

2014 North Dakota State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Agriculture continues to be the dominant force in North Dakota's economy even though North Dakota has become the second largest oil producing state in the nation. The North Dakota Agricultural Experiment Station (ND AES) and NDSU Extension Service (NDSU ES) serve as major sources of innovation, new tools and knowledge, and educational support to agriculture's continued success. The following examples illustrate recent contributions in the areas of global food security, climate change, sustainable energy, food safety, childhood obesity, and citizen and leadership development.

Global Food Security

Pest Management Application for Smartphone and Tablet Users

Three NDSU Extension Service publications are now available as one application (app) for smartphone and tablet users. The free app combines information from the "North Dakota Weed Control Guide," "Field Crop Plant Disease Management Guide" and "Field Crop Insect Management Guide" into one user-friendly electronic medium. The app gives users the ability to search by crop or pest to find solutions to problems or recommended treatments. Growers are also able to save or mark their favorite areas. Pictures of pests, weeds and diseased plants are included to make in-field comparisons. Crops included in the app are corn, soybeans, dry beans, sunflowers, sugar beets, potatoes and small grains. Additional crops may be added in the future. Because the app is a dynamic tool, it can be updated at any time with the latest information. Since release in 2014, the app has been downloaded approximately 3,000 times. Development of a PC version mirroring the app is currently under way.

Educating Producers on the Farm Bill

The 2014 farm bill gives agricultural producers a chance to make decisions that could affect them for years to come. To help them make the right decision for their operation, NDSU Extension Service farm management specialists and agricultural agents are educating producers about the legislation's provisions. For example, the bill gives producers an opportunity to update program yields which are a factor in the size of payments under the Price Loss Coverage program. The new farm bill also allows producers to reallocate their base acres or change the mix of crop bases. Extension efforts to help producers include:

- Prior to 2014 spring planting Extension farm management specialists made presentations to over 1,800 farmers and others about the program provisions and options.
- Over the summer Extension specialists teamed up with staff from the North Dakota Farm Service Agency (FSA) to provide intensive training for Extension agents and county FSA directors at six locations across the state.
- During fall 2014 Extension and FSA staff conducted 10 producer informational meetings around the state with about 1,700 producers in attendance. In addition, Extension personnel presented farm bill education to about 400 agricultural lenders at the annual Ag Lender Outlook Conferences held at three locations.

Farm bill education will continue throughout the winter months and into the spring of 2015 with Extension agents and local FSA staff holding numerous county meetings.

NDSU Beef Cattle Breeding System Sustainability

NDSU is leading a research and Extension effort to evaluate the sustainability of two breeding systems on beef operations throughout North Dakota. While artificial insemination (AI) is not new, the synchronization technology has evolved to the point where all cows in a herd can be AI bred on a single day and achieve pregnancy rates acceptable to many producers. Benefits of using AI and estrus synchronization can include shifting calving distribution, increasing weaning weight of calves and incorporating superior genetics of AI bulls. However, cattle still need to be gathered and handled a minimum of three times to accomplish timed AI protocols. To evaluate the production, performance and profit of each breeding system, producers, Extension agents and campus faculty work side by side to implement the breeding systems research and interpret results. Conducting research on commercial operations also offers students and Extension personnel opportunities to see science in action, understand and address a variety of concerns facing producers, and use this experience to help others with similar questions. Personnel from the departments of animal sciences, agribusiness and applied economics, and sociology and anthropology at NDSU, NDSU Extension Service, North Dakota Beef Cattle Improvement Association and North Dakota Farm Business Management are involved in the efforts.

Climate Change

Soil Salinity Education and Demonstration

As a result of salinity, nearly 90 percent of producers statewide are facing loss in productivity from reduced germination, stunted crop growth and poor range health. Salinization has been enhanced by the wet-cycle and shifts in management practices over the past 30 years in the eastern and central parts of the state. Locations most impacted by the wet cycle have seen higher water tables, transporting dissolved salts upwards into the rooting zone. Additionally, excess water in these locations has moved across the landscape, redistributing salts in surface and rooting zone locations. Producers are looking for education opportunities on the basics of salinity and guidance on management strategies. A network of eight salinity demonstration sites was established across eastern and central North Dakota to increase awareness of salinity issues, demonstrate salinity management options and provide learning opportunities. Field days were held at five of these locations, and the 353 people who attended reported a general 25 percent increase in understanding of saline soil management.

Better Bean-breeding Strategies

Two ND AES scientists are members of a national research team that successfully completed the sequence of the common bean genome. North Dakota is the leading producer of dry beans in the U.S. Both scientists are faculty members of the NDSU Plant Sciences Department. Data analysis determined that the domestication of the common bean in Mexico and the Andean region of South America involved almost completely different sets of genes. A national field trial was conducted that identified regions of the genome associated with seed size and other traits of economic importance. The genome sequence has important implications for North Dakota agriculture because the state produces 30 percent of this billion-dollar crop. Sequencing helps breeders release varieties that are competitive with other crops a producer can grow. This includes breeding a more climate-resilient bean. The sequence revealed that disease-resistance genes are highly clustered in the genome. This knowledge will lead to better breeding strategies to combat the many diseases that challenge the bean crop. These ND AES scientists are cooperating locally, nationally and internationally with other bean breeders and geneticists to develop the next generation of molecular markers that will be another important tool to aid bean breeding worldwide.

Improving Soil Quality on Prevented Plant Acres

Walsh County and northeastern North Dakota experienced a very cold, wet spring and early summer in 2014. Large parts of Walsh County and the surrounding areas went unplanted, and there was a need to get cover plants on the ground to protect soil quality and to ensure eligibility for participation in government programs. This cover could potentially utilize excessive moisture and build the quality of the soil. Walsh County Extension was in the third year of the Northeastern North Dakota Cover Crops Project funded by North Dakota SARE, and this difficult spring situation provided Extension personnel with the opportunity to use the education and experience gained through the SARE project. Radio shows, news columns, press releases and relationships with private industry personnel were all used to promote the use of a diverse cover crop mix on prevented plant acres. Fifty producers from northeastern North Dakota and Walsh County sought advice on seeding cover crops. An estimated 10,000 acres were planted with a cover crop mix in the region. Turnips, radishes and pea mixes were popular. An added bonus of this management practice was providing important food and habitat for wildlife throughout the winter.

Sustainable Energy

Surface Considerations for Mineral Development

Oil and gas development continues in western North Dakota. The flurry of mineral leasing between mineral owners and mineral developers has subsided but it is being replaced by increased interaction between surface owners and energy companies as industry infrastructure, such as roadways and pipelines, are being built to accommodate the production of minerals. Questions about the relative legal rights and obligations of mineral developers and surface owners have escalated. Extension agents conducted three workshops in western North Dakota to answer questions about mineral leasing, mineral development, and the need for land on which mineral developers build and operate necessary infrastructure. The workshops couldn't address all of the questions or resolve the problems, but they did increase awareness for participants and Extension agents about the growing impacts of mineral development. Extension agents focused on helping individuals address needs but relied on state government leaders to address regulatory strategies. The need for additional information for surface owners continues to be emphasized by landowners, Extension educators, members of the legal profession, and other interested persons and organizations. One small piece to the overall puzzle will be developing a checklist of topics for surface owners to consider when interacting with mineral developers.

