2018 South Dakota State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The College of Agriculture, Food and Environmental Sciences at South Dakota State University is home to both SDSU Extension and the South Dakota Agricultural Experiment Station. One of eight colleges that make up SDSU, our college has an integral role in fulfilling the land grant mission of the university. The college is the largest at SDSU in terms of student enrollment, faculty/staff, and building space. Stakeholder solutions for South Dakotans are found through the collaborative partnership of SDSU Extension and SDSU Agricultural Experiment Station.

SDSU Extension and the South Dakota Agricultural Experiment Station achieve their goals with researchers and state specialists located on the SDSU campus in eastern South Dakota, eight Extension regional centers operating across the state with Extension field specialists, and six research field stations. Outreach is also achieved with four Tribal Extension program offices, and the West River Agricultural Center representing the western portion of South Dakota. 4-H Youth Development begins on campus with the South Dakota State 4-H Office and has 4-H Extension field specialists in Extension regional centers and 4-H youth advisors in county-owned offices.

SDSU Extension continued to use the online iGrow.org platform to deliver useful and impactful educational information. During more than 907,000 sessions, 697,523 users consumed educational information totaling more than 1 million page views. Sitewide, the audience was 51.7% female and 48.3% male with the following age demographics: 18-24 (17.31%), 25-34 (25.08%), 35-44 (19.68%), 45-54 (15.37%), 55-64 (14.18%) and 65+ (8.39%). The primary audience of iGrow is in South Dakota and the United States, but content was viewed from 218 countries around the world. Over the lifetime of the iGrow.org website (2011-2018), page views grew 409.2%.

South Dakota State University uses the following Planned Programs in its Combined Research and Extension Plan of Work. The Planned Programs are based on the USDA Knowledge Area Classification System.

Natural Resources and Environment
The research activities in this program are primarily supported by our Department of Natural Resource Management. Hatch funded projects include but are not limited to research studies involving the consequences to soil from climate and land-use changes, risk analysis of water resources, environmental impacts on grasslands, climate variability, the impact on crops from Canada geese, watershed management, soil productivity, bioenergy, wildlife habitat, pollution prevention, and range management. Activities for SDSU Extension in this Planned Program involve grassland management, wildlife habitat development, no-till, corn and soybean nitrogen recommendations, soils management, and Concentrated Animal Feeding Operations.

Plants and Their Systems
The research activities in this program are primarily supported by our Department of Agronomy,

Horticulture, and Plant Science, and our Department of Biology and Microbiology. Hatch funded projects include but are not limited to research studies in genetically modified corn, soil-borne plant pathogenic fungi and other crop pests and diseases, seed traits in grass species, nitrogen fixation, oat breeding, nodule development in soybeans, crop genetics and genomics, perennial grasses for bioenergy, grapevine mapping, improved alfalfa production, and best management practices for carinata, camelina, and flax. Activities for SDSU Extension in this Planned Program involve sorghum production, agronomy field schools, cover crops, alfalfa growth and production testing, utilization of field peas in South Dakota, Pesticide Applicator Training, Master Gardeners, and Integrated Pest Management.

Animals and Their Systems
The research activities in this program are primarily supported by our Department of Animal Science, Department of Dairy and Food Science, and our Department of Veterinary and Biomedical Sciences. Hatch funded projects include but are not limited to research studies to improve health and performance in dairy cattle, epidermis repair of food animals, pre-harvest management of beef cattle, co-product feeds for sheep, milk production management for dairy cattle, vaccines for viral diseases, and reproductive efficiency in cattle. Activities for SDSU Extension in this Planned Program involve the establishment of a partnership with Puerto Rico to recruit dairy workers, artificial insemination schools, the enhancement of a sustainable dairy community through a multistate collaboration, mineral nutrition in cattle, sheep production, animal welfare, heifer development, and the Calf Value Discovery program.

Agricultural, Natural Resource, and Biological Engineering
The research activities in this program are primarily supported by our Department of Agricultural and Biosystems Engineering. Hatch funded projects include activated carbon for water and blood purification, lignocellulosic based bio fuel, and the development of microorganisms to facilitate composting of plant materials. Activities for SDSU Extension in this Planned Program include land use and management practices to enhance water quality, feedlot development, calving barns, and lambing facility ventilation.

Food and Non-Food Products: Development, Processing, Quality, and Delivery
The research activities in this program are primarily supported by our Department of Agricultural and Biosystems Engineering, Department of Dairy and Food Science, and our Department of Biology and Microbiology. Hatch funded projects include but are not limited to emerging technologies in dairy manufacturing, conversion of lignocellulosic biomass into advanced liquid biofuels, the manufacture of new dairy food products, technologies for improving food safety, and the development of oilseed biofuels. Activities for SDSU Extension in this Planned Program include beef carcass fabrication, meat cookery, Meat Science Expo, and Barbeque Bootcamp.

Economics, Markets, and Policy
The research activities in this program are supported by our Department of Economics. Hatch funded projects include but are not limited to the economics of a bio-based industry, price behaviors of agricultural commodity derivatives, enhancing rural sustainability and quality of life, market studies for South Dakota produced beef, agricultural land market trends, and economic impacts of agricultural trade policies. Activities for SDSU Extension in this Planned Program involve ag land values, economics of conservation, risk and business management, commodity marketing, and costs of crop production.

Human Nutrition, Food Safety, and Human Health and Well-Being
The research activities in this program are supported by our partnership with the College of Education and Human Sciences. Hatch funded projects include research involving functionality traits of wheat dough, dietary bioactive food components, rural food environment, intervention to improve healthful behaviors in young adults, and dietary influences on obesity and chronic inflammation. Activities for SDSU Extension

involve nutrition, healthy eating, physical activity, worksite wellness, food preservation, chronic diseases, community gardens, and gerontology.

Families, Youth, and Communities
The research activities in this program are supported by our partnership with College of Education and Human Sciences. The Hatch funded project is research that involves psychological and behavioral factors that impact the decision to save financially. Activities for SDSU Extension involve 4-H Youth Development, women in agriculture, estate and transition planning, family financial wellness, Native American events, rural sustainability, and building community capacity.

NOTABLE ACHIEVEMENTS

Managing for Soil Health to Improve Agroecosystem's Sustainability and Productivity in South Dakota
Collaborations with farmers and regional soil scientists from NRCS and USDA-ARS, have begun to monitor changes in soil health with intensification of cropping systems, no-tillage systems, incorporation of livestock, accidental wild fires, and cover crops. These collaborations help with creating standard indicators and laboratory procedures to assess soil health.

Quantifying the Role of a New Crop (Brassica Carinata) on Pollinator Health
Our research demonstrates that carinata provides important nectar and pollen resources for native pollinators and honey bees and positively contributes to pollinator and honey bee health.

Understanding Genetic Controls of Seed Dormancy and Longevity in Grass Species
This research suggested that natural genes controlling seed primary dormancy are involved in regulation of seed longevity and that there must also be additional genes controlling seed longevity in weedy rice.

