2017 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 North Dakota State University 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 cropping systems, natural resources, livestock systems, economic and community vitality, 4-H youth development, and human development and education.

Cropping Systems

Education Helps Soybean Farmers Get It Right
From 2000 to 2017, the soybean acres harvested in North Dakota increased from 1.85 million to 7.1 million, with a record yield of 41.5 bushels per acre in 2016. Due to the increased interest in soybean production in North Dakota, especially in the western part of the state, the need to educate producers about all management aspects of growing soybeans is continuous. To meet this need, the NDSU Extension Service, in partnership with the North Dakota Soybean Council, created a series of meetings called "Getting it Right in Soybean Production." In 2017, five meetings were conducted at locations throughout the state. Extension specialists and agents presented research-based educational material to soybean growers on the topics of variety selection, soybean diseases, control of insects, intensive crop management and soybean economics. Participants at the 2017 meetings estimated the value of the knowledge they gained, if implemented on their farm, at $11.58 per acre. The 153 attending growers, collectively farming 116,000 soybean acres, estimated the total perceived value of the meeting series at $1.3 million. In addition to the soybean production meetings, a team of NDSU Extension agents and agronomists embarked on a three-year study, starting in 2015, aimed at generating baseline producer data on current soybean practices in North Dakota. Some additional data from 2014 also was included in the survey.
Although the survey is ongoing, preliminary data has determined:

- Growing soybeans after corn or wheat in eastern North Dakota resulted in up to 2.8 bushel per acre higher yields, compared with growing soybeans after soybeans.
- Chemical seed treatments resulted in higher yields from 2014 to 2016.
- Planting soybeans before mid-May, if conditions are favorable, may provide higher soybean yields.
- Seeding at 165,000 to 170,000 seeds per acre provided the highest yields from 2014 to 2016.

Research Impacting the Reputation of Wheat
Celiac disease is a serious autoimmune disorder that occurs when the ingestion of gluten leads to damage in the small intestine. It is estimated to affect one in 100 people worldwide. When people with celiac disease eat gluten, a protein found in wheat, rye and barley, their body mounts an immune response that attacks the small intestine. According to the Celiac Disease Foundation, a genetic predisposition to celiac must exist in individuals before the presence of gluten peptides triggers the immune response. However,

the simplified explanation that gluten causes celiac disease has hurt the reputation of wheat and foods containing wheat. Claims also have been made that modern wheat breeding practices have changed wheat protein chemistry, resulting in a higher concentration of immunogenic peptides in modern wheat, compared with historical wheat varieties, which contributes to increased incidences of celiac disease. A 2017, study conducted by NDSU scientists aimed to test the protein chemistry of 30 hard red spring wheat cultivars released in North Dakota in the last century to determine the presence of celiac disease-initiating peptides. The research found that 15 immunogenic peptides were present, but the presence of these peptides was not related to the release year of cultivars and the peptides appeared randomly. Researchers were able to conclude that modern hard red spring wheat varieties are not higher in terms of celiac disease immunogenicity, compared with historical varieties. Though not directly related to wheat production, behind the scenes this research is helping to keep hard red spring wheat profitable for North Dakota farmers. The work of the wheat-quality research program at NDSU is relevant to real people, farmers and consumers.

Precision Ag Research Helps Producers Make Profitable Decisions

Technology that allows producers to apply more fertilizer where it's needed in a field and less where it's not saves money. Automatic steering, automatic spray-rate controllers and high-tech row crop planting also have been very helpful in reducing equipment operator fatigue and improving accuracy. Today's high-tech agricultural equipment can provide producers with massive amounts of data, but many don't use the information to make farming decisions. ND AES researchers and NDSU ES specialists lead research to evaluate agricultural technology and demonstrate how producers can use it to make better decisions about their farming operation and increase their profit. For the past few years, the scientists have tested a variety of UAS-mounted sensors. The sensors can locate waterlogged parts of fields, for instance, or determine the extent of hail damage in an area. Specific precision ag research projects:

- Invasive and noxious weeds - Researchers use UAS imagery to monitor leafy spurge and purple loosestrife in ditches and on rangeland and other public and private land. This information is important to county weed control boards.
- Weed identification - UAS imagery detects troublesome weeds such as kochia, waterhemp and ragweed while they still are small (3 inches or less) so they can be treated before they get out of control.
- Herbicide injury - UAS imagery shows where damage occurred if herbicide isn't applied at the proper rates or it drifted outside the application area.
- Plant stand - Sensors provide data on a variety of issues, including when seeds germinate and the number of plants growing per acre, which helps producers decide whether they need to replant, or how much fertilizer to apply and where in the field to apply it.
- Herbicide resistance - Sensors on UAS flying over a field hours after a herbicide application can detect whether weeds are resistant to the chemical. Herbicide-sensitive weeds are about 5 degrees warmer than resistant weeds after a herbicide application because healthy plants have enough water in their cells to keep them cooler.

The scientists also are evaluating the usefulness of precision agriculture technology to detect volunteer soybeans coming up in dry edible bean fields early in the growing season so the soybeans can be eliminated, help producers determine how much nitrogen to apply in a field and identify the particular disease affecting a field. Additionally, NDSU continues to evaluate the huge amount of data collected in 2016 and 2017 during a collaboration with Elbit Systems of America. Elbit, an Israeli-based company, provided a UAS with a 35-foot wingspan for a project to study the usefulness of large-scale UAS in crop and livestock production. The goal is to make the data available to producers and others interested in using the information.

Research Supports Organic Agriculture

U.S. residents are buying more organic food and household products than ever according to the Organic Trade Association, the nation's leading organic industry group. In 2016, sales of organic food and goods

topped $47 billion, an increase of more than 8 percent from the previous year. General Mills Inc., one of the nation's top five organic ingredient purchasers in North America, is aiming to double the organic acreage from which it sources ingredients. The company expects to have 250,000 acres by 2019. In North Dakota, 114 certified organic farms utilize 116,305 acres of certified organic land. In response to the growing demand for organic production information, the Carrington REC (CREC) has been conducting research in certified organic environments for more than 17 growing seasons at the center and in the fields of participating farmers. Off-farm research sites have been near the North Dakota communities of Cathay, Robinson, Tappen, Dawson, Fessenden, Rugby and LaMoure. The CREC's certified organic land has been approved by the USDA for 10 years, with the last restricted product applied in the summer of 2004. In 2014, the center began converting an additional 12 acres to meet the needs of its expanded organic research program. The majority of the research conducted has been to provide organic crop and variety trial data for wheat, oats, barley, durum, flax, field peas, faba beans, dry beans, soybeans, cowpeas, emmer, einkorn, spelt, potatoes, buckwheat, cover crops and rye. Other areas of research have included trials related to various production practices or management, such as seeding rate and date, cover crop management, compost tea, no-till practices, and rotation trials using animal manures and cover crops. In 2014, the CREC joined a collaborative effort to develop an organic field pea variety. Pulse USA, a member-owned seed company specializing in pulse crops, and Blaine's Best Seeds, a certified organic seed grower, entered multiple experimental cultivars into the CREC organic field pea variety trials. Two other organizations also were involved in the project: the Northern Plains Sustainable Agriculture's Farm Breeding Club, whose members assist in the development of organic seed through research and education, and the Foundation for Agricultural and Rural Resources Management and Sustainability (FARRMS), a nonprofit educational organization that provided the funds for the variety testing. The ultimate goal of the project, once the evaluation of experimental cultivars is complete, will be to select the best lines adapted to an organic environment, then secure seed rights to grow and sell the seed exclusively to organic seed markets.