The Bio-Industry Summit

In North Dakota, there was an expressed need to explore trends and activities shaping global demand for products and technologies derived from biological and agricultural sources. A committee of about 15 industry leaders was formed to assist with assessing the need for an educational event and to assist with identifying appropriate topics and speakers. A Summit was organized that focused on four Bio-Industries - Biotechnology, Bio-energy, Life Sciences and Bio-materials. The Summit illuminated the opportunities for the Bio-Industry, explored the innovative work being done at the university level and showcased bio-industry business successes. It also featured valuable opportunities for networking and explored how organic based technology can be an economic driver in the region. Just over 100 people from industry, organizations, agencies and university faculty and graduate students attended the summit. Participants rated the eventual benefit or value of the summit 7.8 on a scale of 1-9 with 9 being great and 1 being little. Participants also related that 87% gained new knowledge, 74% developed new contacts within the bio-energy field and 42% engaged in discussions of business and research collaboration.

Food Safety

Small Meat and Food Processor Support

Increased government oversight of food processors, especially the upcoming implementation of the Food Safety Modernization Act (FSMA), has resulted in an increased need for technical assistance in Hazards Analysis Critical Control Point Systems (HACCP) and food safety plans. Many customers of North Dakota meat and food processors now require written documentation of food safety practices. The implementation of food safety plans has become a cost of doing business in the food industry. NDSU Extension is providing support and training for small meat and food processors, including HACCP courses, and answering calls and emails about regulations and HACCP deviations. In addition, assistance with the development of food safety plans, updating HACCP plans to meet changes in regulation, and conducting mock audits of HACCP and food safety plans has been initiated. The implementation of food safety plans has ensured continued access to markets for small food and meat processors located in North Dakota. By utilizing Extension, an estimated \$100,000 in meat product was saved by providing opinions and evidence of product safety for 14 different meat processing plants in North Dakota. Moreover, over 50 contacts were made with small meat and food processors about upcoming regulations and changes in regulatory interpretation of food handling rules. Two HACCP courses were conducted to train 30 processors in HACCP and food safety procedures. Five mock audits were conducted providing feedback for the improvement of food safety plans. Small meat food processors indicate that the training and support are essential to continuing operations and interest is growing.

Animal Steroids' Don't Affect Human Puberty

Ever wonder if the meat from cattle that received growth-promoting steroidal implants influences the onset of puberty in young girls? Research that NDSU Animal Sciences Department conducted suggests it does not. Pre-pubertal female swine were used as a biomedical model for human girls. Pigs are simple-stomached omnivores like humans. Pigs digest food similar to humans, and the consumed food influences hormone release in pigs as it does in humans. Pigs are the ideal model to study how food affects health and well-being. Pigs were selected at weaning that all were born on the same day and had the same sire genetics. Pigs were housed in the same facility but separate pens and received a similar grain-based diet low in estrogenic properties. The pigs were divided into four feed groups. Group one ate the base diet, group two was fed a quarter-pound of cooked "natural" hamburger and group three received a quarter-pound hamburger from steers that had received growth-promoting steroidal implants twice while in the feedlot. Group four received a quarter-pound cooked tofu (meat alternative) burger. The beef burger treatments then were compared with the meat-alternative tofu burger that also was fed every day. The burgers were fed until each gilt reached puberty. The estrogenic content of the burgers was lowest in the "natural" beef, while it was three times higher in the "implanted" beef. Maxing out at the top was the tofu; its estrogen content was 572 times higher than in the natural burger. Despite the large difference in estrogenicity, none of the treatments significantly influenced the onset of puberty.

Child Obesity

Garden Project Sharpens Science Skills and Improves Diets of Youth

Strong science skills are needed to help North Dakota's children compete in the global marketplace. The science skills of North Dakota children rank high in the USA, but the National Assessment of Educational Progress reports that 56 percent of eighth-graders in our state lack proficiency in science. A group of 260 children in 30 counties were recruited to evaluate 176 promising varieties of plants in their gardens. Each of these children worked with a parent or guardian to compare two varieties of a particular vegetable, herb or flower of their choice. The children documented which of the two varieties was healthier, produced the first harvest, produced more yield and had superior product quality (taste or floral appearance). Two hundred twenty-five children (87 percent) successfully conducted trials and submitted reports. This data

was analyzed to identify superior vegetable, herb and flower varieties for North Dakota gardens. Results are published online and were presented to over 1,000 gardeners in 2014. This information has significant economic worth as the value of vegetables grown in North Dakota gardens is estimated at \$56 million. A survey of parents revealed significant impacts of the program:

- Ninety-five percent of parents reported their children's nutrition improved due to participation in the project.
- Seventy-eight percent of parents reported increased levels of physical activity for their children.
- Ninety-five percent of parents reported improved science skills in their children.

SNAP-Ed and EFNEP Support Nutrition Decisions of Families in Need

Although North Dakota has one of the lowest poverty rates nationally, seven counties in North Dakota are in persistent poverty and one in twelve North Dakotans struggle with hunger. North Dakota households with children are twice as likely to be food insecure. Poverty and food insecurity are strongly correlated with negative health outcomes, including obesity and chronic diseases like diabetes and heart disease. Efforts are needed to help struggling families in North Dakota. In North Dakota, the Family Nutrition Program (FNP), and the Expanded Food and Nutrition Education Program (EFNEP) serve low-income families and children to increase the likelihood that they will make healthful food choices and choose physically active lifestyles. These programs encourage more fruits and vegetables, whole grains, low fat dairy and balancing a healthy diet with physical activity. EFNEP and FNP also teach important food skills, including meal planning and basic cooking, to help learners stretch limited food dollars in healthful ways. FNP reaches North Dakotans that are receiving or eligible for Supplemental Nutrition Assistance Program (SNAP) benefits by providing federally-funded SNAP Education (SNAP-Ed). In 2014, FNP provided classes to 11,147 participants, including 5,591 youth, and reached over 65,000 North Dakotans with events like health fairs and grocery store demonstrations. EFNEP focuses on families with children in the household and school-aged children. In 2014, 126 adults graduated from EFNEP and reported improvements in nutrition, food safety, and food resource management practices. North Dakota EFNEP participated in a multi-state cost-benefit study that found that every \$1 spent on EFNEP provides a return of \$8.82 in benefits, including health care savings. Evaluation shows many benefits from FNP and EFNEP programming. After classes, 88 percent of youth eat more fruits and vegetables, 75 percent choose milk over soda, and 89 percent are more physically active. After adult programming, over 70 percent of adults adopted at least one habit to spend their food dollars more wisely.

Citizen and Leadership Development

Strengthening Rural Communities through Extension's Marketing Hometown America

Working with Nebraska and South Dakota Extension colleagues, NDSU Extension Service personnel developed and pilot-tested a program to help small rural communities attract new residents while maintaining their identity and unique characteristics that make them a place people want to call home. Two communities, Ellendale and Edmore, tested the effectiveness of the materials taking similar, yet different paths. The materials were built on some earlier multi-state work that examined factors that made a community appealing to long-term residents, those just moving in and those who were considering making such a move. Residents participated in work groups to understand and identify community assets. By having a mixture of people in the room, individuals better understood how some things appeal to one group or another. Communication was increased and improved. A common response in evaluations was how often people were surprised about how many positive assets a community had. With this better awareness, participants indicated that they would speak differently of their community as a way to market it to family, friends and passersby.