Regulation of Preovulatory Estradiol and Its Impact on Fertility and Reproductive Efficiency in Cattle
Cow-calf profitability is greatly impacted by timing of conception during the breeding season. Our recent results demonstrate that animals that do not exhibit estrus prior to fixed-time AI had decreased AI conception rates, decreased breeding season pregnancy success, and conceived later in the breeding season compared to animals that did exhibit estrus. These differences are likely the results of differences in specific protein abundances in the uterine fluid between animals that exhibited estrus and animals that did not.

Carbohydrate Based Carriers of Bioactive Compounds
Researchers found that amounts of anthocyanins in aronia berries is dependent on the harvesting time along with location parameters such as sunlight, seasoning temperature, rainfall and soil conditions.

Marketing of Commodity Quality Characteristics
This research found that the marketing of commodity characteristics via transferable eco-label benefits and proper governance rules could achieve cooperative sustainable outcomes. Researchers found more broadly that cooperatives could be sustainable because of important positive macro-factors, despite increasing diversity amongst producer-members. With respect to directly managing commodity price risk, value-at-risk models were developed to provide risk assessments that enable firms to better understand and manage their risk exposure.

Examining and Impacting Environmental Determinants of Obesity in Rural Populations
We have summarized existing work examining the differences in diet and physical activity patterns between rural and urban youth, and have established methods for improving rural obesity research.

Additionally, we have published work linking both rural occupation and rural lifestyle to diet and physical activity, providing environmental focus areas for future research and interventions.

Dietary Influences on Inflammation and Mental Health
Preliminary results demonstrated omega-3 fatty acid intakes below recommendations and a suboptimal omega-3 index for young adults in a university setting. A disconnect among level of knowledge of omega-e fatty acids, intake, and the omega-3 index (a reflection of status) was evident. These results can be used to help inform the development of interventions targeting sources of omega-3 fatty acids and to serve as a complementary health approach in the prevention and treatment of mental health issues in young adults.

Peer-Reviewed Publications

- Number of peer-reviewed publications for 2018:
- South Dakota Ag Experiment Station - 151
- SDSU Extension - 33

Master Gardeners
There are currently 445 active SDSU Extension Master Gardeners in South Dakota that contributed nearly 10,500 service hours to community horticulture education, reaching 37,350 contacts, a value of $231,000, with over 350 educational events held state-wide.

Pesticide Management Program
Almost 15,000 individuals were reached through 83 Integrated Pest Management training events held throughout South Dakota. Participants increased their knowledge of pest biology, disease identification, pesticide label interpretation, pesticide handling, and environmental factors. This leads to increased use of IMP practices and objective, science-based decision-making on reducing risks from pests and preventing unacceptable levels of pest damage in both agriculture and residential settings.

Agritourism in South Dakota
SDSU Extension Community Vitality and the SD Department of Tourism, as well as representatives from 7 partnering organizations, joined together to form a work group to foster the growth and promotion of agritourism in South Dakota. The work group participated in booths at 4 large state events to survey farm and ranch operators. Results showed that about 70% of farm and ranch operators are interested in learning more about agritourism.

Health & Wellness Program Volunteers
SDSU Extension Health & Wellness programs engaged 346 volunteers from October 2017-September 2018, providing 3,378 hours which represents a value of almost $72,000 of service to SD communities. Healthy South Dakotans leads to thriving communities.

South Dakota Shooting Sports
During 2018, 4,465 youth were enrolled in the Shooting Sports project, which is the largest programmatic effort in South Dakota, with 500 volunteers serving as active certified instructors. The project certified 131 volunteers through 9 workshops conducted. Certified volunteer instructors provided over 96,000 instruction hours to the program, which represents a value of $2,051,000 in support of the South Dakota 4-H program.

South Dakota Dairy Fest
A Dairy Fest was held with 7 educational events implemented to increase public support for the dairy industry. Participants learned about dairy opportunities for personal employment or business ventures, as well as the nutritional value of dairy products made from milk. Almost 2,800 adult participants, 95 youth and 106 volunteers participated

BeefSD Provides Knowledge and Networking
The BeefSD Program Class #3 trained 53 beginning producers across the state owning and/or managing 14,000 head of cattle through 9 face-to-face workshops, 4 case study ranch tours, 2 travel study trips, 10 webinars, and multiple peer mentor meetings. Participants gained tools, knowledge and networking to be successful in an ever changing and progressing industry.

Gerontology: A Multidisciplinary Field
An Aging Gracefully Expo (AGE) event took place via webcast in 3 participating South Dakota communities. As a result of AGE activities, 325 participants learned about resources, services, and opportunities for community engagement to better prepare South Dakotans for later stages of life. Twenty-five volunteers contributed approximately 240 hours to the event, representing a value of $5,110 to SD communities.

Pesticide Applicator Training Sessions
Fifty-seven commercial and private applicator training sessions were held statewide in South Dakota with almost 5400 total participants. Participants enhanced their knowledge and understanding of safe and sustainable methods to apply pesticides.

Planned Programs Staff Effort Summary

This explains how much of each program is associated with each knowledge area.
South Dakota Agricultural Experiment Station (Hatch Research)
1. Natural Resources and Environment - 16%
2. Plants and Their Systems - 20%
3. Animals and Their Systems - 38%
4. Agricultural, Natural Resource and Biological Engineering - 1%
5. Food and Non-food Products, Development, Processing, Quality and Delivery - 11%
6. Economics and Market Policy - 3%
7. Human Nutrition, Food Safety, and Human Health and Well-Being - 10%
8. Families, Youth and Communities - 1%

SDSU Extension (Smith-Lever 3(b)(1) and (c))
1. Natural Resources and Environment - 8%
2. Plants and Their Systems - 10%
3. Animals and Their Systems - 13%
4. Agricultural, Natural Resource and Biological Engineering - 5%
5. Food and Non-food Products, Development, Processing, Quality and Delivery - 1%
6. Economics and Market Policy - 5%
7. Human Nutrition, Food Safety, and Human Health and Well-Being - 14%
8. Families, Youth and Communities - 44%

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	108.0	0.0	167.0	0.0
Actual	120.5	0.0	132.2	0.0

II. Merit Review Process

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

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

2. Brief Explanation

All Hatch projects are subjected to peer review prior to implementation and require independent peer reviews from two scientists. The department head or a departmental executive committee identifies peer reviewers. The department head and the AES Director serve as merit reviewers. Reviewers are required to comment on why the proposed research is needed, its relevance to agriculture, the target audience, and how it compliments other research. Proposals for research grants that are funded by stakeholder groups are subjected to review by the stakeholders themselves and by college administrators. SDSU Extension administrators serve as the merit review team for the plan of work. Department heads and program directors conduct peer reviews of programs.

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
- Survey specifically with non-traditional individuals

Brief explanation.