Natural Resources

Scientists Improve Soil Reclamation Success

When an oil or brine spill occurs, or pipeline installation disturbs cropland, one of the most important resources in the reclamation process is knowledge. That knowledge is what ND AES and NDSU ES scientists are providing through their research at sites such as oil and brine releases near Tioga and a water pipeline installation in a field at NDSU's Williston Research Extension Center (WREC). For the past two growing seasons, scientists have been planting test plots of spring wheat and field peas at the Tioga spill site using different soil mixtures. The scientists are looking at whether they can use thermally desorbed subsoil with or without native topsoil. Thermal desorption is used to remove the petroleum hydrocarbons from contaminated subsoil by heating the soil material to about 650 F. The resultant product is low in hydrocarbons and has been found to be safe to be used as growing media or fill. Not a lot of extra topsoil is available in western North Dakota, so the scientists are hoping to find the mixture of topsoil and thermally desorbed subsoil that will bring the oil spill-damaged land back to its prior productivity. Test results have been promising. Andeavor, the pipeline's owner, provided funding for the research. In addition, an NDSU ES specialist and ND AES researcher received a U.S. Department of Agriculture (USDA), National Institute for Food and Agriculture (NIFA), Agriculture and Food Research Initiative (AFRI), Critical Agricultural Research and Extension (CARE) grant for brine spill remediation. Their objective is to develop reclamation strategies to help landowners by returning disturbed land to its prior productivity and assist companies doing the reclamation. The oil industry is very supportive of the scientists' efforts.

Waterline Installation Leads to Research

When a 36-inch water pipeline was installed at the Williston REC in 2015, ND AES researchers and NDSU ES specialists saw it as an opportunity to do some much-needed research. Collaboratively, the scientists chose to evaluate five annual and two perennial cropping sequences using hard red spring wheat, durum,

field peas, barley, safflower, alfalfa and native perennial grass to represent the most traditional crops grown in western North Dakota, along with a full-season cover crop mix including turnips and radishes. The scientists are studying the impacts of these cropping sequences on soil health and crop performance on three disturbance areas: the pipeline trench, an area that had its topsoil stripped off and then was used as an access road during pipeline construction, and adjacent undisturbed land. In 2015 and 2016, annual crops yielded less in the road and pipeline areas. However, the alfalfa produced significantly more biomass over the pipeline than in the undisturbed and road areas. The scientists suspect alfalfa grew better over the pipeline because the soil may not be as compacted thereby allowing water to accumulate there, making it the last place to run out of water in drought conditions. Also, alfalfa's deep rooting may have allowed it to access otherwise unavailable moisture. Moisture-sensing equipment will be installed at the site to help determine how water is contributing to crop performance. The scientists also are studying other soil health and production improvement options, including one-time, 18-inch-deep tillage, called ripping, alone and with the application of manure to decrease compaction, jump-start beneficial organisms in the soil and increase organic matter.

Livestock Systems

Cattle Dietary Studies
Research at the Central Grasslands Research Extension Center (CGREC) found that supplementing cows with feed such as corn dried distillers grains with solubles will provide the animals with the extra nutrients they require. The scientists involved in this research also studied the impact of supplementing pregnant cows with alfalfa hay and a liquid supplement. Cows supplemented with alfalfa or liquid supplement lost weight and body condition, which might indicate that these supplements did not supply adequate energy to meet animal demands.
Research at the CREC found that corn can be fed to beef cattle in the backgrounding and finishing phases without having to process the corn, which is a money-saver for producers. Typically, when corn is included in cattle rations, particularly in backgrounding and finishing diets, it is processed by dry rolling, grinding or steam flaking. However, not everyone has the ability to process corn on the farm and it is an added cost.

Meat Palatability
Scientists in NDSU's Animal Sciences Department found that taking vitamin A out of growing and finishing diets for commercial Angus and purebred Simmental steers improved the meat quality of the Angus steers but not the Simmental steers. The Angus steers were an Angus-Simmental cross, with a minimum of 75 percent Angus genetics. Marbling is the fat that appears as white flecks in beef and improves the meat's tenderness, juiciness and flavor. The Angus-cross steers without vitamin A in their diets had a 16 percent increase in marbling, the research showed. That resulted in 26.6 percent of these steers grading higher for their meat than the steers that were fed vitamin A. Increasing marbling has the potential to add significant value to a beef carcass.

Beef and Human Health
NDSU scientists have found that eating red meat can be good for humans, provided that the meat is part of a balanced diet. Using pigs as a model for humans, researchers discovered that replacing sugar in the average American diet with nutrient-dense beef may alter body composition and reduce risk factors for obesity-related metabolic disorders. Scientists found that gilts fed ground beef developed less fat and more muscle mass than gilts receiving a ration suitable for swine based on the average American diet, called the total Western diet or TWD, and the growth of the pigs on the TWD was stunted. The gilts eating the ground beef also had a 1.65 times greater concentration of insulin-like growth factor I, an anabolic hormone that likely is driving the increase in muscle mass in the female swine fed ground beef. In another NDSU study that has implications for humans, piglets born to sows that didn't get exercise had considerably more fat between the muscle cells than piglets of sows that had regular exercise. In livestock species this type of fat as marbling, but when observed in human muscle, it is an indication of metabolic syndrome. Metabolic syndrome is a group of risk factors such as high blood pressure, high blood sugar,

unhealthy cholesterol levels and abdominal fat. This research provides sound dietary advice that will help medical providers when they give dietary advice and ultimately will result in increased domestic and foreign demand for U.S. beef.

