based on their lifestyle and environments.

What has been done
NC Cooperative Extension has used multiple delivery strategies to increase the knowledge of participants in healthy eating. Agents have conducted workshops and demonstrations in a variety of settings, including after school, faith community, work site, and others. Media were used to effectively disseminate a clear message about healthy eating to even more citizens.

Results
More than 41,000 North Carolinians who participated in programs conducted by NC Cooperative Extension acquired skills needed to have a healthy diet. While acquiring skills does not indicate behavior change, it is a step in moving toward lifestyle changes in diet that promote optimal health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components

703 Nutrition Education and Behavior

724 Healthy Lifestyle

Outcome #3

1. Outcome Measures

Educational program participants make one or more positive dietary change

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	125000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The importance of promoting nutrition and wellness throughout life has been clearly established. Dietary factors are associated with five of the 10 leading causes of death in North Carolina and the United States. Programs that provide consumers with research-based information on healthy eating are imperative to increase their knowledge of the importance of making changes in their dietary patterns to optimize health. Further, consumers need knowledge as to how to go about making these changes based on their lifestyle and environments.

What has been done
NC Cooperative Extension has used multiple delivery strategies to increase the knowledge of participants in healthy eating. Agents have conducted workshops and demonstrations in a variety of settings including after school, faith community, work site and others. Media were used to effectively disseminate a clear message about healthy eating to even more citizens.

Results
More than 125,000 North Carolinians who participated in programs conducted by NC Cooperative Extension made at least one positive dietary change. Changes include increased consumption of fruits and vegetables, increased breakfast consumption, decreased fat consumption, increased dairy consumption, and change in portion sizes to better match recommendations per mypyramid.gov. All of these behaviors reduce the risk of chronic diseases including heart disease, stroke, and some forms of cancer. Also, these dietary behaviors are related to an increased likelihood of achieving and maintaining a healthy weight.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #4

1. Outcome Measures

Program participants decrease body weight.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1421

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Overweight and obesity are issues of critical importance to the public's health. Overweight and obesity increases the risk of many chronic conditions, including sleep apnea, arthritis, type 2 diabetes, heart disease, and some forms of cancer. In addition, the economic toll of overweight and obesity in North Carolina is billions of dollars each year in health care costs and loss of productivity.

What has been done
NC Cooperative Extension, in partnership with NC Division of Public Health, offers the Eat Smart, Move More, Weigh Less program. Eat Smart, Move More, Weigh Less is a 15-week weight management program that offers dietary, physical activity, and lifestyle strategies that are consistent with a healthy weight. Participants plan, track and live mindfully in addition to eating healthy and being physically active.

Results
The Eat Smart, Move More, Weigh Less program was in its third full year of implementation in 2011. Most participants set a healthy weight loss goal at the beginning of the program (some participants enroll to learn about healthy eating and physical activity and do not need to lose weight).

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #5

1. Outcome Measures

Program participants decrease blood pressure.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1758

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
High blood pressure increases risk for heart disease and stroke.

What has been done
Several programs conducted by NC Cooperative Extension promote eating and physical activity patterns that have been shown to decrease blood pressure.

Results
More than 1,700 participants decreased blood pressure as a result of participating in programs conducted by NC Cooperative Extension. Many other participants adopted physical activity or healthy eating behaviors that can positively affect blood pressure.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #6

1. Outcome Measures

Program participants increase physical activity.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	28143

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many North Carolinians are not active on a regular basis. Few are active to the level recommended by the Dietary Guidelines for Americans. Physical activity is widely accepted as a positive behavior for optimal health and can decrease the risk of heart disease, stroke, and high blood pressure, and can help control weight.

What has been done
NC Cooperative Extension encourages both moderate and vigorous physical activity in several lifestyle management programs. Participants are educated about recommended levels of physical activity and develop skills that can help them become physically active for life.

Results
More than 28,000 participants increased their physical activity. While this is the first step, we need to encourage participants to meet or exceed the minimum of 30 minutes of activity on most days. To that end, 5,920 youth met the minimum recommended physical activity guidelines, while 2,736 youth adopted behaviors exceeding the minimum recommended physical activity guidelines.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #7

1. Outcome Measures

Program participants increase their fruit and vegetable consumption by at least one serving.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	22299

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fruit and vegetable consumption is a critical component of a healthy diet. Increased fruit and vegetable consumption alone has been shown to be effective in decreasing fat and calories while increasing fiber and critical nutrients. Fruit and vegetable consumption is associated with an increased intake of phytonutrients that have been shown to decrease the risk of heart disease and certain forms of cancer.

What has been done
Many programs and media campaigns across North Carolina focus on fruit and vegetable consumption. In addition to educational programs that include fruit and vegetable consumption as a healthy behavior that should be adopted, we also encourage community gardens, home gardening, and home food preservation.

Results
More than 22,000) participants across North Carolina increased their fruit and vegetable consumption by at least one serving.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #8

1. **Outcome Measures**

Research projects produce findings that can and will have an impact on the knowledge of and control of vectors that impact human health and safety.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Many factors affect individuals' decisions and abilities to practice positive behaviors with respect to healthy eating and physical activity. These factors include the physical and social environment of families, communities, and organizations; the policies, practices, and norms within the social and work settings; and access to reliable information. Lasting changes in healthy behaviors require physical environments and social systems that support positive lifestyle habits. In order for individuals (adults and children) to make positive lifestyle changes with respect to healthy eating and physical activity, changes need to be made in the surrounding organizational, community, social, and physical environment. Without these changes, successful health behavior change is difficult to achieve and sustain. Confidence in adopting and maintaining a behavior may be strengthened when the physical and social environment supports the new behavior. Policy and environmental interventions can improve the health of all people, not just small groups of motivated or high-risk individuals. NC Cooperative Extension continues to work using the multilevel model or socioecological model for behavior change. It is within that context that we provide education to participants while working at the county and state level to make systems, policy, and environmental changes. These changes are systemic and societal, thus do not happen quickly. Slow changes in policy and environments that support healthy eating and physical activity continue to challenge our ability to make improvements in eating and physical activity patterns.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

In 2011, 4,613 families enrolled in EFNEP, while 18,892 participated in 4-H EFNEP.