Stakeholder participation is solicited from many sources and events, including agricultural check-off groups, commodity groups, funding organizations, governmental agencies, elected officials and boards, public events and meetings, news releases, and industry associations. SDSU Extension seeks and receives stakeholder participation through focused conversations with representative constituent groups reflective of outreach conducted via our Capstone program areas.
SDSU Extension Outreach occurs through the following groups:

- Competitive Livestock Systems
- Competitive Cropping Systems
- Horticulture/Gardening
- Food & Families
- 4-H Youth Development
- Community Vitality

Stakeholders are highly encouraged to participate in and take an active interest in SDSU Extension by providing direction, suggestions, and positive ideas. We ask stakeholders to share visionary strategies that meet the SDSU Extension mission, particularly in the capstone area they are representing. Stakeholders are encouraged to provide feedback and ideas for collaboration and partnership, and to help SDSU Extension reach and serve all demographic populations of the state. At the county level, County Commissioners are asked to maintain a county advisory structure that engages the local 4-H Promotion and Expansion Committee in the advisory role. This advisory structure predominantly gives guidance to county funded budgets and local 4-H expansion efforts.

Example Sources of Stakeholder Input:
- South Dakota Soybean Research and Promotion Council
- South Dakota Beef Industry Council
- South Dakota Corn Utilization Council
- South Dakota Oilseeds Council
- South Dakota Pork Producers Council
- South Dakota Wheat Commission Council
- South Dakota Department of Education and Cultural Affairs
- South Dakota Department of Health
- South Dakota Department of Social Services
- South Dakota Department of Economic Development
- Department of Energy
- Environmental Protection Agency
- South Dakota Department of Agriculture
- Office of State Veterinarian
- South Dakota Game, Fish and Parks
- Natural Resources Conservation Service
- Bureau of Indian Affairs
- South Dakota Weed and Pest Commission
- South Dakota 4-H Leaders Association
- South Dakota Association of County Commissioners

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
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

{NO DATA ENTERED}

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 the general public (open meeting advertised to all)
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups

Brief explanation.

Open dialogues are held with constituent groups to identify ways in which SDSU Extension can provide/develop outreach programs to meet identified needs to the targeted audience, whether that is a broad scale audience, e.g., ag producers, or specific sub-audiences such as beef producers. Capstone program areas will engage with their constituent groups on a quarterly to semi-annual basis. Written summaries of this feedback are produced and then shared on our web portal so they are accessible to staff and the general public. This feedback is then used to guide strategic program development within that program area.

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.

Administrators evaluate all input, requests and comments from stakeholders. SDSU Extension writes summaries of the discussions held by each capstone program with stakeholder and constituent groups. Program Directors share summaries specific to the capstone program area with department heads, faculty and specialists during program meetings. Stakeholder input is reviewed, considered and used as a basis to create SDSU Extension programs and AES research projects.

Brief Explanation of what you learned from your Stakeholders

Stakeholder input is very important to the Agricultural Experiment Station and to SDSU Extension. By soliciting input, we learn what the challenges are that they are facing and what they would like to see us do to address their challenges. We also learn what they believe the future of South Dakota looks like, what they see as opportunities, and what they think we can do to support those opportunities. Stakeholder input is reviewed, considered and used as a basis to create SDSU Extension programs and AES research projects.

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	2457382	0	3063781	0
Actual Matching	2457382	0	3063781	0
Actual All Other	0	0	0	0
Total Actual Expended	4914764	0	6127562	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

Natural Resources and Environment

☑ 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
101	Appraisal of Soil Resources	10%		6%	
102	Soil, Plant, Water, Nutrient Relationships	32%		36%	
103	Management of Saline and Sodic Soils and Salinity	0%		3%	
111	Conservation and Efficient Use of Water	4%		3%	
112	Watershed Protection and Management	0%		13%	
121	Management of Range Resources	18%		10%	
131	Alternative Uses of Land	5%		0%	
133	Pollution Prevention and Mitigation	11%		0%	
134	Outdoor Recreation	2%		6%	
135	Aquatic and Terrestrial Wildlife	0%		10%	
136	Conservation of Biological Diversity	6%		13%	
141	Air Resource Protection and Management	12%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	6.5	0.0	36.7	0.0
Actual Paid	8.2	0.0	21.1	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**
196591	0	498635	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
196591	0	498635	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct Field and Lab Research
- Collaborate with Other States
- Partner with South Dakota Game, Fish and Parks
- Partner with the South Dakota Grassland Coalition
- Partner with Business Organizations
- Collaborate with Non-profit Organizations
- Participate with the South Dakota State Climate Office
- Conduct Training for Concentrated Animal Feeding Operations
- Partner with the South Dakota Department of Environment and Natural Resources
- Partner with the Natural Resources Conservation Service

2. Brief description of the target audience

- Watershed Practioners
- Wildlife and Fisheries Managers
- Scientists
- Environmentalists
- Outdoor Enthusiasts
- Farmers, Ranchers and Producers
- General Public
- Operators of Concentrated Animal Feeding Operations

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	37891	27691	5161	3524

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	17	17

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Natural Resources and Environment

Year	Actual
2018	16

Output #2

Output Measure

- Increase Rancher's Knowledge of Grazing Techniques and Grassland Management

Year	Actual
2018	61

Output #3

Output Measure

- Number of CAFOs Participants

Year	Actual

2018	201

Output #4

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2018	4

Output #5

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2018	45

Output #6

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2018	0

Output #7

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual
2018	52

Output #8

Output Measure

- Create Soil Health Learning Opportunities

Year	Actual
2018	9

Output #9

Output Measure

- Conduct Field Research to Determine the Effectiveness of the Canada Goose Damage Program

Year	Actual
2018	1

Output #10

Output Measure

- Research Climate Variability and Management Impacts on South Dakota Grasslands

Year	Actual
2018	1

Output #11

Output Measure

- Research Environmental Impacts on South Dakota Grasslands
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number of Natural Resources and Environment Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	31

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
South Dakota has a wide diversity of natural resources that depend on maintenance and good stewardship of the land. Land managers need tools and techniques to help them monitor rangeland condition, improve utilization of rangeland resources, control invasive species, and develop management plans to respond to challenges resulting from drought and other natural disasters.

What has been done
Within the College of Agriculture, Food and Environmental Sciences, there are 31 Hatch projects that are categorized in the Planned Program of Natural Resources and Environment. The research activities in this program are primarily supported by our Dept. of Natural Resource Management. Projects include but are not limited to research studies involving the consequences to soil from climate and land-use changes, risk analysis of water resources, climate variability, soil productivity, pollution prevention, and range management.

Results
Through research, our Department of Natural Resource Management continues to build a scientific knowledge base to improve and understand the management of natural resources in South Dakota. Examples include: Best management practices to protect soils, reduction of nitrates in drainage water, streamflow trends under climate variability, atmospheric nitrogen deposition on native prairie, anthraquinone effectiveness on soybean plants, prevention of nitrates through tile drainage, newly discovered insect species, construct elemental fingerprints of reservoir ecosystems, climate change effects on beaver-created wetlands, and biomass yield from switchgrass land. In addition, graduate students gain valuable knowledge and skills while collaborating on research projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
134	Outdoor Recreation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
141	Air Resource Protection and Management

Outcome #2

1. Outcome Measures

Number of Grazing School Participants

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	61

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There are approximately 22 million acres of permanent pasture and rangeland in South Dakota. Rangeland is the lifeline of streams, ponds and lakes, and it is a source of wildlife habitat, recreation and scenic beauty. Rangeland is fragile and is profoundly impacted by management. The grazing lands of the Northern Plains are recognized as one of the most threatened ecosystems globally. As grazing lands are predominantly privately owned and managed, principally for livestock production, secure and profitable ranching is necessary to conserving this vital resource.