Proactive on Animal Health

The veterinary feed directive (VFD) changes the way livestock producers buy certain antibiotics. Three years before it went into effect on January. 1, 2017, NDSU Extension specialists and agents began educating producers, veterinarians and livestock feed distributors about the federal regulation. It requires producers to obtain a written order from their veterinarian before buying antibiotics intended for use in or on animal feed. Agents and specialists spoke about the VFD at numerous meetings; created YouTube videos, a publication, brochure and handout; and provided information in news releases, columns and media interviews, and through social media. An Extension agent discovered just how far ahead NDSU Extension was on VFD training when they attended the 2017 National Cattlemen's Beef Association meeting in Nashville, Tenn. Beef quality assurance program directors told her that in many states, producers didn't receive any education until after the directive went into effect. As part of the VFD effort, Extension also educates producers and veterinary professionals on the proper use of antibiotics, including why they're needed, when and how they should be used, what antibiotics to use, the correct dose and how they're administered. Proper vaccine storage is another focus of Extension's animal health work. Temperature fluctuations and exposure to sunlight can reduce vaccines' effectiveness. After seeing a vaccine storage cooler that the Extension beef quality assurance specialist made, Fort Rice ranchers created one of their own by drilling holes in the sides of a small plastic foam cooler. They insert vaccine-filled syringes into the cooler through the holes to keep the vaccine at the proper temperature until it's needed. It's expensive if you don't vaccinate, it's expensive if you do vaccinate, it makes financial sense to do it right.

Economic, and Community Vitality

Leadership Development Benefits Rural N.D.

Finding enough people to serve on governmental and nonprofit organization boards can be challenging. North Dakota has more than 8,000 boards, councils and committees, which means one of every 24 residents 18-plus years old would need to serve in a leadership role. NDSU Extension developed Lead Local, a one-day program that teaches participants about ethics, parliamentary procedure and conflict resolution, to help people develop the skills and confidence to serve effectively. Board service especially can be an issue in rural areas. Nearly 240 people from 528 North Dakota organizations, 39 of them agriculture-related, have attended Lead Local. Many report that their boards save an hour of meeting time because their meetings run more efficiently now. If all 528 organizations saved an hour a month, that would be a yearly savings of $160,934 (based on Independent Sector's value of volunteer time). Rural Leadership North Dakota (RLND), Extension's 18-month leadership development program, also impacts rural North Dakota substantially: 32 percent of the participants were from the agriculture sector, and 19 have run for office. Three were elected to positions, including county commissioner. In addition, RLND participants have used their leadership skills to initiate projects such as:

- Events, activities and blogs to educate youth and adults about North Dakota agriculture
- Heifer exchange program for Dickinson State University's agriculture program and Ag Club students
- Farm and ranch agrotourism operations
- Calf feed-out program for Angus producers
- Agricultural internship program for Moldovan and Romanian students

4-H, Youth Development

STEM Projects Challenge Youth

Supplied with a small computer, sensor, batteries, wires and guide book, McLean County fifth- and sixth-graders spent about an hour working in groups to create wearable, functioning health monitors. They were among thousands of U.S. youth who receive hands-on experience in science, technology, engineering and math (STEM) through the 4-H National Youth Science Day experiment every October. The students tackle a different experiment each year. In the 2017, it was Incredible Wearables. The Incredible Wearable involved many wires being placed in correct slots on the device. The students found it was an enjoyable challenge. About 2,000 North Dakota students participate in the 4-H National Youth Science Day experiment annually in the classroom or through 4-H clubs.

Other STEM Opportunities Available Through 4-H
Aerospace Camp - During this one-day program, 10- to 15-year-olds learn the basics of aircraft structure, navigation and aerodynamics, and about aerospace careers.

Rube Goldberg - This new science contest will be offered at the 2018 State Fair. Youth will organize teams to create a Rube Goldberg machine, a complex machine that does a simple task.

Computer science - Ten Cass County youth leaders will lead computer science activities with New Americans in partnership with Lutheran Social Services and the Fargo Microsoft headquarters through a grant from Microsoft and the National 4-H Council.

Educational trunks - A grant from Google and the National 4-H Council funded two trunks with 10 virtual reality devices in each trunk and 30 Chrome Book computers for pilot computer science activities in North Dakota counties.

Girls in STEM - Webinars and other programming will engage girls in STEM in a co-ed environment through a National 4-H Council grant. The webinars will focus on being aware of biases, real and fake male and female differences, and mentoring youth in a STEM environment.

Human Development and Education

NDSU ES Family and Community Wellness agents and specialists enhance the lives of individuals, families and producers through educational experiences, and encourage leadership and service to the community. They work at the county level, at regional Parent and Family Resource Centers and on the main campus of NDSU.

Aging and Wellness
Powerful Tools for Caregivers - This program supports caregivers of spouses, partners, adult children, children with special needs, other family members, neighbors and friends. These caregivers provide a range of daily activities, such as transportation, personal care, managing finances and grocery shopping.

Stepping On - A program designed to assist older adults in reducing falls, exploring coping behaviors and learning safety strategies in everyday life. NDSU Extension partners with the North Dakota Department of Health to implement Stepping On. About 2.5 million older adults are treated annually for injuries stemming from falls. The subsequent direct medical costs, when adjusted for in inflation, were $34 billion. Falls are the No. 1 reason elderly people have to leave their homes.

Food and Nutrition
Diabetes Prevention Program - This community-based, lifestyle- change program offers diabetes prevention education and support for people with prediabetes and those at high risk for prediabetes. About 68,000 North Dakota adults have diabetes - 49,000 are diagnosed and 19,000 are undiagnosed - and more than 200,000 have prediabetes. Those with diabetes incur an average of $13,700 per year in medical costs, resulting in a total cost of $700 million in North Dakota.

Smarter Lunchrooms - A program that nudges kids to eat more healthfully at school. NDSU Extension's Smarter Lunchrooms technical assistance providers work to improve the environment and practices in schools to positively in influence healthful eating.

The Family Table - This online resource provides activities, handouts, newsletters and more to encourage family meals, which provide numerous bene ts to children and parents.

Food Preparation - Online materials assist in preparing healthful and safe food. Food preparation series include Cooking With Low Vision, Cooking 101, Garden to Table, Master Mixes, Pinchin' Pennies in the Kitchen, Vary Your Veggies, Focus on Fruits and Grilling.

Food Preservation - Online materials assist in preserving food safety. Food preservation publications include information on canning, drying, freezing, pickling, fermenting, working with wild game, meat and sh, equipment needed and how to store foods properly.

Food Safety - Online materials ensure food safety for all ages. Food safety publications include information on allergens, older adults, food service, disasters, and safety for pregnancy, infants and children. Each year, an estimated 48 million people become ill, 128,000 are hospitalized and 3,000 die from foodborne illnesses. Foodborne illness outbreaks cost $6.6 billion in the U.S. annually.

Children, Parents and Families
Parent and Family Resource Centers - Regional centers that provide research-based parent education to North Dakota parents. More than 14,300 reports of suspected child abuse and neglect were madein North Dakota in 2016. One dollar spent on early childhood programming saves $10 to $16 dollars in prisons, police, welfare and other services.