The following data were compiled from pre- and post-evaluation surveys administered to participants by EFNEP program assistants across the state. Completing the series of lessons improved nutrition, food behavior, and food safety practices. As a result of participation in EFNEP 78% improved in one or more food safety practices, 88% improved in one or more food resource management practices, 48% of participants increased amount of physical activity, 56% increased fruit consumption, 50% increased vegetable consumption, and 54% increased consumption of calcium rich foods.

Key Items of Evaluation

Eat Smart, Move More, Weigh Less (ESMMWL) is a weight-management program that uses research-based strategies for weight loss/weight maintenance. This 15-week program informs, empowers, and motivates participants to live mindfully as they make choices about heating and physical activity. The program provides opportunities for participants to track their progress and keep a journal of healthy eating and physical activity behaviors.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Families and Communities

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
801	Individual and Family Resource Management	34%	34%	34%	
802	Human Development and Family Well-Being	33%	33%	33%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	33%	33%	33%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	25.0	5.0	11.0	0.0
Actual Paid Professional	20.0	6.0	4.0	0.0
Actual Volunteer	72.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
292220	250300	321366	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
292220	249500	321366	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1369557	12700	2695640	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Develop and Conduct Family Resource Management, Healthy Housing and Parenting Trainings and Workshops (Educational workshops for consumers related to family resource management, debt reduction, developing budgets and savings plans will be included in these trainings. Trainings will also be designed to include low to moderate income families and families headed by women.
2. Educational workshops for consumers related to reducing home hazards.
3. Dissemination of research findings related to family resource management, housing and parenting.
4. Establish and/or maintain collaborative partnerships with agencies/organizations serving limited resource families.

2. Brief description of the target audience

The target audience for programs includes individual/family consumers, working poor, low to moderate income, minorities, women whose poor economic decisions, ability, and other socio-economic factors make them more at risk of experiencing negative consequences than other families, youth/students, homeowners, families with young children, limited resource parents, caregivers, court mandated or DSS referred parents, grandparents raising grandchildren in North Carolina.

3. How was eXtension used?

Several CoPs within eXtension support this program area. They include:

Personal Finance - resources on money management, credit, financial planning, home ownership, and estate planning

Child Care - resources on quality child care

Family Caregiving - support for developing and sustaining health family relationships, aging well, and raising grandchildren

Parenting - resources for parents of infants, chidren, or teens

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	44043	272535	2465	9600

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	13	0	13

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Develop and conduct Family Resource Management training and workshops.

Year	Actual
2011	139

Output #2

Output Measure

- Educational workshops for consumers related to family resource managment, debt reduction, developing budgets and savings plans -

Year	Actual
2011	139

Output #3

Output Measure

- Conduct educational workshops for consumers related to parenting and family life.

Year	Actual
2011	148

Output #4

Output Measure

- Conduct Healthy Homes trainings for health and housing professionals.

Year	Actual
2011	8

Output #5

Output Measure

- Parents mandated by the court and agency referred parents consistently using positive parenting strategies.

Year	Actual
2011	1312

Output #6

Output Measure

- Develop and conduct financial education workshops for community based finanical educators.

Year	Actual
2011	25

Output #7

Output Measure

- Conduct educational workshops related to energy efficiency and conservation.

Year	Actual
2011	38

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Parents adopting appropriate guidance/supervision practices.
2	Individuals and families will follow a household budget.
3	Individuals and families will increase savings.
4	Individuals/families will reduce debt.
5	Individuals/families will participate in retirement planning.
6	Individuals, businesses, industries and governments engaging in best managment practices related to energy use/conservation.
7	Individuals participating in the Healthy Homes Specialist certification exam.

Outcome #1

1. Outcome Measures

Parents adopting appropriate guidance/supervision practices.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1138

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Basic skills and socialization and educational motivation are first taught in the home. Many youth, however, are growing up in environments that lack parental supervision and support. Quality time with parents is essential to building trusting relationships. The consequence of these circumstances is that youth may display anti-social behavior, including gang membership, disruptive behavior, school dropout, and substance abuse.

What has been done
Family and Consumer Science agents are assisting in building strong families by educating citizens on parenting and family life issues. Agents direct educational workshops, conferences, camping experiences, and other outreach efforts focused on positive parenting skills. These efforts address the importance of family time and identify real life concerns of parents

Results
As a result of educational programs, 497 fathers increased their involvement with their children at home, in school and in the community, and 115 incarcerated parents implemented strategies for staying involved in their children's lives. In addition, 1,138 parents adopted appropriate guidance and supervision practices and 1,312 court mandated and agency referred parents consistently used positive parenting strategies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being

Outcome #2

1. Outcome Measures

Individuals and families will follow a household budget.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1181

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The seriousness of today's economic climate has highlighted the importance of basic money management skills. Unfortunately, individuals and families often lack basic financial decision-making skills. Budgeting and record keeping are essential skills for individuals and families to master in order to begin forming a secure financial future. Programs focused on these areas help equip individuals and families with skills to better manage economic change that will occur throughout their lives.