What has been done

In cooperation with the South Dakota Grasslands Coalition and several other entities, SDSU Extension has partnered in grasslands management training to more than 620 student ranchers since 2003. Students participated in classroom presentations as well as hands-on field activities. The topics covered include plant identification, wildlife habitat development, prescribed burning, and ecological sites and soils.

Results

With its partners and the South Dakota Grazing School, SDSU Extension has helped producers of all ages become more skilled at reading their landscape. As new participants are reached, there is an increase in knowledge of many topics, including managing diversity on rangelands, pasture allocation, holistic management, soil health and infiltration, plant identification, and concepts of grazing. By better understanding the grassland conditions of their property, ranchers develop the skills needed to detect important information both beneficial and detrimental to their grasslands. The workshops and activities also allow producers to network, sparking creativity to help find solutions to their own challenges. By targeting many of the events to youth, SDSU Extension continues to help conserve South Dakota's fragile rangelands.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
121	Management of Range Resources

Outcome #3

1. Outcome Measures

Number of CAFOs Training Sessions

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Large-scale livestock producers, known as Concentrated Animal Feeding Operations (CAFOs), create potential water and air quality conflicts for rural communities in SD. There is a need for the development of these operations, but environmental laws must be followed and good-will with neighbors is imperative. Any CAFO that is applying for a General Permit must attend a CAFO Environmental Training Program. The SD General Permit for CAFOs was re-issued in 2017, requiring all current permit holders to reapply for permit coverage in the next four years.

What has been done
SDSU Extension and three other partnering agencies, provide training two to three times a year for federal and state water pollution and control programs. The training sessions included topics on livestock production, management of nitrogen, and phosphorus content of manure and air quality and odor. In FY2018 there were two training sessions. Paper-based exit surveys were distributed and collected at the end of the Environmental Training Programs to gauge change in knowledge and application of information.

Results
For the CAFO Environmental Training Programs provided, approximately 73% of the participants were required to be at the training sessions and the remaining 28% attended for the learning experience. The session participants from livestock operations represented 65,558 beef cattle, 49,080 dairy cows, 613,705 pigs, and 4,752,800 poultry/turkeys. Survey results showed a 26% to 51% increase in the overall understanding of the topics and an 80% overall satisfaction rate with the program. At the end of the training, there was an increase in adoption of the practices demonstrated ranging from a 23% increase in land application of manure to a 208% increase in nutritional changes to alter manure content.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

Outcome #4

1. Outcome Measures

Increase Soil Management Knowledge to Participants

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Interest in soil health among South Dakota farm producers has increased in recent years. Healthy soil contributes to a healthy ecosystem which in turn can impact society. Conservation practices used to improve soil health are responsible for regenerating degraded soils. This leads to improved food security for an increasing global population and can contribute to stabilizing society.

What has been done
SDSU Extension cooperated with the Soil Health Coalition, the South Dakota No Till Association, the USDA-NRCS and the Grasslands Coalition to carry out outreach activities that focused on increasing the awareness of natural resources conservation. Fourteen statewide events were held including a Soil Health School, Managing Soil-Maximizing Profit, No Till Event, Mitchell Soil Health, field tours, field schools, farm shows, and seminars with a total of 1934 participants.

Results
The programs conducted by SDSU Extension have increased soil health awareness and conservation activities of producers in the field. The 2018 Soil Health School held in conjunction with the SD Soil Health Coalition, included numerous hands on, in-depth presentations that demonstrated to interested ag producers the value of incorporating conservation practices. SDSU Extension programs have improved producer awareness of cover crop benefits and selection, diverse cash crop rotations, herbicide interactions, nutrient cycling and livestock integration. All of which enhance overall soil health. Agricultural producers have learned to incorporate cover crops into their cropping systems for soil health benefits. Conservation practices (no-till, cover crops and crop rotations)are increasing in SD.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

Outcome #5

1. Outcome Measures

Increase Knowledge to Control the Canada Goose Population

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2018 1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since the early 1900's, there has been a rapid decline in Giant Canada geese in South Dakota. Through restoration programs, Canada geese populations today have increased to the point that farmers register complaints that the geese are damaging crops, particularly soybeans. Research is needed to generate harvest parameters and survival rates estimates for the Canada goose population.

What has been done
The SDGFP Canada goose damage program allows landowners that file a complaint free access to abatement techniques. Little research has been conducted on flightless Canada geese that cause crop damage during the brooding and molting period. Currently, South Dakota AES is evaluating the effectiveness of several commercial chemical goose deterrents on soybeans in northeast South Dakota. New methods to reduce crop damage caused by Canada geese are being identified.

Results
The distance from water which geese would travel to eat soybeans after the areas near the wetland was treated with anthraquinone was evaluated. Upon completion of a student thesis, recommendations will be provided on the concentration of anthraquinone needed, the distance into the field water to apply, and effects of the chemical on soybean yield. Journal articles will be published from the thesis.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #6

1. Outcome Measures

Produce Knowledge to Implement a State-and-Transition Model for South Dakota Grasslands

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2018 1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Climate variability complicates our ability to manage invasive plants and pests, rangeland quality, and livestock production. Changes in grazing pressure are triggers that lead to alterations in rangeland productivity and plant community structure. To better describe these changes, a State-and-Transition Model for South Dakota Grasslands is needed.

What has been done
Research is ongoing to determine the impacts of climate variability, increased nitrogen deposition, and management on resistance and resilience to plant community change and primary production of eastern South Dakota grasslands. Clipping, fire, and nitrogen treatments were applied 2017. Rainout shelters that simulated a drought with 50% reduction in rainfall was established on three ranch demonstration sites.

Results
During this reporting period, this study demonstrated that:
1-Clipping and fire have similar effects on manipulating prairie vegetation
2-Frequency of treatment shows exotic cool-season grass species are resilient to disturbance
3-sumulated increased nitrogen deposition appears to have minimal impact of community plant composition

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

No Data Entered

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Agricultural producers have learned to incorporate cover crops into their cropping systems for soil health benefits and to provide forage for livestock. Crop producers are seeking other crops to improve landscape diversity. More producers are considering reduced and

no-till systems, cover crops and diverse crop rotations to improve their economic bottom line and at the same time improving soil health and water quality.