Basic Beginnings and Bright Beginnings - These programs focus on raising young children and key aspects of a child's growth and development. The programs explore a child'searly years through lessons on brain development, parent-child attachment, prenatal health, social development, children and play, good-quality child care, reading and other topics.

Gearing Up for Kindergarten - A program that assists parents and their children in preparing for the transition to kindergarten.

Nurturing Parenting Program - Family-based parent education programs to help families establish a nurturing way of life and develop healthier, stronger relationships.

Parents Forever - Education to Aid Families in Transition (Divorce Education) - an online program that explores the effects of divorce on children, managing stress in family transitions and maintaining respectful, healthy relationships.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	160.0	0.0	99.0	0.0
Actual	156.0	0.0	97.0	0.0

II. Merit Review Process

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

- Internal University Panel
- External University Panel
- Combined External and Internal University Panel
- 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 multi-state 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
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey 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. Of special note, an external review of NDSU ES was conducted in 2017 at the request of the SBARE and the ND legislature. Additional information about the review is contained in section III, 2(B), 3.

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), other community interests, 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 county advisory councils, 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 ES 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 RECs use the input from winter meetings with their advisory boards to set program direction for research projects and Extension programs at their centers.

SBARE conducted a comprehensive review of the NDSU ES, which included 30 recommendations to endorse existing practices or for improvements. The NDSU ES received the input and has begun to implement changes in response to the review. The review and progress in response can be found at https://www.ag.ndsu.edu/sbare/ndsu-extension-service-comprehensive-review

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
{No Data Entered}	{No Data Entered}	{No Data Entered}	{No Data Entered}

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	3438336	0	2408039	0
Actual Matching	3438336	0	2408039	0
Actual All Other	7203364	0	9137122	0
Total Actual Expended	14080036	0	13953200	0

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Cropping Systems

☑ 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	15%		5%	
103	Management of Saline and Sodic Soils and Salinity	5%		15%	
202	Plant Genetic Resources	5%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	5%		10%	
205	Plant Management Systems	20%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	15%		10%	
212	Pathogens and Nematodes Affecting Plants	15%		15%	
213	Weeds Affecting Plants	5%		10%	
216	Integrated Pest Management Systems	5%		10%	
405	Drainage and Irrigation Systems and Facilities	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	45.5	0.0	51.5	0.0
Actual Paid	43.7	0.0	47.0	0.0
Actual Volunteer	5.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1113223	0	1367775	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1113223	0	1367775	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1872192	0	3997128	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.
- Present crop 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

The targeted audience will include but not be limited to:

1. Crop producers in North Dakota and surrounding states
2. Crop consultants and agricultural advisors
3. Commodity groups
4. Crop improvement associations
5. Extension personnel
6. Agribusiness and agricultural finance personnel
7. Government agencies

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	321397	29362886	9183	296595

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

Patent Applications Submitted

Year:	2017
Actual:	0

Patents listed
None

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	48	57	105

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 acres of hard red spring wheat and number of acres of durum wheat grown in North Dakota are seeded with ND AES derived cultivars.
2	Number of farmers adopting new practices to achieve highly productive crops in a changing environment.
3	Number of farmers adopting new practices to improve pest management in a changing environment.

Outcome #1

1. Outcome Measures

Number of acres of hard red spring wheat and number of acres of durum wheat grown in North Dakota are seeded with ND AES derived cultivars.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	2400000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Crop producers, crop consultants, nutritionists, crop consultants, commodity groups, Extension personnel, Crop Improvement Associations, and end users are directly impacted by the number of acres planted with ND AES derived cultivars. NDAES derived cultivars are environmentally adapted to flourish in the upper great plains thereby increasing wheat production and enhance the economic sustainability of the region.

What has been done
Development of new and improved germplasm in 14 crops, including some with multiple market classes. Improved germplasm has improved 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
Released 7 crop cultivars: ND Crown chickpea, ND Grano durum wheat, ND Riveland durum wheat, ND17009GT soybean, ND Stutsman soybean, ND Wells soybean, and ND VitPro hard red spring wheat.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
211	Insects, Mites, and Other Arthropods Affecting Plants

212 Pathogens and Nematodes Affecting Plants

216 Integrated Pest Management Systems

Outcome #2

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
2017	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Crop producers, crop consultants, nutritionists, crop consultants, commodity groups, Extension personnel, Crop Improvement Associations, and end users are directly impacted by a changing environment. Adoption of scientifically proven techniques and methods increases wheat production and enhances the economic sustainability of the region.

What has been done
The NDSU Extension Service organizes meetings designed to provide the best and latest information on wheat production practices and marketing. One of these key educational programs that is specifically focused on wheat issues is: The Best of the Best in Wheat Production and Marketing. This meeting is offered in two locations in western North Dakota each year. In these meetings, research-supported recommendations that address the major production challenges of spring and durum wheat growers are presented. Furthermore, important principles and skills are reinforced with hands-on sessions. An effort is made to include the most recent research findings and focus on the most relevant topics that impact the profitability of wheat production. A similar meeting is held in eastern North Dakota that focuses on wheat and soybean.

Results
Based on the average annual yield increase that has been achieved in the last 15 years, we can estimate that more than 4 million bushels of wheat were produced in 2017 above that which was produced the previous year as a result of the adoption of improved varieties and management practices. At today's price cash price for wheat of $5.87 per bushel, this means that nearly 23.5

million additional dollars were earned by farmers in North Dakota over what would have been earned the previous year as a result of using better varieties.

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
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
405	Drainage and Irrigation Systems and Facilities

Outcome #3

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
2017	5000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Each year, there are numerous crop pests (insects, diseases and weeds) and agronomic problems (early frost, drought, flooding and other situations) that can negatively impact North Dakota's crop production. Producers, agronomists of fertilizer/chemical/seed companies, crop consultants, state and federal agencies, field scouts and university extension and research workers need timely updates and the latest research on field crop pests, agronomy and weather problems to maximize crop yields and quality.

What has been done

The NDSU Extension Crop & Pest Report is a weekly summer newsletter, which includes many articles on the occurrence and management of crop pests, and agronomic updates on crops and soil conditions. These articles are written by NDSU extension specialists. Valuable and timely information is described on crop pests, integrated pest management strategies, pesticide updates, agronomy, soil and fertility issues, new pest detections, important Extension meetings/Field Days, local field reports from 'Around the State' and weather forecasts. Anyone can easily access it via internet, Facebook, or sign up for the weekly electronic mail list.

Results

Readers of the Crop & Pest Report were mainly comprised of producers, agronomists of fertilizer/chemical/seed companies, university extension/research workers and crop consultants from 10 countries on five continents! The number of readers has increased 20 times to almost 5,000 readers today. As a result of this timely information, producers are making profitable crop management decisions.