4-H Prepares Youth for Future

For more than 100 years, 4-H has played a key role in preparing youth to meet the challenges of tomorrow. As the state's largest research-based youth development program, 4-H is available to all youth ages 5 to 18 in every county in North Dakota. More than 30,000 youth participated in 4-H programs in the 2013-14 year in North Dakota. Youth participate through clubs, camping, special-interest groups, after-school programs and school-day enrichment experiences. 4-H also relies on the support of a remarkable number of dedicated adult volunteers and community members. To address increased demand for science, engineering and technology professionals, 4-H is working to reach more young people in science programs, ultimately anticipating this will lead to more youth being interested in science-related careers. Currently, North Dakota 4-H science programs reach more than 5,500 youth with hands-on learning experiences to prepare the next generation of science, engineering and technology leaders. 4-H's approach is to use inquiry-based learning to provide constructive learning through hands-on experience that help youth provide solutions to real world problems. Programs being conducted in this area include an aerospace event, GEAR-Tech-21 camp, robotics event, film festival and 4-H National Youth Science Day. Evaluations from the Maps & Apps 4-H National Youth Science Day experiment, related to geospatial science, indicated that over 73 percent of the youth participating in this experiment made them more interested in science and over 83 percent indicated that this experiment helped them learn how to use science to solve problems.

Total Actual Amount of professional FTEs/SYs for this State

| Year: 2014 | Extension | | Research | |
|------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 53.0 | 0.0 | 71.0 | 0.0 |
| Actual | 60.4 | 0.0 | 85.9 | 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
- Expert Peer Review

2. Brief Explanation

Research programs were subjected to four different types of scientific peer review. These reviews occur prior to, during and at the conclusion of each research project. First, research faculty who participate in multistate research projects receive a critical review of their contributing project from fellow committee members, the administrative adviser and the North Central Multi-State Research Committee. Second, most faculty augment their multistate research funding with competitive grants. These grants are awarded on the basis of scientific merit and afford an opportunity for external peer review. Third, each research faculty member with the ND AES is required to have a station project that is reviewed for scientific merit by a Project Review Committee that is comprised of one faculty member from each discipline. Finally, all research is peer reviewed, either internally or externally, prior to publication.

Extension program leaders in agriculture and natural resources, family and consumer science, 4-H and youth development, and community resource development from the North Central Region meet twice a year to evaluate program needs and develop plans of work for the whole region. Ongoing efforts are made to update North Central regional logic models and develop and collect multistate impact indicators. State Extension specialists frequently submit grant proposals to regional and federal agencies and commodity groups to fund applied-research and Extension program activities. These proposals are externally reviewed prior to selection for funding. Extension bulletins are internally peer reviewed prior to publication.

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
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Other (Input from State Board of Agricultural Research and Education)

Brief explanation.

Building linkages with the public enables us to discover information about community/county/district/state assets and needs. Various methods for stakeholder input are utilized on an on-going basis. Advisory and commodity boards are used annually to identify issues and refine research and Extension programs. Examples include county extension advisory boards, Sustainable Agriculture Research and Education (SARE) advisory board, nutrient management advisory board, soil health advisory board, sugar beet research and Extension board, research extension center (REC) advisory boards, and the State Board of Agricultural Research and Education (SBARE). Input from stakeholders, the general public and from targeted audiences is used to develop our five-year plan of work and to make adjustments to the plan based on crisis situations that may develop in the state, e.g. drought, flood, insect infestations, plant diseases, high-risk issues of youth, bioenergy economics, animal welfare issues. Using several methods and several venues to collect data ensure that high priority issues are identified, people that have self-interest in the issue are brought to the planning meetings, and the appropriate research project or educational program and design is developed to address the issue using a variety of delivery methods.

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
- Use Surveys

Brief explanation.

The State Board of Agricultural Research and Education (SBARE) is charged by the state legislature to determine the causes of any adverse economic impacts on crops and livestock produced in this state; develop ongoing strategies for the provision of research solutions to negate adverse economic impacts on crops and livestock produced in this state; develop ongoing strategies for the dissemination of research information through the NDSU ES; annually evaluating the results of research and extension activities and expenditures; and report the findings to the North Dakota Legislative Council and the State Board of Higher Education. SBARE actively solicits input from all sectors of agricultural interests (i.e. different commodity and livestock groups) and meets throughout the state to gather input.

County commissioners actively participate in county extension program reviews with extension district directors. The county extension budgeting process also results in strong engagement from county government. Local needs are also identified through input from crop and livestock improvement boards, soil conservation districts, 4-H councils, and area focus groups. End of program surveys are used at most county and state extension programs to identify emerging clientele needs.

In 1992, the North Dakota Department of Human Services and NDSU ES were legislated by the North Dakota state legislature to form a statewide Family Life Education Committee. The committee is composed of state legislators, an Extension specialist, an Extension Human Development Agent, citizens with a parenting self-interest, two administrators from the Child Division of the State Department of Human Services and the Extension Assistant Director, Nutrition, Youth and Family Science. As a result of this partnership, the state Department of Human Services provides funding opportunities to six state family life education centers through a request for proposal process. The availability of designated funds also directs the focus of the parenting education programs provided through the six family life education center coordinators. The six family life education coordinators provide evaluation feedback to the Family Life Education Committee of the state Department of Human Services on program impacts. These impacts are then shared with state legislators.

The ND Department of Health, under the direction of the Governor of North Dakota, formed an alliance of organizations in ND that provide significant support and leadership for health-related initiatives. NDSU Extension is represented on this coalition. Networking among these professionals is invaluable, in addition to the legislative work.

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

Brief explanation.

The process of collecting stakeholder input was described above in III, 2(A),1 along with the process in identifying stakeholder groups and individuals.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

The State Board for Agricultural Research and Education (SBARE) is charged with developing ongoing strategies for the dissemination of research information through the ES; annually evaluating the results of research and Extension activities, recommending faculty and support positions and areas for program expenditures; and reporting the findings to the North Dakota Legislative Council and the State Board of Higher Education. Their findings directly affect the research and Extension budgeting process. The SBARE priority research and Extension needs can be found at: <http://www.ag.ndsu.edu/sbare/>

Commodity councils and research-education boards guide research and Extension program priorities and activities through their call for proposals, proposal review sessions, and grant funding. The staff from the seven Research Extension Centers (RECs) uses the input from winter meetings with their advisory boards to set program direction for research projects and Extension programs at their centers.

During county staff evaluations each year, program input is gathered from commissioners who take part in the staff evaluations. This arrangement helps assure that extension programs are grass roots driven and are focused on local issues and needs. County commissioner input is also critical in determining the staffing level and emphasis within county Extension offices as 50 percent of the Extension agent's salary is paid by the county.

The statewide Family Life Education Committee, composed of state legislators, an Extension specialist, an Extension Human Development Agent, citizens with a parenting self-interest, two administrators from the Child Division of the State Department of Human Services and the Extension Assistant Director, Nutrition, Youth and Family Science determine the availability of designated funds which direct the focus of the parenting education programs provided through the six family life education center coordinators. The six family life education coordinators provide evaluation feedback to the Family Life Education Committee of the state Department of Human Services on program impacts. These impacts are then shared with state legislators which in turn affect budgeting.

Stakeholders are frequently important contributors on the search committees of Extension state specialists and county commissioners are partners in the search committees and interview process of county staff. A SBARE member or another stakeholder is often a representative on faculty position searches.

Brief Explanation of what you learned from your Stakeholders

Our stakeholders are very supportive of the ND AES, NDSU ES and their activities and efforts. It is very important that Federal capacity be maintained to ensure NDSU's continued success. The ND AES and NDSU ES enhance the lives of the citizens of ND.