What has been done
Family and Consumer Science Agents collaborated with county and state partners to conduct workshops, conferences, and other educational events addressing the importance of basic money management skills such as record keeping and budgeting. These outreach efforts are designed to equip individuals and families with the tools they need to better manage economic change throughout their lifespan.

Results
As a result of educational efforts, 2,411 individuals and families have developed a household budget and 1,015 have developed a household record keeping system. In addition, individuals and families developed other financial management skills, including 4,215 program participants who now use cost comparison skills, and 1,181 program participants who now follow a budget.

4. Associated Knowledge Areas

KA Code	Knowledge Area

801	Individual and Family Resource Management
802	Human Development and Family Well-Being
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

Outcome #3

1. Outcome Measures

Individuals and families will increase savings.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1153

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Savings are an essential element in overall financial well-being. When individuals and families have savings, they are able to better weather difficult economic circumstances such as a reduction in income, loss of a job, or health crisis.

What has been done
Family and Consumer Science agents in North Carolina conducted workshops and trainings to assist limited resource and non-limited resource individuals in improving their financial management skills. Skills such as budgeting, debt reduction, and credit management have helped consumers develop the essential tools for improving their financial situation.

Results
As a result of educational programs, 1,153 individuals and families reported increasing their savings accounts and 1,124 families and individuals reported achieving their financial goals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being

Outcome #4

1. Outcome Measures

Individuals/families will reduce debt.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	439

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A symptom of increased indebtedness of working class and middle class families is the rise in the number of personal bankruptcies. In addition, in recent years, home foreclosures have seen alarming increases. A high level of indebtedness among households not only threatens the economic health of families but also the state's economy at large.

What has been done
Family and Consumer Science Agents along with partners in various agencies, organizations, and institutions developed and implemented educational programs related to debt reduction and foreclosure prevention.

Results
Individuals and families used information provided to achieve a number of money management goals. For example, 455 individuals paid their bills on time; seven IDA participants purchased homes; and 1,020 individuals budgeted their basic monthly expenses. In addition, 15 individuals and families used strategies to prevent home foreclosure.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being

Outcome #5

1. Outcome Measures

Individuals/families will participate in retirement planning.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2386

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Recent economic circumstances have resulted in decreases in some individual's retirement savings. As a result, some individuals have elected to postpone retirement until the volatility of the financial markets subsides, and they have a more secure financial situation. Others have returned to work after experiencing a significant drop in their retirement income.

What has been done
Family and Consumer Science agents conducted workshops, conferences, and other educational programs focused on retirement planning, estate planning, financial management, and insurance plans in order to assist individuals in planning for their retirement future.

Results
Regardless of circumstances, thoughtful retirement planning is essential for security in later years. As a result of educational programs,198 individuals planned for retirement; 2,386 gained knowledge about retirement planning and 548 gained skills in retirement planning. In addition to those planning for retirement, 3,416 individuals reviewed insurance plans for adequate coverage and 164 individuals and families implemented estate planning strategies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

Outcome #6

1. **Outcome Measures**

Individuals, businesses, industries and governments engaging in best managment practices related to energy use/conservation.

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

Individuals participating in the Healthy Homes Specialist certification exam.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

A number of factors contributed to the adoption of practices as they relate to family resource management, parenting, and home safety. Overall, the economy of the state and nation plays a significant role. In 2011**,** the North Carolina economy continued to struggle. Tightened lending, declining job markets and industry closings all influenced individual income. Foreclosures and bankruptcies continued to be problems. Normal stressors of maturity, communication, and family dynamics are often compounded by external forces, including the economy. In addition to economic forces, families must cope with concerns such as deployment of one or both parents, substance abuse, incarceration and violence.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluation of Family and Community programs is on-going. The methods and timing of evaluation depend on each individual program and each Family and Consumer Science agent's plan of work. Evaluation of programs reveal that 2,411 individuals developed a household budget; 1,153 individuals increased their savings, 1,124 individuals achieved their financial goals; 1,138 parents adopted appropriate guidance and supervision practices; 497 fathers increased involvement with their children; and 1,498 adults increased

their conflict resolution and anger management skills.

Key Items of Evaluation

Programs focused on areas such as family finances, including savings and money management, and parenting skills. These programs were designed to give North Carolina families the information they need to thrive in today's complex world.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Youth Development

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
806	Youth Development	100%	100%	100%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	52.0	7.0	0.0	0.0
Actual Paid Professional	45.0	15.0	0.0	0.0
Actual Volunteer	124.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
394497	635500	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
394497	633500	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1848902	32400	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Objectives listed under the six Long Range Focus Areas are accomplished by teams of campus/field based youth development educators. Each team continuously works to accomplish three related, over lapping focus area/objective specific processes. Each team works to build youth development professional practices and expand the impact of evaluations as they: 1) Scan the environment for emerging focus area

specific and deliver programs responsive for those existing and emerging needs. 2) Design and deliver programs responsive to those existing and emerging needs. 3) Design evaluation tools to facilitate program impacts for reporting into the Extension Reporting System. Each team will produce, share and implement the following program-wide set of elements: Focus/Objectives Teaching Points Situation Statement Evaluation strategies: 1) Measures of Progress;2) Impact Indicators Related Research Programming Resources Target Audiences. Youth development professionals and volunteers working with low income and minority youth will be engaged in various phases of the program design and development. They will also assist with pilot testing developed educational products. Strategies to increase access to 4-H programs in local communities will be built by matching income youth. This strategy will promote the building of a strong network of individuals equipped to address the unique needs of the targeted audience.