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
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest 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
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

There were no affects from external factors in 2017.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Acreage data for durum and spring wheat with NDSU released varieties was determined using a report published by the USDA-NASS.
Participants at recent Extension meetings were asked where they obtained information they used in selecting new wheat varieties. The three most common responses were: annual reports from the Research Extension Centers; a printed copy of the variety selection guide published by the Extension Service; and information obtained from meetings sponsored the Extension Service.
A yearly Qualtrics Survey on the **Crop & Pest Report** revealed the following results:

- 87% of readers state that **Crop & Pest Report** is the major source of information on pests, integrated pest management and crop production.
- 95% of readers indicated that the **Crop & Pest Report** provided timely information, and was a reliable source of unbiased science-based information.
- More than 97% of readers reported sharing information from the **Crop & Pest Report** with other professionals.
- An average of 82% of readers said that they i**ncreased their knowledge** on pests, integrated pest management or crop production.
- Readers indicated that they increased their **knowledge and/or changed their behavior** on the following topics:
    - 90% of respondents conducted pest identification;
    - 84% conducted pest scouting and used economic thresholds before making pesticide applications;
    - 80% used crop production guidelines;
    - 78% used and relied on NDSU's pesticide guides;
    - 75% used fertility management;
    - 70% used weather information; and
    - 64% used harvest guidelines.
- 63% of readers used additional NDSU resources to further research topics. Some examples include: NDAWN, disease forecasting models, annual crop pest management guides, and extension publications.
- 59% of readers said that there was at least one article in the **Crop & Pest Report** that increased their profitability.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Natural Resources

☑ 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	25%		25%	
103	Management of Saline and Sodic Soils and Salinity	25%		25%	
205	Plant Management Systems	25%		25%	
405	Drainage and Irrigation Systems and Facilities	25%		25%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	16.0	0.0	14.0	0.0
Actual Paid	16.7	0.0	22.1	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**
463492	0	545650	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
463492	0	545650	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
819576	0	1808446	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Determine thresholds for salinity and sodicity to serve as management goals on affected soils
2. Produce systems to reclaim saline and sodic areas within farm fields
3. Determine the strengths and weaknesses of saline and sodic soil reclamation methods
4. Determine the interaction of salinity, sodicity and soil microorganisms
5. Survey and improve management recommendations for insect pests on the major crops
6. Devise improved range management methods to allow increased soil health in saline or sodic threatened soils
7. Provide improved guidelines to growers on best choice of crops for lands affected by salts or sodium
8. Translate scientific findings into practical producer applications and provide transformational education through workshops, field days and conferences, and resource materials
9. Conduct research on controlled drainage and subsurface irrigation to improve crop yield
10. 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

The targeted audience will include but not be limited to:

1. Crop producers in North Dakota and surrounding states
2. Crop consultants and agricultural advisors
3. Commodity groups
4. Crop improvement associations
5. Extension personnel
6. Agribusiness and agricultural finance personnel
7. Government agencies

3. How was eXtension used?

The eXtension system was used very sparingly in the area of soil science.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	58146	2914784	1454	29442

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

Patent Applications Submitted

Year:	2017
Actual:	0

Patents listed
None

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	10	4	14

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 and landowners who understand the source of salinity and sodicity, and take steps to prevent their spread.
2	Number of farmers and ranchers who better understand the relationship between range plants, crop plants, ground water management, and salinity and sodicity management.
3	Number of farmers and landowners who better understand surface and sub-surface moisture management and how it impacts soil health and crop production management.

Outcome #1

1. Outcome Measures

Number of farmers and landowners who understand the source of salinity and sodicity, and take steps to prevent their spread.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Soil salinity and sodicity adversely affects farm productivity and profitability. Increasing farmer/landowner knowledge of how to reduce salinity and sodicity is very important to their future viability as farmers and productivity of the land.

What has been done
The Soil Health team maintains an active website and Twitter account that promotes ongoing programs, contains results of research and demonstration projects that are directed towards salinity and sodicity and advertises upcoming events, such as county meetings, regional meetings, and 'café talks' that farmers and others can attend. Active participation and sharing with other farmers and ag-consultants is encouraged at these events. Field days are hosted on farmer's farms who have incorporated recommended management strategies and demonstrate their effectiveness to others.

Results
These programs have reached over 1,000 farmers each year, and the number of growers adopting management practices to contain and reduce salinity and sodicity increases each year. There is still much to do, but the momentum continues to build.

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

Outcome #2

1. Outcome Measures

Number of farmers and ranchers who better understand the relationship between range plants, crop plants, ground water management, and salinity and sodicity management.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Crop choice makes a difference in water use. Poor crop choice increases area of salinity, while more tolerant crops help keep saline areas in check and begin to reduce their effect to subsequent crops.

What has been done
The important of crop choice has been included in major events such as the Conservation Tillage Conference, Advanced Crop Advisor Workshop, Corn and Soybean grower meetings and the Soil and Soil Water Workshops, as well as the series of winter 'café talks' conducted last winter.

Results
Growers are beginning to understand that cultivating crops more tolerant to salinity in saline field areas is crucial to reducing salinity in fields.

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

Outcome #3

1. Outcome Measures

Number of farmers and landowners who better understand surface and sub-surface moisture management and how it impacts soil health and crop production management.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	650

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Excess rain has raised water tables, increased soil salinity and affected crop production in many areas of ND. Farmers have lost soil productivity, yields and economic return thus the interest in the use of subsurface drainage and water management.

What has been done
As in past years, a 2-day tile drainage design workshop was conducted in conjunction with the University of Minnesota Extension Service. Ten (10) presentations on subsurface drainage and sub-irrigation were presented at various venues across ND plus there were 5 farm and 6 office visits to solve site-specific problems.

Results
Over 650 people were educated on subsurface drainage and sub-irrigation issues. One of the presentations was testimony to the Agriculture Committee of the ND Senate, another presentation was made to Legislative Council, comprised of elected representatives from ND, SD, MN, Manitoba and Saskatchewan.

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

There were no external factors which affected the outcomes of the planned programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Attendees indicated an increased understanding of how to address salinity and sodicity on farms and indicated a desire to improve their management strategies.
Growers are more knowledgeable regarding crop choices better suited for saline soils. Economics of crop choice is a driving force in grower decisions. Their grasp of the yield drag of salinity on certain crops and its effect on the profitability is a force that moves them to less profitable crops on paper that are more profitable when they grow them in saline-distressed acres.
Drainage design workshops were evaluated by the participants on a scale of 1-4.. Overall, the participants rated them 3.6 out of 4. The participants were asked to rate each design session and/or presentation using this rating scale:

1. Nothing was presented that I didn't already know.
2. Familiar with the topic but the review was useful.
3. I learned something new and useful.
4. I gained important insights and information that I can use on the farm or my job.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Livestock Systems

☑ 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	25%		15%	
301	Reproductive Performance of Animals	30%		35%	
302	Nutrient Utilization in Animals	30%		35%	
305	Animal Physiological Processes	15%		15%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	21.0	0.0	21.0	0.0
Actual Paid	22.6	0.0	17.5	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**
556378	0	329168	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
556378	0	329168	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
931318	0	1855484	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Educational programming will be conducted using a variety of methods including: face to face meetings, webinars, news releases, media interviews, in-service training programs, needs assessments, advisory boards, and social media. Research activities include livestock and forage research, laboratory activities, and pursuit of grant funds.