IV. Expenditure Summary

| 1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS) | | | |
|--|-----------------------|-----------------|--------------------|
| Extension | | Research | |
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 3414433 | 0 | 3013801 | 0 |

| 2. Totaled Actual dollars from Planned Programs Inputs | | | | |
|---|--------------------------------|-----------------------|-----------------|--------------------|
| | Extension | | Research | |
| | Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| Actual Formula | 1591442 | 0 | 2371339 | 0 |
| Actual Matching | 1591442 | 0 | 2371339 | 0 |
| Actual All Other | 2011735 | 0 | 5707910 | 0 |
| Total Actual Expended | 5194619 | 0 | 10450588 | 0 |

| 3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous | | | | |
|--|---------|---|---|---|
| Carryover | 1591442 | 0 | 0 | 0 |

V. Planned Program Table of Content

| S. No. | PROGRAM NAME |
|--------|--|
| 1 | Global Food Security and Hunger |
| 2 | Climate Change |
| 3 | Sustainable Energy |
| 4 | Food Safety |
| 5 | Childhood Obesity |
| 6 | Citizenship and Leadership Development |

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|---|-----------------|-----------------|----------------|----------------|
| 121 | Management of Range Resources | 15% | | 5% | |
| 202 | Plant Genetic Resources | 5% | | 15% | |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants | 5% | | 5% | |
| 204 | Plant Product Quality and Utility (Preharvest) | 5% | | 10% | |
| 205 | Plant Management Systems | 20% | | 10% | |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants | 15% | | 10% | |
| 212 | Diseases and Nematodes Affecting Plants | 15% | | 15% | |
| 301 | Reproductive Performance of Animals | 5% | | 10% | |
| 302 | Nutrient Utilization in Animals | 5% | | 5% | |
| 305 | Animal Physiological Processes | 5% | | 10% | |
| 702 | Requirements and Function of Nutrients and Other Food Components | 5% | | 5% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 12.0 | 0.0 | 37.0 | 0.0 |
| Actual Paid | 18.2 | 0.0 | 46.8 | 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 |
| 546496 | 0 | 1372371 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 546496 | 0 | 1372371 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 486801 | 0 | 3270054 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Meet with stakeholder groups to gather input and refine program directions.
 Develop improved crop cultivars acceptable to growers and those who use and process the grain.
 Conduct research on alternative grazing and feeding systems.
 Conduct research on the effect of maternal treatments on the productivity of offspring.
 Present crop and livestock research results at field days and grower meetings, popular press, radio and TV spots, web sites, and educational classes and workshops to foster producer adoption.
 Evaluate the effectiveness and impact of the extension programming.

2. Brief description of the target audience

Grain and livestock producers, crop consultants, nutritionists and feed personnel, veterinarians, extension personnel, commodity groups, crop improvement associations, and grain processors.

3. How was eXtension used?

We provided eXtension expertise advice to the clients who had questions related to grazing and feed lot management.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 2088 | 93500 | 995 | 8450 |

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

Patent Applications Submitted

Year: 2014
 Actual: 2

Patents listed

Jopa durum wheat

Rosie dry edible beans

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|------------------|-----------------|--------------|
| Actual | 12 | 42 | 54 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|---|
| 1 | Percentage of seeded acres in ND that are grown with new NDSU developed crop varieties with improved disease resistance and the ability to produce a high quality crop under both favorable and marginal growing conditions. |
| 2 | Increased percentage of livestock producers that utilized NDSU developed cover crop mixtures as forage to improve livestock production per land area, reduce costs to feed an animal, and ability to produce a high quality forage crop for livestock grazing under both favorable and marginal growing conditions. |

Outcome #1

1. Outcome Measures

Percentage of seeded acres in ND that are grown with new NDSU developed crop varieties with improved disease resistance and the ability to produce a high quality crop under both favorable and marginal growing conditions.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 27 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Crop producers, crop consultants, nutritionists, commodity groups, Extension personnel, Crop Improvement Associations, food processors, millers, bakers and consumers world wide depend on ND to supply high value crops such as durum wheat for pasta, hard red spring wheat for high protein flour, peas for noodles and other crops developed to meet the increasing demand for nutritious food.

What has been done

NDSU has been key to the development of new and improved germplasm in 14 crops, including some with multiple market classes. This Improved germplasm has increased plant resistance to abiotic and biotic stresses. The improved germplasm also has improved end use quality that is desired by those who use and process the harvested seed

Results

As a result of these actions and commitment, approximately 27% of seeded acres in ND utilize crop varieties developed at NDSU. As evidence of NDSU's commitment to supplying new and improved varieties for ND, in 2014 NDSU released one dark red kidney dry bean, one light red kidney dry bean, and one red potato for use primarily in ND and surrounding states and Canadian provinces.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|-------------------------|
| 202 | Plant Genetic Resources |

| | |
|-----|---|
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |
| 204 | Plant Product Quality and Utility (Preharvest) |
| 205 | Plant Management Systems |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants |
| 212 | Diseases and Nematodes Affecting Plants |
| 702 | Requirements and Function of Nutrients and Other Food Components |

Outcome #2

1. Outcome Measures

Increased percentage of livestock producers that utilized NDSU developed cover crop mixtures as forage to improve livestock production per land area, reduce costs to feed an animal, and ability to produce a high quality forage crop for livestock grazing under both favorable and marginal growing conditions.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 22 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As land prices continue to escalate and a need to produce more food from the current land base, livestock producers and farmers are looking for ways to increase the amount of food produced from their limited land base without adding costs. As the world population continues to grow, creating cost effective farming and ranching management strategies are critical to produce more food from the same land base, or even shrinking land bases.

What has been done

A three year cover crop grazing trial studying economic efficiency and livestock performance using single and dual cropping systems for grain production followed by late-season grazing was conducted.

Also, a series of two day beef production workshops in four towns to cover the southwest region of North Dakota was conducted. The goal of the workshop is help producers incorporate new livestock management systems to increase efficiencies in raising cattle while creating environmentally beneficial grazing programs.

Results

The cover crop study showed heifers can be developed on a dual cropping system utilizing full use grazing; however, drylot heifers performed better in terms of average daily gain. The only cover crop grazing option that was economically viable was full use grazing (compared to take half/leave half). The full use grazing dual crop option was the best option compared to take half/leave half and drylot in one of three years. The full use single crop option (no commodity crop planted) was cost effective two of three years. The take half/leave half and non-use single and dual cropping systems were not cost effective in any of the three years. Drylot feeding of heifers was always cost effective.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|-------------------------------------|
| 121 | Management of Range Resources |
| 301 | Reproductive Performance of Animals |
| 302 | Nutrient Utilization in Animals |
| 305 | Animal Physiological Processes |

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations

Brief Explanation

Weather extremes occurred at times that had minimal impact on research and Extension programs. Locally wet conditions in the northeast and north central areas of the state increased preventive plant acres and the use of cover crops. 2014 was a good year in crop production, but commodity prices were low. 2014 was an excellent year for livestock production with record commodity prices. Public policy changes were minimal and government regulations were stable.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Livestock growers attending the beef day workshops in southwestern North Dakota increased their knowledge of range/grazing management from neutral knowledge to somewhat knowledgeable after attending the workshops. Over 33 percent of the beef day workshop attendees shared the information gained from the workshops with other people five months after the workshops, with 22 percent implementing change as a result of the workshops. Almost 39 percent implemented ideas learned from the workshop five months after the workshops. The most significant impact reported by participants centered around the topic "managing today's rangeland", with 61 percent of those surveyed incorporating what they learned into their operation. They incorporated new grazing systems that increased stocking density and improving grazing efficiency of the resource, increasing the economic return from each acre of rangeland.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