Key Items of Evaluation

No Data Entered

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Plants and Their 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
201	Plant Genome, Genetics, and Genetic Mechanisms	1%		45%	
202	Plant Genetic Resources	0%		11%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		3%	
204	Plant Product Quality and Utility (Preharvest)	5%		0%	
205	Plant Management Systems	20%		6%	
206	Basic Plant Biology	11%		6%	
211	Insects, Mites, and Other Arthropods Affecting Plants	23%		9%	
212	Pathogens and Nematodes Affecting Plants	9%		17%	
213	Weeds Affecting Plants	8%		0%	
216	Integrated Pest Management Systems	23%		3%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	10.8	0.0	46.8	0.0
Actual Paid	12.1	0.0	26.4	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**
245738	0	608463	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
245738	0	608463	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Develop Improved Oat Cultivars
- Collaborate with Master Gardeners
- Develop Improved Wheat Cultivars
- Conduct Research on Economic Impacts of Fungal Diseases
- Develop Superior Sunflower Germplasms
- Develop New Cultivars of Prairie Cordgrass for Bioenergy Production
- Analyze and Map Genes for Soybean Resistance of Aphids
- Conduct Pesticide Applicator Training Sessions
- Deliver Integrated Pest Management Resources
- Partner with the South Dakota Agri-Business Association

2. Brief description of the target audience

- Oilseed and Other Specialty Crop Growers
- Research Community
- Soybean Growers
- Wheat Growers
- Corn Growers
- Biofuels Crop Industry
- Producers
- Graduate Students
- Private and Commercial Pesticide Applicators

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	48785	35652	6563	4482

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

Patent Applications Submitted

Year: 2018

Actual: 1

Patents listed

Oahe (Wheat PVP)

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	14	14

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Plants and Their Systems

Year	Actual
2018	20

Output #2

Output Measure

- Number of Pesticide Applicator Training Sessions

Year	Actual
2018	107

Output #3

Output Measure

- Number of Master Gardener Training Sessions

Year	Actual
2018	24

Output #4

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2018	112

Output #5

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2018	115

Output #6

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2018	1

Output #7

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual
2018	78

Output #8

Output Measure

- Conduct Research for Improved Oilseed Production
  Not reporting on this Output for this Annual Report

Output #9

Output Measure

- Number of Integrated Pest Management Training Events Conducted

Year	Actual
2018	83

Output #10

Output Measure

- Conduct Research on Spring Wheat Cultivars
  Not reporting on this Output for this Annual Report

Output #11

Output Measure

- Conduct Research on Oat Cultivars
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number of Plants and Their Systems Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	35

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Crop diseases, insect pests, drought, changing climatic conditions, soil erosion, and fewer acres of land available for farming are all serious production constraints for all crops produced in South Dakota.

What has been done
Within the College of Agriculture, Food and Environmental Sciences, there are 35 Hatch projects that are categorized in the Planned Program of Plants and Their Systems. The research activities in this program are primarily supported by our Department of Agronomy, Horticulture, and Plant Science, and our Department of Biology and Microbiology. Projects include but are not limited to research studies in genetically modified corn, nitrogen fixation, crop genetics and genomics, and best management practices for carinata, camelina, and flax.

Results
Through research, we continue to build a scientific knowledge base to improve and understand plant varieties, increased agricultural productivity, plant diseases, and the impacts of tillage on soil carbon levels. Examples include: Prevention of pollination contamination in maize, engineered cyanobacteria to produce biofuels and commodity chemicals, new releases of oat and wheat cultivars, the development of high yield, pest resistant sunflower, oil extraction from oilseeds for biofuel production, soybean plants that produce more of its own nitrogen, and improve efforts to extend carbon assimilation of switchgrass. In addition, graduate students gain valuable knowledge and skills while collaborating on research projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Number of Pesticide Applicator Training Participants

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	5378

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Producers planning to apply any pesticide to a commodity worth $1,000 or more must be certified as a private applicator. Anyone that applies pesticides for hire must be certified and licensed as a commercial applicator. 2018 was also the first year where agricultural use Dicamba products were labeled as restricted use products in South Dakota. This increased the number of participants at our commercial ag and private meetings as clients wanted to insure they were properly certified for the 2018 growing season.

What has been done
SDSU Extension organized and participated in 50 commercial applicator sessions and 57 private applicator training sessions across the state. Fifteen commercial categories were covered. Speakers at the sessions included SDSU Extension specialists, State Department of Agriculture representatives, and State Department of Environment and Natural Resources.

Results

Participants enhanced their knowledge and understanding of safe and sustainable methods to apply pesticides. Topics covered during these trainings include proper selection of personal protective equipment, understanding and comprehension of label languages, resistance development on weeds and insects and ways to prevent its development, proper technique to measure pesticides and calibrate pesticide application equipment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #3

1. Outcome Measures

Number of Participants Completing Master Gardener Training

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	58

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Every day, SDSU Extension Field Specialists are providing research-based education and direct-service programs to improve the health and quality of life of South Dakotans. With over 800,000 residents to serve, SDSU Extension can broaden and strengthen their reach by leveraging the skills of volunteers that serve with us every day. Horticulture, home gardening, and in particular, home vegetable gardening, serves a crucial need to help fill a gap that many families and small communities face in having access to nutritious food.

What has been done
In exchange for their training, SDSU Extension Master Gardeners share their time and knowledge on current, research-based, consumer horticulture information within their communities.

Results
Through the close partnership of SDSU Extension and Master Gardeners, citizens across South Dakota have access to public education that enables them to improve their health and lifestyle by growing nutritious foods. Adults and youth have gained confidence that their gardening skills are based on accurate, research-based information. By growing their own food, gardeners are saving

money, eating fresher produce, and making their own decisions about pesticide use. There are currently about 445 active SDSU Extension Master Gardeners in South Dakota that contributed nearly 10,500 volunteer service hours, reaching nearly 37,350 contacts, valued at nearly $231,000. Extension Master Gardener volunteers traveled nearly 3,450 miles to provide their services to South Dakota residents.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #4

1. Outcome Measures

Number of Integrated Pest Management Participants

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	15000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the past decade and especially the past couple of years, new invasive pests have been identified through the work of the SDSU Plant Diagnostic Lab, SDSU Extension Specialists, and the SDSU Integrated Pest Management (IPM) program. Along with these new pest, current pest have shown evidence of developing pesticide resistance, as well as, resistance to common, mechanical management practices. The proper identification of pests and the use of proper IPM measures have a direct influence on the profitability of the farm operation.

What has been done
The South Dakota IPM Program is a collaborative effort between public and private agencies, multiple states, SDSU Extension, and the SDSU Research. Approximately 15,000 people attended 83 training events in 2018, which included one aerial applicator training, one state fair, Dakotafest, 52 private applicator trainings, ten commercial applicator trainings, seven minor category commercial applicator trainings, two IPM field schools, five field schools/workshops, and four wheat walks.