2. Brief description of the target audience

The targeted audience will include but not be limited to:

1. Livestock producers in North Dakota and surrounding states
2. Livestock consultants and agricultural advisors
3. Veterinarians
4. Commodity groups
5. Livestock improvement associations
6. Extension personnel
7. Agribusiness and agricultural finance personnel
8. Government agencies

3. How was eXtension used?

Five livestock specialists have eXtension accounts and interact with their audience by providing resource materials and answering 'Ask An Expert' questions.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	112799	2368356	3760	23923

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

Patent Applications Submitted

Year: 2017

Actual: 0

Patents listed

None

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	9	36	45

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 ND livestock producers with increased technical knowledge of practices to improve the efficiency of livestock production systems. Technical areas include reproduction, nutrition, environmental stewardship, and animal health.
2	Number of ND livestock producers with increased knowledge of practices to improve livestock stewardship practices and reproduction.

Outcome #1

1. Outcome Measures

Number of ND livestock producers with increased technical knowledge of practices to improve the efficiency of livestock production systems. Technical areas include reproduction, nutrition, environmental stewardship, and animal health.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Drought impacted nearly every livestock operation in North Dakota in 2017. Severity ranged from slightly affected to extreme drought. Livestock producers, allied industry personnel, and main street businesses were all adversely affected. Local communities were impacted by reduced economic activity and psychological stressors related to drought conditions.

What has been done
Extension programming efforts included face to face meetings, news releases, farm and ranch visits, development of phone apps to estimate grazing capacity, and coordinating a variety of sample testing (feed and water) for affected livestock producers.

Results
Over 400 forage samples underwent nitrate quick tests, over 300 forage samples were collected and analyzed for nutrient content, and over 125 water samples were tested for total dissolved solids. Follow up consultations and recommendations prevented over 16,000 cattle from being exposed to toxic forages and over 8,000 cattle from being exposed to toxic water. This likely saved affected producers several million dollars in losses.

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

Outcome #2

1. Outcome Measures

Number of ND livestock producers with increased knowledge of practices to improve livestock stewardship practices and reproduction.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	66

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Livestock and environmental stewardship are important to the sustainability of farming and ranching in this region. Consumers are increasingly interested in understanding where their food is produced and that the food was produced in manner that shows care for the animals and the environment.

What has been done
Face to face meetings were held, bulletins were prepared, and social media (Facebook and Twitter) were used to inform livestock producers, consumers, and allied industry personnel about the importance of livestock and environmental stewardship. An advisory board offers guidance to the specialists involved in this program area.

Results
Sixty-six in-service attendees reported increased knowledge gain as a result of programming related to corn silage quality (17 attendees) and range management and stewardship (49 attendees). In-service training provided in depth educational resources for attendees and equipped them to better manage their nutritional programs (in the case of the corn silage workshop) or be better stewards of their rangeland resources (range management workshop).

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
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
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

There were no external factors that prevented the completion of the program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Overall evaluation results indicated NDSU Extension was very responsive to producers adversely affected by drought conditions. Stewardship education continues to be a need. Producers are keenly interested in improved methods to manage their resources for improved sustainability and production.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Economic and Community Vitality

☑ 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
602	Business Management, Finance, and Taxation	35%		100%	
608	Community Resource Planning and Development	15%		0%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	50%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	22.5	0.0	13.5	0.0
Actual Paid	17.1	0.0	10.8	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**
458360	0	165446	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
458360	0	165446	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
808267	0	1476064	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Educational programming will be conducted using a variety of methods including: face to face meetings, webinars, new releases, media interviews, in-service training programs, needs assessments, advisory boards, and social media. Research activities include develop new risk management tools for under served commodities. Educational activities include use of the real-time commodity training room, and training through the Rural Leadership North Dakota (RLND) program.

2. Brief description of the target audience

1. Crop producers in ND and surrounding states
2. Livestock producers in ND and surrounding states
3. Small business entrepreneurs
4. Agribusiness and agriculture finance personnel
5. Civic leaders
6. Commodity groups
7. Government agencies
8. extension communities of practice
9. Extension personnel

3. How was eXtension used?

The eXtension system was used very sparingly within this program.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	95075	1844608	2377	18632

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

Patent Applications Submitted

Year:	2017
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	3	0	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 utilize price risk management strategies, production risk management strategies, and financial risk management strategies.
2	Number of individuals involved in new leadership roles as a result of leadership programs.

Outcome #1

1. Outcome Measures

Number of growers and industry personnel who utilize price risk management strategies, production risk management strategies, and financial risk management strategies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	10487

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Risk management training is needed for lenders to make informed lending decisions, producers to mitigate declining commodity prices, and industry stakeholders to minimize risks and increase revenues.

What has been done
Agricultural Lenders Outlook: A one day conference was held in four locations within North Dakota. This Outlook is comprised of professional development sessions that help to prepare lenders for the upcoming agricultural loan renewal season

Crop Insurance Conference: A one day conference was held for crop insurance agents from North Dakota, South Dakota and Minnesota for professional development.

Commodity Trading training sessions: Focused training in an actual commodity trading environment is provided for stakeholder groups and their members for professional development and market forecasts.

Results
Respondents to multiple surveys indicate that 84% of attendees utilized information gained at these training in their day-to-day activities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation

803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #2

1. Outcome Measures

Number of individuals involved in new leadership roles as a result of leadership programs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	189

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
North Dakotans have been concerned with the shortage of leaders in communities and organization across North Dakota, especially in rural areas. Over 8,300 volunteer organizations need leaders in North Dakota at the local, regional and state levels.

What has been done
Since 2003, the 18-month Rural Leaders North Dakota cohort program has been offered to increase leadership skills. A total of 144 alumni of this program provide support to their communities and serve in leadership roles across the state. These alumni continue to meet to network, learn and address North Dakota issues.

The Growing Leaders Short Course, a five-session leadership training was provided in one North Dakota community in 2017. This program includes the completion of a community or organizational betterment project.

Lead Local, a one-day 'boardsmanship' training was provided in five communities in 2017. This program is designed to build confidence in participants who serve on boards, councils and committees by helping them understand meeting basics, parliamentary procedure, and handling conflict in groups.