Reporting on this Program

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 | 10% | | 10% | |
| 103 | Management of Saline and Sodic Soils and Salinity | 15% | | 15% | |
| 205 | Plant Management Systems | 7% | | 7% | |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants | 8% | | 8% | |
| 212 | Diseases and Nematodes Affecting Plants | 15% | | 15% | |
| 213 | Weeds Affecting Plants | 15% | | 15% | |
| 216 | Integrated Pest Management Systems | 10% | | 10% | |
| 405 | Drainage and Irrigation Systems and Facilities | 20% | | 20% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 22.0 | 0.0 | 24.0 | 0.0 |
| Actual Paid | 22.1 | 0.0 | 28.1 | 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 |
| 556173 | 0 | 847198 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 556173 | 0 | 847198 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 790052 | 0 | 1424468 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

- 1) Establish best water management practices for wet and dry conditions in North Dakota
- 2) Produce systems to reclaim saline and sodic areas within farm fields
- 3) Calibrate fertilizer application under both lower and higher moisture environments
- 4) Adjust disease management for all the major crops due to increased rainfall and higher humidity or drought conditions
- 5) Survey and improve management recommendations for insect pests on the major crops
- 6) Adapt weed management strategies to changing cropping systems, including resistance management
- 7) Investigate agronomic systems that are adapted to the change in rainfall amounts and intensity and longer growing season
- 8) Translate scientific findings into practical producer applications and provide transformational education through workshops, field days and conferences, and resource materials

2. Brief description of the target audience

- 1) Crop producers in both North Dakota and adjacent states
- 2) Crop consultants and agricultural advisors
- 3) County Extension personnel
- 4) Agribusiness and agricultural finance personnel
- 5) Government agency staff

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 23954 | 128200 | 355 | 3500 |

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|--------|-----------|----------|-------|
| Actual | 35 | 21 | 56 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|--|
| 1 | Number of farmers adopting new practices to achieve highly productive crops in a changing environment. |
| 2 | Number of farmers adopting new practices to improve pest management in a changing environment. |
| 3 | Number of farmers adopting improved soil and water management practices in response to a changing environment. |

Outcome #1

1. Outcome Measures

Number of farmers adopting new practices to achieve highly productive crops in a changing environment.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 200 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Wind erosion of soil and increased soil salt and sodium levels left unchecked will ruin millions of acres of North Dakota land for future production.

What has been done

Extensive education at local and state levels have been aimed at increased awareness of wind erosion potential, and the use of several strategies to halt the spread of soil salt and decrease salt levels over time.

Results

The Soil Health Team has worked with several ND County Extension Agents to establish local demonstration plots that use various techniques for salt alleviation and control. Numerous events have been held with local growers at coffee shops, County offices, field days and larger state and regional programs to disseminate information gathered from the demonstration plots and research programs of the Soil Health Team.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 102 | Soil, Plant, Water, Nutrient Relationships |
| 103 | Management of Saline and Sodic Soils and Salinity |
| 405 | Drainage and Irrigation Systems and Facilities |

Outcome #2

1. Outcome Measures

Number of farmers adopting new practices to improve pest management in a changing environment.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 5500 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Overuse of glyphosate (Roundup) in resistant crops have caused glyphosate-resistant kochia, horseweed, ragweed, and waterhemp in North Dakota. The NDSU Extension recommendation to use foundation soil-applied herbicides to avoid and delay glyphosate resistant weeds has been mostly disregarded. Despite increase in glyphosate resistant weeds after 2008, grower behavior did not change. The 2012 ND Pesticide Use Survey show only 11% of corn acres and 4% of soybean acres received a soil-applied herbicide.

What has been done

Detailed information was added to the ND Weed Control Guide on effective weed management programs in Roundup Ready crops, yield loss from late herbicide applications, and strategies for effective weed management. An <AgDakota> list serve was created for Extension specialists to disseminate timely and critical crop production information. Approximately 400 agricultural professionals subscribe to the list serve. The <AgDakota> list serve is used to deliver important information, including dates of field days and Extension meetings, new product registrations, pest out-breaks, and response to issues that develop through the year. Over 360 participants in the 2014 Wild World of Weeds were polled regarding use and value of NDSU Extension information.

Results

- 86% use information in the ND Weed Control Guide for effective weed management.
- 66% use the information disseminated by NDSU Extension Specialists through the <agdakota> list serve.
- 96% have improved their weed management practices by using information provided by the NDSU Extension Service.
- 31% claim the NDSU Extension Service as their primary source of pest management information.

- 75% indicated they will use a central NDSU Extension Service recommendation to use soil-applied foundation herbicides in addition to post-applied glyphosate.
- 77% will use NDSU Extension Specialists recommendations to use herbicides with multiple modes of action in addition to glyphosate for effective weed management.
- 51% of workshop participants are willing to use the most distained NDSU Extension recommendation - to use hand-weeding to remove individual plants or small patches of herbicide resistant weeds to prevent increase in infestation across the entire field.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 205 | Plant Management Systems |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants |
| 212 | Diseases and Nematodes Affecting Plants |
| 213 | Weeds Affecting Plants |
| 216 | Integrated Pest Management Systems |

Outcome #3

1. Outcome Measures

Number of farmers adopting improved soil and water management practices in response to a changing environment.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 150 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Since 1993, and again during the spring of 2014, above average annual precipitation has created excess water on the landscape and this has impacted crop production significantly in North Dakota. Millions of acres could not be seeded in 2014 due to excess moisture during the spring planting season.

What has been done

During 2014 tile drainage information was presented at over 20 producer workshops throughout ND and MN Red River basin. Seminars were also given to several businesses and industries. NDSU Extension cooperated with SDSU Extension and the University of Minnesota Extension to organized three, 2-day tile drainage design workshops in each state.

Results

Tile drainage education was provided to over 1,700 persons in 2014. Each of the three tile design workshops was evaluated with an 'end of the course' survey. One of the questions we asked was "If you were to place a dollar value on the information you received (when you apply the knowledge you learned in your business and not the price you paid today) what would it be?" When the responses from participants were tallied, they indicated the perceived value was well over \$2M. In the spring of 2014, 600 extra copies of Extension bulletin AE1690 Frequently Asked Questions About Subsurface (Tile) Drainage were printed to satisfy the demand. Of producers attending design workshops, 150 indicated they would put in tile drainage systems in 2014, and more than 12 commercial tile ploughs are currently working in ND

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 102 | Soil, Plant, Water, Nutrient Relationships |
| 103 | Management of Saline and Sodic Soils and Salinity |
| 205 | Plant Management 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
- Public Policy changes
- Government Regulations

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations for numerous field days and meetings indicate that growers will begin adopting greater use of cover crops, better crop selection, better drainage and interception crops to reduce salinity in fields, and better adoption of Integrated Pest Management (IPM) systems. In the survey 45% of the participants indicated that they learned something new and useful and 48% indicated that they gained important insight and information for their farming operation.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy

Reporting on this Program

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 | 20% | | 20% | |
| 402 | Engineering Systems and Equipment | 10% | | 10% | |
| 404 | Instrumentation and Control Systems | 10% | | 10% | |
| 511 | New and Improved Non-Food Products and Processes | 20% | | 20% | |
| 512 | Quality Maintenance in Storing and Marketing Non-Food Products | 10% | | 10% | |
| 601 | Economics of Agricultural Production and Farm Management | 20% | | 20% | |
| 604 | Marketing and Distribution Practices | 10% | | 10% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 3.0 | 0.0 | 2.6 | 0.0 |
| Actual Paid | 2.2 | 0.0 | 4.8 | 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 |
| 85163 | 0 | 90585 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 85163 | 0 | 90585 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 58135 | 0 | 363751 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research on processing, densifying, storage, and transportation of energy beets and biomass.
- Conduct economic analyses of biomass sources for energy production.
- Assist growers in new producing regions with business organization, technology adoption, and market development, and formation of risk management strategies.
- Provide educational materials and programming on production, economics, and policy analysis to decision makers, growers, and industry personnel.