2. Brief description of the target audience

The Development Responsible Youth Initiative is designed to drive collaboration with and among all agencies, programs and organizations dedicated to the well being of young people in our state. Our initiative activity engages youth, volunteers, stakeholders and youth development professionals "to create helping relationships, to enable youths to become responsible, productive citizens."

3. How was eXtension used?

Relevant CoPs include: Better Kid Care, Military Families, and Youth SET for Life. These sources provide valuable information for educators, volunteers, children and their families to aid in development of productive, responsible youth.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	30413	180000	235025	850000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	8	0	8

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Healthy Eating, Physical Activity and Chronic Disease Risk Reduction

Year	Actual
2011	23000

Output #2

Output Measure

- Preparing Youth for an Employable Future and Economic Success

Year	Actual
2011	34997

Output #3

Output Measure

- Building Community through Volunteerism

Year	Actual
2011	17088

Output #4

Output Measure

- Building Citizen Leaders

Year	Actual
2011	15257

Output #5

Output Measure

- Developing Life Skills

Year	Actual
2011	30000

Output #6

Output Measure

- K-12 Academic Achievement and Educational Success

Year	Actual
2011	31328

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Youth Involved: 4-H Clubs, School Enrichment, Special Interest and Resident/Day Camps Healthy eating, physical activity and chronic disease risk reduction
2	Youth Involved: 4-H Clubs, School Enrichment, Special Interest, and Resident/Day Camps Preparing youth for an employable future and economic success
3	Youth Involved: 4-H Clubs, School Enrichment, Special Interest and Resident/Day Camps Building community through volunteerism
4	Youth Involved: 4-H Clubs, School Enrichment, Special Interest and Resident/Day Camps Building citizen leaders
5	Youth Involved: 4-H Clubs, School Enrichment, Special Interest, Resident and Day Camps Developing life skills
6	Youth Involved: 4-H Clubs, School Enrichment, Special interest, and Resident and Day Camps K-12 Academic Achievement and Educational Success

Outcome #1

1. Outcome Measures

Youth Involved: 4-H Clubs, School Enrichment, Special Interest and Resident/Day Camps Healthy eating, physical activity and chronic disease risk reduction

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	15351

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
North Carolina's youth and families continue to discover the world through 4-H camp and child care education programs. Camps and educational conference center operations continue to grow in celebration of being exemplary units in the certification system managed by the American Camping Association. In addition, child care education centers continue to be a foundational layer of community development as more and more families move to a two parent working household model.

What has been done
In 2011, 15,351 youth participated in 4-H day and residential camping. In addition, 10,361 youth participated in 4-H child care education programs, and 139,622 youth participated in school enrichment programs.

Results
Camp and child care education center participants gained significantly in both life skills and knowledge. Knowledge gains were seen in the following areas: safety, environment, personal responsibilities, making wise decisions, and healthy food/physical activity choices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Youth Involved: 4-H Clubs, School Enrichment, Special Interest, and Resident/Day Camps
Preparing youth for an employable future and economic success

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	15500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To successfully face rigorous higher education coursework, career challenges, and a globally competitive workforce, 4-H aligns its academic programs with real world environments by infusing 21st century skills.

What has been done
Youth benefited from involvement in community based programs that focused on the Preparing for an Employable Future (School to Work) Initiative, which includes career pathways, entrepreneurship, K-12 programs and STEM. The career pathways program reported 45,009 youth increased their knowledge of career pathways.

Results
Some indicators of progress included 7,481 youth gaining basic financial management skills and 25,039 youth increasing their knowledge of employability skills. In addition, 10,275 youth aspired to pursue post secondary education and 1,429 youth applied for, obtained employment and/or participated in service learning, job shadowing or internship programs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

Youth Involved: 4-H Clubs, School Enrichment, Special Interest and Resident/Day Camps Building community through volunteerism

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	9117

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Through active 4-H participation, youth learn to manage relationships, make decisions, become resilient enough to overcome risks they face, become better communicators, and serve their communities. 4-H's hands-on, learn-by-doing approach reaches hundreds of thousands of North Carolina's youth in schools, in community clubs, camps, and other settings.

What has been done
A total of 235,025 youth participated in 4-H programs across the state, with 166,966 involved in 4-H Clubs and School Enrichment (K-12) programs and 100,109 participating in Special Interest programs.

Results
4-H professionals worked with youth and adult volunteers in a variety of program areas, including citizenship, civic engagement, global education and cultural education. The volunteer programs reported that 17,088 participants indicated an increase in knowledge of volunteerism and that 1,647 participants served in new roles on community boards or councils. In addition, 4,745 participants reported aspirations to serve as new volunteers in their community. In 2011, the volunteerism initiative had an estimated value to society of more than $5.2 million dollars.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Youth Involved: 4-H Clubs, School Enrichment, Special Interest and Resident/Day Camps Building citizen leaders

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	15257

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The true value of 4-H comes not from short-term results or even the effects over a few years. It comes from the program's influence on the lifelong pathway of development. Just as inoculations protect children from harmful diseases, 4-H programs have similar inoculation effects.

What has been done
Youth benefited from participation in community based programs that focused on developing life skills, which includes problem solving, communication, decision making, critical thinking, and goal setting. Problem solving programs reported 58,284 youth increased their problem-solving skills, and 19,273 youth using appropriate gained goal-setting strategies.