Results

Participants of the South Dakota IPM Program have increased their knowledge of pest biology, disease identification, pesticide label interpretation, pesticide handling, and environmental factors. This leads to increased use of IPM practices and objective, science-based decision-making on reducing risks from pests and preventing unacceptable levels of pest damage in both agricultural and residential settings. The increased use of IPM practices results in better pest management decisions which address the economic aspects of pest management while posing the least possible risk to people, property, resources, and the environment. In the long term, this also helps to reduce pesticide applications and amount of pesticides used.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

Increase Oilseed Crop Knowledge and Productivity and Profitability

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Release Spring Wheat Cultivars

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

No Data Entered

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No Data Entered

Key Items of Evaluation

No Data Entered

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Animals and Their 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
301	Reproductive Performance of Animals	21%		13%	
302	Nutrient Utilization in Animals	23%		21%	
303	Genetic Improvement of Animals	7%		3%	
304	Animal Genome	3%		0%	
305	Animal Physiological Processes	0%		7%	
306	Environmental Stress in Animals	4%		0%	
307	Animal Management Systems	7%		11%	
308	Improved Animal Products (Before Harvest)	10%		3%	
311	Animal Diseases	6%		24%	
313	Internal Parasites in Animals	3%		5%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	1%		0%	
315	Animal Welfare/Well-Being and Protection	15%		13%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	16.2	0.0	40.1	0.0
Actual Paid	15.7	0.0	50.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
319460	0	1167379	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
319460	0	1167379	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Collaborate with USDA Farm Service to Conduct Farm Bill Training
- Multistate partnership consortium for dairy producers
- Develop Vaccine Technologies
- Research Methodologies to Increase Reproductive Performance in Animals
- Conduct Research that Leads to Muscle Growth Augmentation
- Determine the Effects of Co-product Based Lamb Finishing Diets
- Increase Sheep Production Knowledge
- Coordinate Value-Based Marketing System for Cow-calf Operations
- Increase Beef Production Knowledge
- Conduct Ranch Visits

2. Brief description of the target audience

- Veterinarians
- Dairy Producers
- Producers of Ethanol Co-products
- Cattle Producers
- Swine Producers
- Muscle Biologists
- Livestock Nutritionists
- Sheep Industry
- Cow-calf Producers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	61099	44651	8220	5613

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	17	51	68

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Animals and Their Systems

Year	Actual
2018	38

Output #2

Output Measure

- Publish and Disseminate Results of Nutritional Studies in Sheep Diets
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of Learning Activities for Sheep Producers or Consumers

Year	Actual
2018	12

Output #4

Output Measure

- Demonstrate Value-Based Marketing to Cow-calf Producers

Year	Actual
2018	30

Output #5

Output Measure

- Create Learning Opportunities in the Beef Industry

Year	Actual
2018	9

Output #6

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2018	1

Output #7

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2018	106

Output #8

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2018	0

Output #9

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual
2018	98

Output #10

Output Measure

- Educate Producers with Information Impacting the Dairy Industry

Year	Actual
2018	86

Output #11

Output Measure

- Develop Approaches for Detection, Prevention and Control of Viral Diseases of Swine
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number of Animals and Their Systems Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	38

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Production costs are the determining factor in livestock producer profitability. High feed costs, poor reproductive performance, and disease are primary concerns for producers and scientists.

What has been done
Within the College of Agriculture, Food and Environmental Sciences, there are 38 Hatch projects that are categorized in the Planned Program of Animals and Their Systems. The research activities in this program are primarily supported by our Department of Animal Science, Department of Dairy and Food Science, and our Department of Veterinary and Biomedical Sciences. Projects include but are not limited to research studies to improve health and performance in dairy cattle, co-product feeds for sheep, and reproductive efficiency in cattle.

Results
Through research, we continue to build a scientific knowledge base to improve and understand production efficiency and product enhancement, and to prevent and detect animal and human diseases. Examples include: Early detection of subclinical diseases in dairy cows, enhance the innate immune system and speed repair of livestock wounds, growth-promoting implants in nursing calves, lamb finishing diets of soy hulls, DDG and treated corn stover, methods of controlling estrus and ovulation in cattle, and heifer growth performance on reduced fat distillers dried grains. In addition, graduate students gain valuable knowledge and skills while collaborating on research projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area

301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
304	Animal Genome
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
313	Internal Parasites in Animals
315	Animal Welfare/Well-Being and Protection

Outcome #2

1. Outcome Measures

Enable Further Research to Explore Diet Formulation Strategies for Feeding Ruminant Livestock

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of Individuals Participating in Sheep Production Learning Activities

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2165

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sheep and lamb inventory in the United States has been declining over the last few decades. Producers nationwide need to grow their flocks to meet the demands of wool and high quality lamb meat and at the same time keep their operations sustainable. The decline in sheep numbers

has a negative impact also on the infrastructure that supports the sheep industry such as sheep veterinarians, feed supplements and suppliers, sheep auction markets, sheep shearers and wool brokers to name a few.

What has been done
With its partners, such as American Sheep Industry Association, South Dakota Sheep Growers Association, SD Grassland Coalition, USDA NRCS, USDI-BLM, USFS, South Dakota Veterinary Association, South Dakota Livestock Marketing Association, and South Dakota Bankers Association, SDSU Extension continues to support the sheep industry with producer education programs. In particular, SDSU Extension's signature program, sheepSD, helps potential and beginning sheep ranchers enter and expand the sheep industry.

Results
During 2018, SDSU Extension personnel were involved in many events, reaching more than 2165 participants. Participants gained knowledge on many topics including grazing plans, sheep shearing, wool traits, technology in the sheep industry, the economic value of wool, the Sheep Safety and Quality Assurance program, integrating sheep into crop land grazing, lambing time and sheep management practices. Since 2012, a learning community called Growing South Dakota Sheep Producers was formed to support SD sheep producers. This group is comprised of more than 86 sheep producers, loan officers, sheep shearers, lamb marketing representatives and any industry related personnel who all have an interest in the sheep industry and collaborating with SDSU Extension.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
315	Animal Welfare/Well-Being and Protection

Outcome #4

1. Outcome Measures

Number of Cow-calf Operations Participating in the Calf Value Discovery Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	30

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The success of a cow-calf operation can come down to the marketing strategy employed by the producer. Retained ownership is a program that allows producers the opportunity to start with as few as five of their own calves and pool them with other calves to see how they perform in a feedlot. Retained ownership can provide the greatest opportunity to realize the true value of cattle, but it can also have increased economic risks.

What has been done
SDSU Extension coordinated the Calf Value Discovery Program, a retained ownership program in which 30 cow-calf operations participated with 487 calves. Eleven of these producers were beginning farmers/ranchers with less than 10 years of experience in cow-cow production. The calves were vaccinated, dewormed, individually identified, and weighed. They were consigned to a local feed yard where they were fed in a single pen, visually evaluated and sold in semi-load lots.