2. Brief description of the target audience

- Farmers
- Policy makers
- Biomass processors
- Equipment manufacturers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 526 | 10000 | 0 | 0 |

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

Patent Applications Submitted

Year: 2014
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|------------------|-----------------|--------------|
| Actual | 2 | 5 | 0 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|--|
| 1 | Number of growers and industry personnel who are aware of the potential opportunities of growing and processing energy beets or cellulosic biomass for industrial sugars or other biofuel feedstock. |

Outcome #1

1. Outcome Measures

Number of growers and industry personnel who are aware of the potential opportunities of growing and processing energy beets or cellulosic biomass for industrial sugars or other biofuel feedstock.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 125 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

High energy prices and environmental concerns have led to a search for low-cost, green alternatives to the wide range of fuels, chemicals, and materials currently made using petroleum. Among the best opportunities is producing biofuels and bioproducts from sugar. However, today's sugar growers and processors, be they in the United States, Brazil, or elsewhere, target food. Launching a new regional sugar sector that targets industrial uses requires a substantial research and development effort that considers agronomics, engineering, and economics

What has been done

Since 2008, NDSU Extension has educated potential growers and others about the economics of industrial beet production and processing as well as beet agronomics, post-harvest logistics, and process engineering. In 2014, economics-focused activities included the development and distribution of handouts on expected returns. Educational programs were held at five targeted locations for the first commercial-scale facility in North America. The target audience of these meetings were area growers. Discussions focused on the cost of production and agronomic considerations including rotations, soil health, and herbicide carryover.

Results

Understanding the economics of industrial beet production has allowed the diverse group of industrial beet stakeholders to advance more quickly than would have otherwise be the case. For example, having information on the cost of production and relative returns to crop has enabled farmers to evaluate their interest in growing the crop. This is critical given impacts of herbicide carryover on beet production and the availability of acres needed to support a new beet-ethanol refinery. Development efforts in North Dakota led by Green Vision Group and Heartland Renewable Energy are transitioning from research to commercialization. Industrial beet production and processing is expected to begin in 2017.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 205 | Plant Management Systems |
| 402 | Engineering Systems and Equipment |
| 404 | Instrumentation and Control Systems |
| 511 | New and Improved Non-Food Products and Processes |
| 512 | Quality Maintenance in Storing and Marketing Non-Food Products |
| 601 | Economics of Agricultural Production and Farm Management |
| 604 | Marketing and Distribution Practices |

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Government Regulations
- Other (Oil boom in western ND)

Brief Explanation

With the oil boom associated with the Bakken formation in western ND, interest in energy beets has decreased slightly. However, towards the end of 2014 the price of crude oil had dropped precipitously worldwide, and interest in energy beets is again growing.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Growers attending energy beet educational meetings were encouraged to provide feedback via a post meeting evaluation. All growers who returned evaluations stated that the energy beet economic profitability information was easy to understand and they were satisfied or very satisfied with the quality of the presentation. Of evaluations returned, 96% indicated they were satisfied or very satisfied with the subject matter knowledge of the specialist and the quality of the program. It should be noted that due to a tragic loss of a key faculty member in 2013 resulted in a delayed comprehensive energy beet program in 2014, therefore a more comprehensive evaluation component was not completed.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Food Safety

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|---|-----------------|-----------------|----------------|----------------|
| 504 | Home and Commercial Food Service | 50% | | 50% | |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins | 50% | | 50% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 1.8 | 0.0 | 6.0 | 0.0 |
| Actual Paid | 2.3 | 0.0 | 5.6 | 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 |
| 0 | 0 | 54856 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 54856 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 186738 | 0 | 553694 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Implement programs for children and adults based on Fight BAC, Thermy, Produce Safety and BAC Down campaigns; USDA food preservation rules; and implement food safety programs for foodservice and processors (HACCP).

2. Brief description of the target audience

- Children in school and youth program settings
- Teen food handlers in high school and community
- Adults in home settings
- Volunteer food handlers in community settings
- Professionals in foodservice and food processing environments

3. How was eXtension used?

eXtension was used as background/resource material in the creation and implementation of programs.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 1073 | 525000 | 3344 | 31560 |

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|-----------|----------|-------|
| Actual | 2 | 1 | 0 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|--|
| 1 | Number of teens reporting changes in food handling practices to reduce risk of foodborne illness outbreaks. |
| 2 | Number of adult participants in consumer food safety classes reporting intent to change one or more food handling behaviors. |

Outcome #1

1. Outcome Measures

Number of teens reporting changes in food handling practices to reduce risk of foodborne illness outbreaks.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 489 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to a 2002 U.S. Department of Labor report, 22% of employed 15- to 17-year olds work in eating and drinking establishments. According to the National Restaurant Association pocket fact book in 2004, one-third of all employed 15 to 17 year olds work in eating and drinking establishments.

What has been done

"Teens Serving Food Safely" is a statewide NDSU Extension Service food safety education effort designed to improve young food handlers' food safety knowledge and skills and decrease the risk of foodborne illness outbreaks associated with food service establishments. The "Teens" curriculum consists of five lessons based on the Fight BAC and Thermy national food safety campaign concepts, with pre/post and follow-up evaluation procedures. Youth benefit from the curriculum's experiential learning model, obtaining information and tools to share with their families.

Results

About 489 students participated in the multisession "Teens" program in the last year. According to the past year's results, on average, knowledge scores increased from 54% on the pre-test to 85% on the post-test. About 56% of participants had been involved in the preparation of food for the public, and 81% prepare food for themselves or others every week. On the one-month follow up survey, 67% were more careful about cleaning and sanitizing, 48% had shared their knowledge about food safety with others when preparing food and 38% have applied their knowledge when serving food for the public.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|-----------------------|
|----------------|-----------------------|

- 504 Home and Commercial Food Service
- 712 Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Number of adult participants in consumer food safety classes reporting intent to change one or more food handling behaviors.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 260 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Consumer food handling remains an issue of concern, and evaluations focused on outdoor grilling, a popular cooking method, and food preservation. Grilling is one of the healthier methods of preparing food; however, food safety issues, including quality issues and lack of thermometer use, have been cited as issues.

What has been done

A Barbeque Boot Camp program was initiated that brought together Extension, meat science, and faculty from the Department of Animal Science, along with Extension agriculture and family and consumer science agents from across North Dakota. In 2014, the boot camps were held in three locations in North Dakota and reached 220 participants.

A Food Safety Modernization Act (FSMA) workshop that brought together state and local regulators, faculty and businesses attracted about 40 participants. Food entrepreneurship modules were updated and placed online (www.ag.ndsu.edu/food)

Results

The BBQ Boot Camp has reached about 4,400 people during the past five years. Previous post-test scores showed that participants significantly increased their knowledge and indicated they would change their behavior. Follow-up surveys have shown that 83% used the thermometer they received and 58% had changed their meat purchasing decisions after attending the program.