Youth Lead Local, a one-day 'boardsmanship' training for youth was developed and provided in the tri-county region of southeastern North Dakota. Youth learned basic leadership skills and completed local projects.

Building Tomorrow's Leaders, an eight-session youth leadership training was developed and piloted in one location before extending statewide. This program helps young people understand their leadership style, effective communication, managing conflict, team building, the political process and networking.

Two statewide conferences were held in 2017; Inspiring Legendary Leaders and the 2017 Rewriting the Rural Narrative conference. These conferences were designed to help inspire, educate and provide networking opportunities to participants. Over 200 people attended these two conferences in 2017.

Results

A total of 144 individual have completed the 18-month RLND program. The most recent cohort evaluated shared goals of getting more involved in the community, serving on additional boards, running for public office and having a better understanding of issues.

Eight Growing Leaders Short courses have been held in 15 communities with 163 participants since inception. The session held in 2017 included 23 participants who developed action plans for six community projects including a fishing derby, community garden and community event promotion for adults and youth. A community organization and event document was then developed to help citizens identify the opportunities in the community.

Lead Local was held in five sites in North Dakota in 2017 with 94 participants. Participants reported being involved in 246 volunteer groups to assist their local communities and organizations. As these organizations are run more efficiently based on new knowledge and skills, the value of the time saved (based on one hour per organization per monthly meeting x independent Sector Value of Volunteer hour) is $74,981 for participants involved in the program last year.

Youth Lead Local and Building Tomorrow's Leaders trained over 65 youth and encouraged them to get involved.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

There were no external factors that prevented completion of the program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The 2017 Annual Outlook Conferences for Agricultural Lenders were held in four locations in North Dakota. On a scale of 1-5, 392 attendees self-reported increases in understanding of agriculture related financial issues that ranged from 0.45 to 1.13 points.

As of the end of 2017, 170+ individuals have completed the 18-month RLND program. Over $4 million has been invested in the 100+ RLND projects, five businesses have been started, and nine 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. During the 2016 election, three RLND participants were elected to statewide offices and are currently serving.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

4-H Youth 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	50%		0%	
806	Youth Development	50%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	22.5	0.0	0.0	0.0
Actual Paid	22.2	0.0	0.0	0.0
Actual Volunteer	51.0	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**
475558	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
475558	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
821557	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

A variety of different programs and methods are used to reach North Dakota youth, including after school programming, 4-H military partners, club learning experiences and science related events such as the 4-H Aerospace Event, Geospatial and Robotics Technologies for the 21st Century (GEAR-Tech-21) Camp, 4-H Camps, Kids Power, Children, Youth and Families at Risk (CYFAR) Project, 4-H Robotics Event, 4-H Film Festival and National 4-H Youth Science Day.

In an effort to increase the science related knowledge and confidence level of county staff and volunteer leaders several trainings are offered. These trainings have used the inquiry based and experiential learning methods for youth.

2. Brief description of the target audience

North Dakota 4-H Science programs reach more than 12,000 youth with hands-on learning experiences to prepare the next generation of science, engineering, and technology leaders. A special effort is made where Native American youth on four reservations are targeted as an underserved audience.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	18070	280949	271056	1404745

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

Patent Applications Submitted

Year:	2017
Actual:	0

Patents listed
None

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	0	0	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 4-H youth indicating they would like to have a job related to science.
2	Number of 4-H youth indicating that they think science will be important in their future.

Outcome #1

1. Outcome Measures

Number of 4-H youth indicating they would like to have a job related to science.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	575

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
North Dakota's situation parallels that of the United States. There are opportunities to hold a job in a science related field. However, there is a shortage of individuals to fill these positions. Thus, the job market is turning to educational entities to assist them in generating a pool of young people who may be interested in holding science related positions. However, in order to interest youth in science, they must first be engaged in science. Consistent with 4-H's mission and purpose, this engagement should be done through hands-on, experiential learning opportunities. Therefore, 4-H is the perfect fit to provide non-formal, experiential learning opportunities to educate youth about science. Hopefully this engagement will encourage them to pursue science related career opportunities

What has been done
The North Dakota 4-H program offers several science related educational opportunities. They include National 4-H Youth Science Day, Agriculture in the Classroom type programs, Robotics challenges, Aerospace Camp, Scratch computer programming, Rube Goldberg Challenge, and other science based 4-H project work. Additionally, there are hands-on science trainings for agents and adult volunteers.

Results
Adult volunteers reported from program evaluations that they plan to use more science activities at 4-H club meetings. Afterschool program staff reported that youth were more motivated because they were involved in hands-on, active learning activities as part of the program. Youth who completed 4-H science Common Measures surveys reported that they like to do science activities outside of school, would like a career in science, and that 4-H science programs have helped them work as a team and be leaders.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of 4-H youth indicating that they think science will be important in their future.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	611

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
North Dakota's situation parallels that of the United States. There are opportunities to hold a job in a science related field. However, there is a shortage of individuals to fill these positions. Thus, the job market is turning to educational entities to assist them in generating a pool of young people who may be interested in holding science related positions in the future. However, in order to interest youth in science, they must first be engaged in science. Consistent with 4-H's mission and purpose, this engagement should be done through hands-on, experiential learning opportunities. Therefore, 4-H is the perfect fit to provide non-formal, experiential learning opportunities to educate youth about science. Hopefully this engagement will encourage them to pursue science related career opportunities and understand that science will be important in their future.

What has been done
The North Dakota 4-H program offers several science related educational opportunities. They include National 4-H Youth Science Day, Agriculture in the Classroom type programs, Robotics challenges, Aerospace Camp, Scratch computer programming, Rube Goldberg Challenge, and other science based 4-H project work. Additionally, there are hands-on science trainings for agents and adult volunteers.

Results
Adult volunteers reported from program evaluations that they plan to use more science activities at 4-H club meetings. Afterschool program staff reported that youth were more motivated because

they were involved in hands-on, active learning activities as part of the program. Youth who completed 4-H science Common Measures surveys reported that they like to do science activities outside of school, would like a career in science, 4-H science programs have helped them work as a team and be leaders, and science will be important in their future.

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
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

There were no external factors that prevented the completion of the 4-H science program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The North Dakota 4-H program is in the early stages of fully utilizing the 4-H Common Measures resources to evaluate program impact. 4-H Common Measures is a national library of evaluation instruments available to 4-H staff nationwide. The instruments are applicable to a broad range of programs and have been tested for reliability and validity. One of the "libraries" of instruments includes items specifically addressing science programming. 4-H Common Measures instruments were used to assess National 4-H Youth Science Day, and they are now being used to assess all science programs. This will allow us to conduct a complete evaluation of science programs for 2018.