Results
Some indications of progress included 43,420 youth using appropriate communication techniques, 53,358 youth increasing their knowledge of critical thinking skills and 47,899 youth using appropriate decision-making strategies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Youth Involved: 4-H Clubs, School Enrichment, Special Interest, Resident and Day Camps
Developing life skills

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	30000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
North Carolina's youth and families continue to discover the world through 4-H camp and child care education programs. Camps and educational conference center operations continue to grow in celebration of being exemplary units in the certification system managed by the American Camping Association. In addition, child care education centers continue to be a foundational layer of community development as more and more families move to a two parent working household model.

What has been done
In 2011, 18,963 youth participated in 4-H day and residential camping. In addition, 9,859 youth participated in 4-H child care education programs and 147,860 youth participated in school enrichment programs.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #6

1. Outcome Measures

Youth Involved: 4-H Clubs, School Enrichment, Special interest, and Resident and Day Camps K-12 Academic Achievement and Educational Success

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	31328

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Once upon a time, a person did not need a college education to fully participate in the economy. A high school diploma was good enough to get a decent job that could support a family and provide a decent pension. That is no longer the case. Today, high school is the pathway to higher education, career success, and a productive adulthood. Nationally, 70% of all students in public schools graduate yet, only 32% of graduates leave high school qualified to attend a four-year college.

What has been done
Youth benefited from involvement in Extension K-12 academic achievement programs, which included information on homework completion, EOG/EOC test scores, study skills and test taking. Homework completion programs reported 21,740 youth increased the quality of their homework, while 19,669 youth adopted positive study skills as a result of 4-H programs.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (NC DPI Regulations)

Brief Explanation

The national budget crisis and its trickle down impact on the state of North Carolina have affected some of our program outcomes. As the economy tightens, communities and families stay closer to home and are less inclined to participate in educational programs. Despite Extension's footing in communities, when parents struggle with holding down a job and making a living wage, their youth are certainly impacted.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations include retrospective (post program), pre and post program; formative (on-going), case study; and comparisons between program participants (individual, group, organization) and non-participants. Programs are evaluated for impact by objective/goal in the context of the Long Range Focus Area Team Plans. These impacts are reported in the following separate, related systems: Extension Service Report 237; the NC Extension Reporting System; and knowledge, attitude, skill, and aspiration assessments for individual program teams.

Key Items of Evaluation

Youth programs focused on areas such as academic achievement, life skills and communication. These programs are designed to prepare today's young people to become contributing members of society tomorrow.

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Global Food Security and Hunger

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
205	Plant Management Systems	60%	60%	60%	
307	Animal Management Systems	40%	40%	40%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	158.0	12.0	290.0	0.0
Actual Paid Professional	20.0	20.0	31.0	0.0
Actual Volunteer	3.5	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
160721	1092500	169140	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
160721	1089000	169140	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
753256	55700	1418758	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Conduct discovery research on plants and plant systems using tools genomics, metabolomics, and proteomics

• Develop improved crop varieties using traditional and genomic approaches

- Introduce/discover new plants for food use and the green industry
- Develop systems for production of plants for biofuels
- Seek new uses for plants and plant byproducts
- Develop production systems for organic farmers

This plan of work includes broad and extensive research and extension programs. NC Agricultural Research Service scientists will conduct research projects to study methods to improve the efficiency of animal production. Research will focus on methods to improve reproductive performance, nutrient utilization, and genetic influence on growth and reproduction. Scientists will also work to improve animal management systems, decrease the incidence of animal diseases and parasites (external and internal) and improve the management of animal and agricultural pests. Species and commodity groups included in this plan of work are also very broad and include poultry such as turkeys, broiler chickens, and table-egg chickens. The plan of work also includes swine, fish such as flounder, and cattle such as beef and dairy, and numerous pests such as house flies. Research will include many phases of commodity production such as meat and dairy goats, chicken breeders (both broiler and table egg birds), commercial broilers (commercial refers to those animals produced for meat), breeder turkeys, commercial turkeys, swine breeders, commercial swine, all phases of aquaculture and beef and dairy production. Disciplines that will be involved include nutrition, physiology, reproductive physiology, genetics, virology, bacteriology, microbiology, mycology, entomology, and many animal management systems such as grazing and forage management programs, hatchery management, feeding and drinking water systems, litter and bedding management, lighting programs, and breeder selection and management. A very important part of this plan of work is to transfer technology and knowledge to our stake-holders and clientele. Therefore, an extensive outreach effort through Cooperative Extension will be conducted by field and campus based faculty who are based on-site as well as being located across the state and based in local communities. Stake-holders and clientele will be directly engaged in many ways including workshops, conferences, discussion groups, one-on-one teaching, demonstrations, field days, short-courses, continuing education classes, and scientific meetings. Indirect methods to reach stake-holders and clientele will include long-distance education, newsletters, web sites, newspaper releases, television and radio programs, trade journals, scientific journals, and popular press articles. Participants and programs will be evaluated at least annually for success, progress, and effectiveness. Special educational programs focused on limited resource farmers will continue to be a priority for NC A&T focused Extension efforts in pasture based production systems, aquaculture and alternative breeds.