Among the participants in the introductory FSMA workshop, 81 percent said the regulations would

directly affect their businesses, 44 percent said the rule for good manufacturing practice and hazard analysis would affect their businesses, and 37 percent said the standards for growing, harvesting, packing, holding would affect their business. About 56 percent said they knew how to write a food safety plan, and 52 percent had done things to address the FSMA guidelines. Their greatest concern in implementing the guidelines was lack of understanding of the guidelines (59 percent) and record-keeping requirements (32 percent). About 40 percent indicated interest in an online course related to HACCP.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 504 | Home and Commercial Food Service |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins |

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes
- Government Regulations
- Competing Public priorities

Brief Explanation

As new rules and regulations are passed, changes are made to our programs content and delivery.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

We will continue to collect data on our Teens Serving Food Safely program, which was recognized with a national food safety education award. We plan to implement and evaluate a new Extension program for agents to deliver grilling program. We also will monitor the use of the online modules for the food entrepreneurship program. Since 2003, 9,233 North Dakota teens have been trained and received completion certificates based on the "Teens Serving Food Safely" curriculum. According to the past year's results, on average, knowledge scores increased from 54% on the pre-test to 85% on the post-test. Teenage food handlers continue to score very low (54%) on the initial examination. This age group, who commonly work in foodservice operations, are a group that needs ongoing training to prevent foodborne illness outbreaks in commercial settings.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Childhood Obesity

Reporting on this Program

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 | 45% | | 45% | |
| 724 | Healthy Lifestyle | 35% | | 35% | |
| 806 | Youth Development | 20% | | 20% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 4.0 | 0.0 | 1.5 | 0.0 |
| Actual Paid | 2.7 | 0.0 | 0.5 | 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 |
| 15741 | 0 | 2717 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 15741 | 0 | 2717 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 164654 | 0 | 73255 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

School-based curricula, including "On the Move to Better Health", "Banking on Strong Bones", and "Go Wild for Fruits and Vegetables" will continue to be used with children. Community-based programs for adults and children will continue.

2. Brief description of the target audience

Children and adults will be the target groups for the programming. They will be reached with both direct and indirect methods.

3. How was eXtension used?

eXtension is used as a resource for development and implementation of the programs.

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| Actual | 10515 | 535302 | 14720 | 32000 |

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

Patent Applications Submitted

Year: 2014
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|-----------|----------|-------|
| Actual | 5 | 1 | 6 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|--|
| 1 | Number of children participating in the youth education curricula that improved their diet quality and/or their physical activity level. |
| 2 | Number of adults participating in educational curricula that improved their knowledge and practices related to nutrition and/or physical activity. |

Outcome #1

1. Outcome Measures

Number of children participating in the youth education curricula that improved their diet quality and/or their physical activity level.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 1070 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Calcium is the nutrient most likely lacking in the American diet. According to the U.S. Department of Agriculture, 70 percent of preteen girls and 60 percent of preteen boys do not meet daily calcium recommendations. According to nutrition experts, this calcium shortage places the current generation at greater risk for osteoporosis, a condition known as "pediatric disease with geriatric consequences."

What has been done

Children in elementary classrooms and after school programs have been targeted with nutrition education programming. "Banking on Strong Bones" is a five-week, school-based educational intervention for fourth graders. The purpose is to increase knowledge and change behavior regarding an overall healthful diet, calcium-rich foods and weight-bearing activities. Based on "MyPlate" recommendations, the multi-week effort includes classroom nutrition lessons with participation incentives, supplementary activities and taste testing activities. Families receive newsletters designed to improve knowledge of nutrition and physical activity

Results

From 2005-14, the "Banking on Strong Bones" program has reached more than 11,500 children and their families. Students improved their knowledge scores and reported positive attitude and behavior changes toward consumption of dairy products. During the past year, 1,070 fourth graders participated in "Banking on Strong Bones." On the pre-survey, 21 percent reported drinking three servings of milk (or dairy) the previous day, compared to 39 percent on the post-survey. On the pre-survey, 13 percent reported drinking soda pop every day, compared to 10 percent on the post-survey. About 91 percent planned to drink more milk.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|----------------------------------|
| 703 | Nutrition Education and Behavior |
| 724 | Healthy Lifestyle |
| 806 | Youth Development |

Outcome #2

1. Outcome Measures

Number of adults participating in educational curricula that improved their knowledge and practices related to nutrition and/or physical activity.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 3280 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the 2011 Youth Risk Behavior Survey, 11 percent of North Dakota's high school students were obese. Less than 20 percent of North Dakota's children (especially low-income children) eat the recommended levels of fruits and vegetables. Motivating children to try fruits and vegetables and then regularly eat fruits and vegetables is a challenge. Behavior change is more likely to occur if children and their families are engaged in role modeling and tracking of their behavior.

What has been done

"On the Move to Better Health" is a five-week school-based curriculum for fifth graders and their families, which aims to increase fruits, vegetables and calcium-rich foods in the diets of children, as well as increase physical activity. The "On the Move" program was adapted for use in a 4-H camp setting, where children tracked their health behaviors during the 3-to 5-day camps and participated in educational programs and activities.

Results

About 40 percent of the 3,280 children/families participating in "On the Move to Better Health" set a weekly goal, 37 percent of participating parents indicated that their family's fruit consumption had increased, 30 percent reported their family's vegetable consumption had increased, and 14

percent reported their family's whole-grain consumption had increased. According to post-surveys with 4th and 5th graders, about 49 percent reported increasing the amount of fruits and vegetables they consumed, 55 percent reported drinking more milk, 61 percent reported drinking less soda pop, 61 percent drank more water, 56 percent chose healthier snacks, and 54 percent increased their amount of daily physical activity. Of the 332 children who participated in the 4-H Healthy Camp Challenge, 49 percent ate more fruit, 36 percent ate more vegetables, 43 percent drank more water, 59 percent got more exercise, 36 percent brushed their teeth more often, 44 percent wore more sunscreen and 89 percent planned to practice these healthy behaviors more often.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|----------------------------------|
| 703 | Nutrition Education and Behavior |
| 724 | Healthy Lifestyle |
| 806 | Youth Development |

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

North Dakota has had changes in population due to the oil boom as well as immigration of new cultures. Reaching busy parents/caregivers directly continues to be a challenge, so we are exploring new technologies to reach audiences of all ages

V(I). Planned Program (Evaluation Studies)

Evaluation Results

About 40 percent of families participating in "On the Move to Better Health" set a weekly goal, 37 percent of participating parents indicated that their family's fruit consumption had increased, 30 percent reported their family's vegetable consumption had increased, and 14 percent reported their family's whole-grain consumption had increased. According to post-surveys with more than 2,800 4th and 5th graders in the five-week "On the Move to Better Health" program, about 49 percent reported increasing the amount of fruits and vegetables they consumed, 55 percent reported drinking more milk, 61 percent reported drinking less soda pop, 61 percent drank more water, 56 percent chose healthier snacks, and 54 percent increased their amount of daily physical activity.

To continue to thrive and reach new audiences, nutrition educators need to be on the cutting edge of technology use to complement their traditional educational programming, and reach younger audiences and those in rural, isolated areas.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Citizenship and Leadership Development

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|--|-----------------|-----------------|----------------|----------------|
| 803 | Sociological and Technological Change Affecting Individuals, Families, and Communities | 25% | | 25% | |
| 806 | Youth Development | 75% | | 75% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2014 | Extension | | Research | |
|-------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 10.0 | 0.0 | 0.0 | 0.0 |
| Actual Paid | 12.8 | 0.0 | 0.2 | 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 |
| 387869 | 0 | 3612 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 387869 | 0 | 3612 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 325355 | 0 | 22688 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Multiple programs are offered by Extension to enhance civic engagement and leadership skills as well as develop a well-informed, skilled cadre of leaders who create thriving communities. In 2014, these programs included leadership training for local officials, leadership development through marketing hometowns, Rural Leadership North Dakota, and the Rural Leadership Short Course. These programs focus on skill development and strengthening; preparing participants to work with an issue they are passionate about; development of a support network of people; and improving the quality of life for the participant, organization(s), and community.