- 75% of North Dakota youth who participated in the Incredible Wearable/ National 4-H Youth Science Day experiment reported it made them more interested in science.
- 80% of North Dakota youth who participated in the Incredible Wearable/ National 4-H Youth Science Day experiment reported the experiment helped them work as a team.
- After attending an aerospace day camp, 90% of youth reported that they would be interested in an aerospace career.
- 85% of youth who attended a Rube Goldberg day camp reported that they would be interested in a career in engineering.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Health and Human Development Education

☑ 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
607	Consumer Economics	20%		0%	
703	Nutrition Education and Behavior	30%		0%	
724	Healthy Lifestyle	30%		0%	
806	Youth Development	20%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	33.0	0.0	0.0	0.0
Actual Paid	33.8	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
371325	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
371325	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1950454	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Educational programming will be conducted using a variety of methods including: face to face meetings, webinars, news releases, media interviews, in-service training programs, needs assessments, advisory boards, and social media.
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, including the "Nourish Your Body" series of lessons will be implemented for adults. A "Designing Your Succession Plan" curriculum will be developed and used at multiple sites across ND, eventually culminating in a succession planner "certification" program.

2. Brief description of the target audience

The targeted audience will include but not be limited to:

1. Children, teens and adults targeted in educational programming related to nutrition, food safety and health.
2. Crop and livestock producers in North Dakota and surrounding states
3. Agricultural, agribusiness and financial advisors
4. Accountants and attorneys
5. Commodity groups
6. Extension personnel
7. Government agencies

3. How was eXtension used?

eXtension has been used in the "Nourish Your Body" program; the "Ask an Expert" function has been used by practioners to find information.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	193438	2973449	297657	180209

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

Patent Applications Submitted

Year:	2017
Actual:	0

Patents listed
None

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	21	3	24

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 adults and children participating in education curricula conducted in formal and informal situations reporting improvements in one or more healthy lifestyle behaviors.
2	Number of participants in the "Succession Planning" program initiating the development a succession plan for their business.

Outcome #1

1. Outcome Measures

Number of adults and children participating in education curricula conducted in formal and informal situations reporting improvements in one or more healthy lifestyle behaviors.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	11088

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Childhood obesity has more than tripled in the past 30 years. According to the Youth Behavior Risk Surveillance Survey (2015), 42 percent of North Dakota students in grades nine to 12 consumed vegetables less than one time daily, 75 percent of adolescents were not physically active at least 60 minutes per day, and about 12 percent were not physically active 60 minutes on at least one day during the seven days prior to the survey. Some researchers consider children to be "overfed" but "undernourished." Obese children are at higher risk for cardiovascular disease, with 70 percent showing at least one risk factor for cardiovascular disease. Obesity also increases the risk for diabetes, stroke, cancer and osteoarthritis.

What has been done
On the Move to Better Health is a five-week school-based curriculum for fifth-graders. It is based on MyPlate, the current icon for good nutrition. The curriculum aims to increase fruits, vegetables and calcium-rich foods in the diets of children and improve fitness habits. Parents receive newsletters and participate in goal setting and other family-based activities. "On the Move Junior" is a five-week school-based curriculum for second-graders. It is based on MyPlate, the current icon for nutrition, and includes children's storybooks and hands-on activities. The curriculum aims to improve the variety of healthful foods that children consume, especially the amount of fruits and vegetables they consume. It also aims to improve fitness habits. Parents receive newsletters and participate in goal setting and other family-based activities. "On the Move" Cooking School and "On the Move After School" were added to the series.

Results
In On the Move to Better Health program, which reached more than 3,000 children during the year, 55 percent drank less pop, 52 percent chose more healthful snacks, 50 percent ate more fruits and vegetables and 57 percent increased their daily physical activity. In surveys with

parents, 80 percent read the newsletter, 37 percent of families increased fruit consumption, 28 percent increased their vegetable consumption and 33 percent set a weekly goal.

In the On the Move Junior programs, 85 percent of children ate more fruit, 75 percent ate more vegetables, 80 percent tried a new food and 87 percent engaged in more physical activity. About 79 percent of parents read the weekly newsletter, 60 percent reported their children were asking questions about food, 47 percent were requesting healthy snacks and 40 percent tried a new food at home.

After participating in the On the Move Cooking School, 96 percent of 455 children from 18 counties indicated confidence in reading a recipe, 94 percent were confident using measuring tools and 79 percent used nutrition labels to guide choices.

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 participants in the "Succession Planning" program initiating the development a succession plan for their business.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	129

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farm and ranch transition planning is a critical need for North Dakota producers. Surveys completed by commodity groups, producers and financial institutions place a high priority on meeting the need for educational programs addressing farm and ranch succession planning which encompasses business, retirement, transition and estate planning. Our state's farmers and ranchers now average roughly 60 years of age, and many are looking toward retirement and

transitioning their business.

What has been done
NDSU Extension Service held Design Your Succession Plan workshops in 11 North Dakota counties. Seventy-two percent of participants were 50 years and older. This program emphasizes the need to start a succession plan, communicate with family, and be prepared to work with professionals to create a customized succession plan that secures the farm/ranch legacy.

Results
Participants Reported:
-"I appreciate the efforts taken by the staff as it is important for those who have someone to transfer their farm to. More farmers should do this."
-"It was very informative and will be extremely useful to get us started. Thanks."
-"I really feel that this is a great course! I'm looking forward to a second round with other family members."

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

There were no external factors that prevented the completion of the programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The "On the Move to Better Health" nutrition and physical activity-based intervention program successful in promoting healthful behavior changes, specifically increases in fruit and vegetable intake, among students. Data analysis showed a significant difference between pre- and post-survey means and responses for both fruit and vegetable intake. After the program, 51.95% (n=1,446) of participants reported increasing their consumption of fruits and vegetables, while 42.98% (n=1,213) reported that their fruit and vegetable consumption stayed the same.
The "Succession Planning" program has been very successful. Evaluation data included:

- Of 129 participants eligible to give feedback, 96 evaluations were completed for a response rate of 74%.
- 63% of all participants intend to transition their business in under five years with 91% planning to transition in under ten years.

'Succession Planning' participants were asked to rank their confidence level regarding certain items pertaining to succession planning on a scale of 1-4 (1=strongly disagree and 4=strongly agree) in a retrospective pre/post-survey, mean scores are reported below:

- I have confidence in my ability to evaluate the viability of my business by using future projections. (before: 2.54 / after: 3.35)
- I have confidence in my ability to shape the future of the farm/ranch. (before: 2.5 / after: 3.41)
- I have confidence in my ability to plan and conduct a family business meeting. (before: 2.6 / after: 3.4)
- I have confidence in my ability to problem-solve if there is a conflict. (before: 2.61 / after: 3.32)
- I have confidence in my ability to gather the information I'll need when meeting with a professional. (before: 2.72 / after: 3.7)

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 whit 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.