2. Brief description of the target audience

- The scientific community
- Regulatory agencies
- Agricultural chemical companies
- Agribusiness
- Commercial and limited resource farmers
- New and Part-time farmers
- Homeowners
- Consultants
- News media
- General public
- Non-governmental organizations
- Other public agency staff

3. How was eXtension used?

eXtension includes a wide array of plant systems and animal systems CoPs that provide relevant information and strategies for producers, processors, and marketers.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	420	4200	1460	5600

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 3

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	12	32	44

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Programs directed toward minimizing food systems disruptions

Year	Actual
2011	84

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of programs on potential food system disruptions

Outcome #1

1. Outcome Measures

Number of programs on potential food system disruptions

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	84

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Human noroviruses (NoV) are now recognized as the most common cause of acute gastroenteritis in the industrialized world. They are also responsible for over 50% of all food borne illness in the U.S. This constitutes over 5 million cases every year, resulting in thousands of hospitalizations and about 150 deaths. For a number of reasons, NoV are difficult to control: (i) there are no commercially available methods to detect them; (ii) they will not multiply outside of humans; (iii) they persist in the environment for weeks and still remain infectious; (iv) they are resistant to most commercial sanitizers used at manufacturer-recommended concentrations; and (v) there are few scientists with the breadth of expertise to tackle the complex issues associated with virus contamination of foods.

What has been done
In 2011, the USDA-NIFA Food Virology Collaborative (NoroCORE) was established. Funded by the National Institute of Food and Agriculture, this 5 year, $25 million project is spearheaded by Dr. Lee-Ann Jaykus of NCSU, with the participation of 17 other institutions representing the academic, government and industrial sectors. The long-term goal of this project is to reduce the burden of food borne illness associated with virus contamination. The NoroCORE team will take an integrated, multi-disciplinary approach to develop improved tools, skills and capacity to study NoV and use these findings to understand risk and develop methods to reduce virus contamination along the farm-to-fork continuum. The team will engage in six major activities: (i) develop improved methods to study NoV; (ii) develop sensitive, rapid and commercializable, detection methods; (iii) collect and analyze data to aid in estimating disease burden and risk; (iv) develop commercial methods to prevent contamination and/or inactivate NoV if present in foods; (v) translate research findings into practices that will reach important stakeholders (food industry, consumers, regulators); and (vi) develop a professional network to support collaboration and increased capacity for work in food virology.

Results

The NoroCORE team anticipates that its efforts to improve our understanding of NoV will result in better ways to control these viruses. The ultimate outcome will be a measureable reduction in the overall burden of food borne illness in the U.S., substantially contributing to the health and well-being of the food industry and the public.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Research and extension programs were designed to protect the security of our food supply by better understanding threats such as food borne illnesses.

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Climate Change

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	50%	50%	50%	
605	Natural Resource and Environmental Economics	50%	50%	50%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	60.0	11.0	32.0	0.0
Actual Paid Professional	10.0	2.0	6.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
314136	130100	169140	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
314136	129700	169140	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1472273	6600	1418758	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities will be focused on understanding the processes and situations that create pollution problems from agricultural production (including animal operations, field activities, and

processing). With that information in hand, improved management and technological solutions will be proposed and evaluated. Technology transfer will be accomplished through demonstrations, workshops, and publications by Cooperative Extension in concert with the researchers involved.

2. Brief description of the target audience

Agricultural producers, environmental and other governmental agencies (action and regulatory), news media, the general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	20000	50000	1000	5000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	6	11	17

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of farms using precision application technologies

Year	Actual
2011	587

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farms using precision application technology

Outcome #1

1. Outcome Measures

Number of farms using precision application technology

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	587

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
North Carolina is a state of diverse and remarkable physical and natural resources. A strong agriculture is critical to the economy of the state. At the same time, the preservation of the environment and the health of our citizens are of paramount concern

What has been done
This program generates and provides knowledge to develop and maintain highly productive agricultural and ecological systems in the context of climate change. Strategies will help producers and managers plan for and make decisions to adapt to changing environments and sustain economic vitality, and take advantage of emerging economic opportunities offered by climate change mitigation technologies.

Results
In 2011, 587 farms began using precision application technologies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Research and extension programs focused on the adoption of precision agriculture technologies may lessen agricultural energy use and aid in mitigating climate change.

V(A). Planned Program (Summary)

Program # 12

1. Name of the Planned Program

Sustainable Energy

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
403	Waste Disposal, Recycling, and Reuse	100%	0%	100%	
	Total	100%	0%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	19.0	1.0	12.0	0.0
Actual Paid Professional	2.0	0.0	10.0	0.0
Actual Volunteer	1.5	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
80360	0	634230	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
80360	0	634230	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
376628	0	5319964	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and Extension activities will focus on applying and adapting knowledge gained from basic research to agricultural production systems and natural resource pollution prevention. Both "soft" engineering (e.g. unit process engineering) and "hard engineering" (e.g., machines, hardware and sensors and controls) will be a part of the Research and Extension activity. Technology transfer will be achieved

through workshops, demonstrations and field days, and publications.

2. Brief description of the target audience

The target audience will be: agricultural producers, manufacturers of agricultural machinery and food processing and storage equipment, state agencies, watershed stakeholders, and the general public.

3. How was eXtension used?

eXtension provides CoPs for both home and farm energy conservation, providing information, recommendations and strategies for conserving energy in homes and on farms.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4500	20000	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 4

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	21	21

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- New bioproducts identified

Year	Actual
2011	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of waste disposal, recycling and reuse meetings

Outcome #1

1. Outcome Measures

Number of waste disposal, recycling and reuse meetings

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	30

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The general public is interested in minimizing ecological footprints.

What has been done
About 30 training sessions were held around the state.

Results
Scientists, commercial and limited resource farmers, regulatory entities, homeowners, general public and agribusinesses have learned about waste disposal, recycling and reuse.

4. Associated Knowledge Areas

KA Code	Knowledge Area
403	Waste Disposal, Recycling, and Reuse

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

By providing information on waste disposal, recycling and reuse, our programs are helping North Carolina move toward a more sustainable future.