Youth will gain citizenship and leadership skills through 4-H club and summer camp programs. A citizenship event will be held at the state capital and youth participation is planned. Youth will participate in national 4-H events. Parliamentary procedure and leadership resources will be provided to youth groups.

2. Brief description of the target audience

Rural Leadership North Dakota targets emerging agricultural and rural leaders from across the state. Individuals chosen to participate have a desire to strengthen their community and the state of North Dakota for the future. Other leadership development programs in 2014 targeted elected officials and new residents in communities.

The 4-H Youth Development program includes opportunities for youth to become involved in their community, build personal skills, and develop positive attitudes about their behaviors, their community, and place in the community. Youth will develop awareness through participation in state and national citizenship events. Leadership is developed through club and other group activities.

3. How was eXtension used?

eXtension was not used in this program in 2014

V(E). Planned Program (Outputs)

1. Standard output measures

| 2014 | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|---------------------------|-----------------------------|--------------------------|----------------------------|
| Actual | 225770 | 106200 | 30643 | 50000 |

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2014 | Extension | Research | Total |
|---------------|------------------|-----------------|--------------|
| Actual | 7 | 0 | 7 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|---|
| 1 | Number of 4-H youth contributing hours in service to others in their community. |
| 2 | Number of 4-H club members who show improved leadership skills. |
| 3 | Number of jobs created or retained as a consequence of small business entrepreneurial education. |
| 4 | Number of participants reporting new leadership roles and opportunities undertaken by leadership training participants. |
| 5 | Number of youth participating in the 2014 National Youth Science Day indicating an increased interest in science. |

Outcome #1

1. Outcome Measures

Number of 4-H youth contributing hours in service to others in their community.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2014 | 400 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

North Dakota is not immune to poverty and food insecurity issues. A report published by the Center for Rural Affairs at Lyons, Nebraska, cites that rural poverty is a significant issue in many areas of the Plains states. In North Dakota, more than 54,000 people or 7.7% of the state's population, are considered to be food insecure. About 60% of North Dakotans fall below the SNAP (Supplemental Nutrition Assistance Program) and other nutrition programs' threshold of 200 percent poverty.

What has been done

The goal of the 2014 North Dakota 4-H Helping Hands Day was to provide North Dakota 4-H'ers the opportunity to do service in their local area focusing on one project topic during the same time frame as other North Dakota 4-H'ers across the state. Each district created its own opportunities, projects and schedule on the day(s) of its choosing. Districts were asked to report information for each project. Most participating counties chose to collect food donations for local food banks, local mission rescues, or community action locations.

Results

Reporting to an online reporting tool, ten counties, in three districts reported their impacts for Helping Hands Day 2014. More than 400 youth partnered with more than 130 adults and spent at least 700 combined hours serving their communities. In the Northwest district alone, more than 3,300 pounds of food was collected and returned to local communities. The economic value of this service opportunity of those reporting was estimated using North Dakota's value of volunteer time (\$23.92/hour for 2013) and amounted to more than \$16,000. This does not include the economic value of the goods donated.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|-------------------|
| 806 | Youth Development |

Outcome #2

1. Outcome Measures

Number of 4-H club members who show improved leadership skills.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of jobs created or retained as a consequence of small business entrepreneurial education.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of participants reporting new leadership roles and opportunities undertaken by leadership training participants.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 103 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

North Dakotans have been concerned with the shortage of leaders in communities and organizations across North Dakota, especially rural North Dakota.

What has been done

In 2003, the decision was made to create the Rural Leadership North Dakota (RLND) program. The first effort was the development of an 18-month program. In 2009, a short course was developed to provide North Dakotans, who were unable to participate in the longer event due to time constraints, the chance to learn about themselves, their communities and the state. These programs are offered regularly by NDSU Extension.

In 2014 a second major program building leaders involved marketing rural communities. Community members were trained to be local facilitators and program leaders of a study circles conversation to help engage volunteers and build leaders working to promote and market their communities.

Results

From 2003 to the end of 2014, 94 individuals from 57 communities have completed the 18-month RLND program. Eighty-four percent of these alumni are more involved in their community since their experience. Over \$4 million has been invested in the 90+ RLND projects, five businesses have been started, and 9 individuals have run for public office. Over 80% of alumni have taken leadership for various community projects and 20 of them have been asked to serve on boards and councils they had not served on before.

In 2014, seven short course programs were offered in 15 communities with 140 participants attending. Two of the participants have run for public office and several local projects have been accomplished

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 803 | Sociological and Technological Change Affecting Individuals, Families, and Communities |

Outcome #5

1. Outcome Measures

Number of youth participating in the 2014 National Youth Science Day indicating an increased interest in science.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 3572 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The United States faces a future of intense global competition with a startling shortage of scientists. In fact, only 18 percent of U.S. high school seniors are proficient in science (NAEP 2005) and a mere five percent of current U.S. college graduates earn science, engineering, or technology degrees compared to 66 percent in Japan and 59 percent in China.

What has been done

To address increased demand for science, engineering and technology professionals, 4-H is working to reach new young people in science programs ultimately anticipating this will lead to more youth being interested in a career in a science related field. Currently, North Dakota 4-H Science programs reach more than 5,500 youth with hands-on learning experiences to prepare the next generation of science, engineering, and technology leaders.

Results

A total of 3572 youth participated in the 2014 National 4-H Youth Science experiment, Rockets to the Rescue, related to geospatial science. Of these youth:

- Over 85% indicated that participating in this experiment made them more interested in science.
- Over 42% indicated that participating in this experiment helped them like science more.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 803 | Sociological and Technological Change Affecting Individuals, Families, and Communities |
| 806 | Youth Development |

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The above external factors may have had some influence on the program, its focus, and the projects the participants undertake. They also represent areas that leadership-based programs try to prepare participants to deal with after they have completed the program. The engagement of youth in 4-H clubs and their subsequent level of activity may be affected by the overall economy. Declining rural populations and number of farms may reduce the number of youth in 4-H.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Reporting to online reporting tool, ten counties, in three districts reported their impacts for Helping Hands Day 2014. More than 400 youth partnered with more than 130 adults and spent at least 700 combined hours serving their communities. In the Northwest district alone, more than 3,300 pounds of food was collected and returned to local communities. The economic value of this service opportunity of those reporting was estimated using North Dakota's value of volunteer time (\$23.92/hour for 2013) and amounted to more than \$16,000. This does not include the economic value of the goods donated.

A total of 3572 youth participated in the 2014 National 4-H Youth Science experiment, Rockets to the Rescue, related to geospatial science. Of these youth:

- Over 85% indicated that participating in this experiment made them more interested in science.
- Over 42% indicated that participating in this experiment helped them like science more.

Key Items of Evaluation

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

| | |
|---|--|
| Childhood Obesity (Outcome 1, Indicator 1.c) | |
| 0 | Number of children and youth who reported eating more of healthy foods. |
| Climate Change (Outcome 1, Indicator 4) | |
| 0 | Number of new crop varieties, animal breeds, and genotypes with climate adaptive traits. |
| Global Food Security and Hunger (Outcome 1, Indicator 4.a) | |
| 0 | Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources. |
| Global Food Security and Hunger (Outcome 2, Indicator 1) | |
| 0 | Number of new or improved innovations developed for food enterprises. |
| Food Safety (Outcome 1, Indicator 1) | |
| 0 | Number of viable technologies developed or modified for the detection and |
| Sustainable Energy (Outcome 3, Indicator 2) | |
| 0 | Number of farmers who adopted a dedicated bioenergy crop |
| Sustainable Energy (Outcome 3, Indicator 4) | |
| 0 | Tons of feedstocks delivered. |