Results
The Calf Value Discover program provides feedback to producers on feeding performance and carcass characteristics of calves. The data provides a benchmark for comparison with cattle from other operations and it also provides useful guidelines for making selection and marketing decisions in the future. Several producers are using the data to influence their breeding program and some producers are using the data to market their calves for a higher price. Many beginning producers have limited information on how their calves fit into the market place and if their cattle are meeting the desired end-product. These beginning producers now understand the type of calves they are producing and what EPD parameters should be considered in their future sire selection.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #5

1. Outcome Measures

Number of Individuals Participating in Beef Production Learning Activities

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	73

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to the most recent USDA Census of Agriculture, the average age of U.S. producers is 58 and continues to increase. Continuity in land ownership and management requires the entry of new operators. Many beginning operators have limited experience and possibly limited knowledge about beef cattle enterprise operation, land management, and resource and business planning. BeefSD equips beginning ranchers to continue to feed the world as the population expands.

What has been done
Educational resources were provided that increased the management capacity of 73 participants in the current BeefSD class. Educational activities included: Conducted 1 Case Study Meeting, conducted 1 Regulatory Engagement Meeting, conducted 3 webinars, engaged participants through Social Media private site, participants completed the Calf Value Discovery program, half the group attended BEEF 20/20, half the group attended Grazing School workshop, and conducted a final one-day achievement meeting.

Results
Impacts obtained by the participants taking the Beef SD class reported the following (from surveys collected August 2018): 72% of participates have created their beef management team, 64% have made different beef production management decisions based on the information gained through the Beef 20/20 program, 93% increased the scope and understanding of consumers needs and perspective of the beef industry after returning from the east coast travel study trip, 93% have increased their beef industry network in South Dakota and outside of the state, 61% have developed a marketing plan and utilized it to make management decisions, and 58% have developed a production record keeping strategy after completing the program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #6

1. Outcome Measures

Sustain and Enhance Growth in Dairy Production

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	121000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As identified by stakeholders, the present issues and needs of the dairy industry in this region are focused on three areas: 1) Market Assessment and Accessibility, 2) Social License to Grow - public perception, and 3) Dairy Development - availability of labor, succession planning and natural resources.

What has been done
With its many partners and collaborators, SDSU Extension was involved in numerous events to present research based information to the dairy industry and the general public. Farm tours, workshops, expos, demonstrations, and festivals are all part of the outreach efforts to share information and knowledge about the dairy industry. The events were carried out to provide unbiased information, increase profitability, optimize resource management, and enhance learning communities and build partnerships.

Results
In an effort to continue to grow the dairy industry in support of more milk production that is needed for milk processing plants in the upper Midwest, South Dakota continues to be reported in the top 23 states by USDA due to our overall total pounds of milk being produced by the state. Cow numbers have increased along with the total average per cow production levels for the same month in the previous year. Presently estimated to have 121,000 head 118,000 head as of the September 2018 USDA Milk Production report versus 118,000 head in 2017, 115,000 head in 2016 and 107,000 head of milk cows for the same period in 2015. This is a 2.7% increase in cow numbers from the previous year. Annual production per cow also continues to be high with monthly production of 1,915 pounds/cow/month (August, 2018).

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #7

1. **Outcome Measures**

Reduce the Impact of Porcine Reproductive and Respiratory Syndrome Virus on Swine Producers

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

None.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No Data Entered.

Key Items of Evaluation

No Data Entered.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Agricultural, Natural Resource, and Biological Engineering

☑ 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
401	Structures, Facilities, and General Purpose Farm Supplies	50%		0%	
402	Engineering Systems and Equipment	12%		67%	
403	Waste Disposal, Recycling, and Reuse	28%		33%	
405	Drainage and Irrigation Systems and Facilities	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	9.7	0.0	3.3	0.0
Actual Paid	6.0	0.0	1.3	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**
122869	0	24495	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
122869	0	24495	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct Research to Characterize Microbial Samples
- Conduct Research to Produce Graphene from Biochar
- Conduct Research to Create New Sources of Biomass
- Conduct Drainage and Water Management Design Workshops

2. Brief description of the target audience

- Researchers
- Supercapacitor and Energy Industries
- Biofuel Industry
- Scientists
- Farmers
- Landowners
- Drainage Contractors

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	21456	15680	2886	1971

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	4	17	21

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Agricultural, Natural Resource, and Biological Engineering

Year	Actual
2018	1

Output #2

Output Measure

- Number of Subsurface Drainage Design and Water Management Workshops

Year	Actual
2018	1

Output #3

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2018	1

Output #4

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2018	6

Output #5

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2018	0

Output #6

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual
2018	0

Output #7

Output Measure

- Conduct Research to Characterize Microbial Samples
  Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Conduct Research to Create New Sources of Biomass
  Not reporting on this Output for this Annual Report

Output #9

Output Measure

- Conduct Research on Carbon Materials and Biofuel Technologies
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of Agricultural, Natural Resource, and Biological Engineering Hatch Research Projects
2	Number of Subsurface Drainage Design and Water Management Workshop Participants
3	Enhance Understanding of Bio-renewable Graphene Production

Outcome #1

1. Outcome Measures

Number of Agricultural, Natural Resource, and Biological Engineering Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research in bioenergy technology is needed to enhance energy independence for the United States.

What has been done
Within the College of Agriculture, Food and Environmental Sciences, there are 3 Hatch projects that are categorized in the Planned Program of Agricultural, Natural Resource, and Biological Engineering. Projects include bio-char based activated carbon, lignocellulosic based bio fuel, and the development of microorganisms to facilitate composting of plant materials.

Results
Through research, our Department of Agricultural and Biosystems Engineering has continued to build its knowledge base that impacts new innovations and design systems in agriculture. Examples include: Bio-char derived from activated carbon for water purification as well as applications into biomedical areas such as blood purification, the transformation of biochar into graphene to be used in supercapacitor energy storage devices, the development of biochemical or thermochemical pretreatment technologies that lead to the economical production of lignocellulosic based bio fuel, and to further characterize microbial samples that might have ability to both fix dinitrogen gas and break down some components of lignocellulose.

4. Associated Knowledge Areas

KA Code	Knowledge Area
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse

405 Drainage and Irrigation Systems and Facilities

Outcome #2

1. Outcome Measures

Number of Subsurface Drainage Design and Water Management Workshop Participants

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In this reporting period, subsurface drainage design workshops were not conducted by SDSU; however, one water management conference was held. South Dakota lakes, streams, and freshwater ecosystems are susceptible to impairment from sources such as livestock grazing, feeding operations, crop production, and natural sources. To keep these water resources protected, science-based knowledge is necessary for its sustainability.

What has been done
The 2017 Eastern South Dakota Water Conference was held on the campus of South Dakota State University (Nov. 2017). The conference covered the latest strategies and research for water managers and water users in the Northern Great Plains. Presenters from South Dakota, North Dakota, Iowa, and Minnesota were in attendance. The theme for the conference was South Dakota's Water Resources: Where Are We Headed and How Are We Going To Get There?

Results
Approximately 200 attendees from academia, agriculture interest groups, government agencies, and stakeholders gained knowledge and have a better understanding of the current focuses of concern of regional water resources. Participants increased their knowledge of nutrient reduction strategies, soil health, drainage water management, financial liabilities, and the fate and transport of E. coli in South Dakota waters. The knowledge gained will assist the participants when adapting proper land use practices aimed at improving water quality. It will also help government policy makers make informed decisions on water related issues.