V(A). Planned Program (Summary)

Program # 13

1. Name of the Planned Program

Childhood Obesity

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	100%	100%	100%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	35.0	2.5	17.0	0.0
Actual Paid Professional	20.0	1.0	3.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
160721	38800	29600	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
160721	38700	29600	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
753256	2000	248287	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The Nutrition and Health program will promote optimum nutrition and health through diet and lifestyle in all North Carolinians regardless of gender, income, age, or race/ethnicity. Education programs addressing diet, healthy, and chronic disease prevention will be offered to North Carolinians of diverse income levels, age groups, genders, and/or cultural backgrounds across the state. Programs offered will

include Give Your Heart A Healthy Beat, Project Eat Right: Add to Life Program, Color Me Healthy, Moving Towards a Healthier You, Dining with Diabetes, SyberShop, Women Living Healthy - Women Living Well, and Families Eating Smart and Moving More. Programs will be held in many different settings including congregate nutrition sites, senior centers, schools, churches, government buildings, businesses, daycare centers, work sites and outdoors. Various methods will be employed including using the Internet, computers, mailed materials, media, one-on-one contact, and public meeting. Research projects will continue or be undertaken to seek scientific discoveries that will enhance the quality of living for the states' and nation's human population.

2. Brief description of the target audience

Audiences reached included children, adults and the elderly, day care workers, hospital employees, housing authorities, Head Start, Red Cross, food banks, daycare home providers, food stamp and WIC recepients and community coalitions. No time is more important than childhood to promote healthy eating and health practices. Children in North Carolina do not consume enough fruits or vegetables and have diets that are low in fiber and higher in fat than recommended. Children in North Carolina need quality nutrition education to help positively influence their food choices. For nutrition education efforts to be effective they must also include parents and care givers. Helping families make informed decisions about their nutrition will help ensure that North Carolina's children grow to reach their full mental and physical potential. Overweight in children in North Carolina continues to rise. Treatment of overweight and obesity is difficult. Preventing overweight and obesity in children is essential to address this issue. Demographic changes in North Carolina's population continue to impact nutrition and health issues. The fastest growing age group in the state is the 65 years-and-over segment. The elderly run disproportionate risks of malnutrition and poverty as well as poor overall health status. In fact, over 85% of older adults suffer from chronic diseases and could benefit from dietary intervention. The general nutrition needs of the well elderly must be addressed; however, the needs of the elderly for prevention of malnutrition and chronic disease actually begin much earlier in life. Programs addressed to young adults and the middle-aged consumers will continue to impact the health of the population as it "ages." Women are employed in greater numbers, and many of them are among the ranks of the working poor. Over 80% of women who had school-aged children were working outside the home; 67% of women with youngest child under six years were in the labor force. For working parents with very limited resources, lack of after-school and summer programs for youth are a major concern.

3. How was eXtension used?

The Families Food and Fitness CoP of eXtenion offers frequently asked questions, articles, online learning activities, and interactive tools on families, food and fitness topics

The Families Food and Fitness Community of Practice's vision is to become a source of research-based information for families as they work to eat smart, move more and achieve a healthy weight.

The Families Food and Fitness Community of Practice provides education and skills to help families make informed decisions about healthy eating and physical activity by providing them with evidence (science/research) - based information and learning opportunities through eXtension.

Families Food and Fitness is organized around three goals for the Community of Interest:

- Improve diets;
- Increase physical activity; and
- Maintain body weight in a healthy range and avoid excess weight gain.

Initially, the content of the website will be focused on six key behaviors that have been identified in

the literature to be associated with maintaining and achieving a healthy body weight:

1. Move More Everyday
2. Tame the Tube
3. Control Portion Size
4. Enjoy More Fruits and Vegetables
5. Prepare More Meals at Home
6. Re-Think Your Drink

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	75000	85000	15000	20000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	4	4	8

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Program participants increase knowledge that will promote a healthier diet

Year	Actual
2011	39284

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Program participants increase knowledge that will promote a healthier diet

Outcome #1

1. Outcome Measures

Program participants increase knowledge that will promote a healthier diet

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	39284

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Childhood Obesity Planned Program will provide science-based educational and experiential learning opportunities that focus on children, but actively engage an array of audiences--regardless of gender, income, age or race/ethnicity--because of the influence that these groups in society have on the health and well-being of themselves and their children.

What has been done
Programs developed and provided by NC Cooperative Extension in the area of healthy weight for children and adults is part of the larger initiative Eat Smart, Move More North Carolina. As a founding member of the movement, our programs are part of a larger effort to educate and change environments so that all North Carolinians have the opportunity to eat smart and move more.

Results
The Supplemental Nutrition Assistance Program-Education (SNAP-Ed) serves limited resource families across North Carolina to assist those eligible for food assistance to eat smart and move more. SNAP-Ed works to help participants make healthy choices within a limited budget and choose physically active lifestyles. NC State University's SNAP-Ed Program is Steps to Health, which works with preschoolers, kindergarteners, 2nd grade students, 3rd grade students, and high school students. Color Me Healthy is a program developed to reach limited resource children ages four and five. Color MeHealthy uses color, music, and exploration of the senses to teach children that healthy food and physical activity are fun. Agents train child care providers in the use of the program in their setting. Faithful Families Eating Smart and Moving More is a program that helps faith communities in North Carolina make and sustain changes that promote healthy eating and physical activity. Eat Smart, Move More Weigh Less (ESMMWL) is a weight-management program for adults. This 15-week evidence-based program includes strategies proven to work to achieve and maintain a healthy weight and encourages small changes that can be sustained over

time. The program includes a family component to influence the eating and physical activity of all family members. Cook Smart, Eat Smart is a program that teaches simple, basic cooking for teens and adults. Eating more meals at home is an important strategy for eating a healthy diet. Cook Smart, Eat Smart provides hands on education on how to plan, shop, fix and eat healthy family meals. In addition to the methods mentioned earlier, social media tools will be used by researchers as a means of helping to reinforce information about healthy eating and physical activity behaviors among adolescents.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Programs are designed to give children and their parents the information they need to consume health diets and get adequate exercise. These efforts will help combat the state's childhood obesity epidemic.

V(A). Planned Program (Summary)

Program # 14

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	100%	0%	100%	
	Total	100%	0%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	54.0	0.0	63.0	0.0
Actual Paid Professional	20.0	0.0	35.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
635579	0	422850	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
635579	0	422850	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2978786	0	3546894	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Multiple research and educational outreach programs will be conducted that fit under the broad umbrella of improving the quality, safety, security, and nutrition of food products produced in North

Carolina. Specific research projects will identify effective nutritional control strategies for replacement of growth-promoting antibiotics for improving gut function and reducing intestinal colonization and shedding of Salmonella; assessing the incidence, populations, serotypes, genotypes, and antibiotic susceptibility of Salmonella and Campylobacter fecal isolates as a function of farm, bird age, season, management practices, and strategic processing of commercial broiler, turkey, and layer farms; assessing novel antimicrobial strategies for use in reducing foodborne pathogens and biofilm formation on food processing contact surfaces; employing the antimicrobial properties of eggshell membranes for reducing the heat resistance of foodborne pathogens; development of Salmonella-specific inhibitory nanoparticles for preventing intestinal colonization; development of alternative layer molting diets for reducing the risk of Salmonella contamination of shell eggs; characterization of Campylobacter respiratory chain genes for use in developing rational drugs for controlling infection of food animals; conduct ecotoxicological studies to identify chemical pollutant sources that contaminate aquatic human foods; development of a high hydrostatic pressure system for reducing toxigenic histamine-forming bacteria in scombroid fish and vacuum and MAP packaged fresh tuna; develop a more efficient means of producing a high-gelling protein isolate from underutilized fish species and other meat sources that could replace surimi manufacture and improve the quality, sensory and yield characteristics of new and existing muscle food products; development of a Vienna sausage product without casings via an in-tube focused microwave field heating technology; improving the texture and yield of canned/pouched Albacore tuna by controlling precook proteolysis and injection of a tuna-derived protein isolate; application of continuous flow processing of foods and biomaterials using advanced focused microwave technology; and development and testing of tools, methods and devices for rapid sterilization and production of high quality vegetable and fruit purees. A very important aspect of this plan of work is to transfer technology and knowledge to our stakeholders and clientele. Therefore, an extensive outreach effort will involved campus and field faculty located in local communities. Direct outreach efforts will include engaging stake-holders in workshops, conferences, discussion groups, one-on-one teaching, demonstrations, field trials, short courses, continuing education classes, and scientific meetings. Indirect methods will include internet sites and courses, newsletters, press releases, television and radio interviews and programming, trade journals, scientific journals and popular press articles. Participants and programs will be evaluated at least annually for success, progress, and impact.

2. Brief description of the target audience

Primary food producers, food processors, foodservice operators, county extension agents, state and federal regulatory agencies, commodity associations, news media and consumers. The primary audience will be in North Carolina but will also extend to audiences in other states (state and federal agencies, local, state and federal politicians and other stakeholders).

3. How was eXtension used?

eXtension CoP on Food Safety is a resource available for educators and users seeking relevant, contemporary information on safe foods.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2500	10000	20	50

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	20	30	50

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Highly focused non-degree credit group training activities conducted

Year	Actual
2011	200

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of companies adopting new technologies

Outcome #1

1. Outcome Measures

Number of companies adopting new technologies

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The value-added meat processing industry is an important segment of North Carolina?s economy. USDA reported that North Carolina?s muscle foods industry contributed over $4 billion to the state economy. North Carolina State University is serving this industry via cooperative extension activities, conducting research and training students to work in the muscle foods industry. This three tiered approach to serving the muscle foods industry is critical to its continued success.

What has been done
North Carolina State University provides a state of the art pilot plant muscle foods processing laboratory. This lab contains a fresh meat operation room to conduct teaching, research and extension activities relating to muscle quality and carcass composition. This facility is available for meat processors to conduct small scale research and development projects. RDI Foods, Inc, of Raleigh is currently using the NCSU meat extension program for technical support. This company has also utilized the muscle foods processing laboratory to develop new value-added meat products.

Results
RDI Foods has utilized the NCSU Processed Meat Laboratory to develop numerous nutritionally enhanced meat snacks for the U.S. Military. Many of these snack sticks have been introduced to troops deployed around the world. These meat products were designed with various fortifications, including caffeine (for energy boost) and quercetin (a natural anti-inflammatory found in onion skins). These products are shelf stable (do not require refrigeration), nutrient dense, yet light weight and easy for soldiers to carry. This partnership between RDI Foods and the NCSU Meat Extension Program is an example of how industry and the university can work together in order to

produce value-added meat products for our nation?s military.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compiled from a range of sources. Chief among these are a North Carolina Cooperative Extension reporting system as well as faculty activity reports and impact statements filed annually by faculty in the College of Agriculture and Life Sciences at North Carolina State University.

Key Items of Evaluation

Research and extension programs continually provide information and technology that may be used by the private sector to develop new products and spur economic activity. The programs act as an economic engine throughout North Carolina.