4. Associated Knowledge Areas

KA Code	Knowledge Area
405	Drainage and Irrigation Systems and Facilities

Outcome #3

1. **Outcome Measures**

Enhance Understanding of Bio-renewable Graphene Production

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Competing Programmatic Challenges

Brief Explanation

No Data Entered

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No Data Entered

Key Items of Evaluation

No Data Entered

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food and Non-Food Products: Development, Processing, Quality, and Delivery

☑ 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
501	New and Improved Food Processing Technologies	10%		55%	
502	New and Improved Food Products	0%		9%	
504	Home and Commercial Food Service	45%		0%	
511	New and Improved Non-Food Products and Processes	10%		27%	
703	Nutrition Education and Behavior	25%		9%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.2	0.0	11.7	0.0
Actual Paid	1.2	0.0	14.5	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**
24574	0	351920	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
24574	0	351920	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Evaluate Native Plants for Medicinal Uses
- Conduct Research to Enhance the US Dairy and Food Industry
- Conduct Research on Co-products of Corn and Soybeans
- Research and Improve Biofuel Production Processes
- Conduct BBQ Bootcamp Workshops
- Partner with South Dakota Beef Industry Council
- Partner with South Dakota Pork Producer's Council

2. Brief description of the target audience

- Native Americans
- US Dairy Industry
- Farmers
- Biofuels Industry
- Beef Science Community
- Beef Producers
- Food Businesses
- Consumers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5825	4257	783	535

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	16	16

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Food and Non-Food Products: Development, Processing, Quality, and Delivery

Year	Actual
2018	11

Output #2

Output Measure

- Developed a Strong Research Program to Enhance the US Dairy and Food Industry
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Extract and Analyze Oilseeds to Determine Biofuel Production Suitability
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of BBQ Bootcamp Workshops

Year	Actual
2018	3

Output #5

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2018	10

Output #6

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2018	8

Output #7

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2018	6

Output #8

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual
2018	1

Output #9

Output Measure

- Conduct Research to Utilize Milk Components in Dairy Products
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of Food and Non-Food Products: Development, Processing, Quality, and Delivery Hatch Research Projects
2	Increase Knowledge of Structure-Function Relationships of Milk Proteins
3	Increase Knowledge for Obtaining Maximum Oil Yields
4	Number of BBQ Bootcamp Participants

Outcome #1

1. Outcome Measures

Number of Food and Non-Food Products: Development, Processing, Quality, and Delivery Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The challenge today of producing enough food, fiber and fuel for more than 9.5 billion people by 2050 is almost daunting, especially because it needs to be accomplished using less land, less water and less energy than is used today. Science driven technologies must be developed for this to be achieved in a sustainable manner.

What has been done
Within the College of Agriculture, Food and Environmental Sciences, there are 7 Hatch projects that are categorized in the Planned Program of Food and Non-Food Products: Development, Processing, Quality, and Delivery. Research activities in this program are primarily supported by our Dept. of Agricultural and Biosystems Engineering, Department of Dairy and Food Science, and our Department of Biology and Microbiology. Projects include but are not limited to emerging technologies in dairy manufacturing and technologies for improving food safety.

Results
Through research, we continue to build a scientific knowledge base to improve and understand food and non-food products. Examples include: Controlling and optimizing dairy product properties, identifying medicinal uses of plants traditionally used by Native Americans, upgrading bio-oils into hydrocarbon biofuels, the manufacture of modified milk protein concentrates to be used as ingredients in food products, improved health and nutrition benefits from dairy products, and the development of an oilseed based biofuel industry biodiesel, bio-jet fuel, oil additives, and specialty lubricants that can help reduce our dependence on petroleum-based products. The biofuel industry also provides opportunities for agricultural diversification and rural sustainability in South Dakota.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
511	New and Improved Non-Food Products and Processes

Outcome #2

1. **Outcome Measures**

Increase Knowledge of Structure-Function Relationships of Milk Proteins

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Increase Knowledge for Obtaining Maximum Oil Yields

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Number of BBQ Bootcamp Participants

2. **Associated Institution Types**

- 1862 Extension

3a. **Outcome Type:**

Change in Knowledge Outcome Measure

3b. **Quantitative Outcome**

Year	Actual
2018	935

3c. **Qualitative Outcome or Impact Statement**

Issue (Who cares and Why)
In recent years, there has been a lot of negative information surrounding meat products. Often this information is incorrect and misleading, leaving the consumer grasping for answers. Consumers have expressed the need for trusted science-based information to base their

decisions upon. Consumers are also unsure of the proper way to handle and prepare meat to ensure both safety and quality.

What has been done

SDSU Extension conducted three full workshops (two in Sioux Falls and one in Brookings), and one modified program in Sioux Falls. The full workshops, which had 135 participants, provided intensive, hands-on opportunities for consumers to enhance their understanding of meat cookery, barbequing, smoking, food safety, meat selection, and nutrition. The modified program in Sioux Falls, which had 800 participants, informed consumers of the nutrition and convenience of beef tri-tip.

Results

Participant evaluations indicate the workshops were very successful in educating consumers. According to participant evaluations the program greatly enhanced their understanding of cookery, selection, and nutritional content of common beef cuts as shown by the 2.2 unit increase in knowledge. Additionally, the participants viewed the program as extremely beneficial as they rated the program at 9.7 out of a possible 10 points.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

No Data Entered

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No Data Entered

Key Items of Evaluation

No Data Entered

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Economics, Markets, and Policy

☑ 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
601	Economics of Agricultural Production and Farm Management	36%		30%	
602	Business Management, Finance, and Taxation	32%		0%	
603	Market Economics	10%		20%	
604	Marketing and Distribution Practices	10%		0%	
605	Natural Resource and Environmental Economics	5%		10%	
607	Consumer Economics	7%		20%	
608	Community Resource Planning and Development	0%		10%	
610	Domestic Policy Analysis	0%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	7.6	0.0	15.0	0.0
Actual Paid	6.0	0.0	4.0	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**
122869	0	104212	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
122869	0	104212	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Analyze Supply Chain Management Strategies
- Analyze Farm Real Estate Market Developments
- Analyze Agricultural Commodity Prices
- Research Trends and Financial Risks
- Develop Marketing Strategy Recommendations
- Conduct Ag Workshops

2. Brief description of the target audience

- Agricultural Commodity Groups
- Policy Makers
- Environmental Groups
- Farmers, Ranchers
- Producers
- Ag Land Owners
- Women in Agriculture
- Youth
- Agricultural Leaders

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	25813	18864	3472	2371

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	4	6	10

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Economics, Markets, and Policy

Year	Actual
2018	3

Output #2

Output Measure

- Number of Ag CEO Workshops
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2018	9

Output #4

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2018	24

Output #5

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2018	1

Output #6

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual
2018	9

Output #7

Output Measure

- Conduct Research to Enhance Rural Sustainability and Quality of Life

Year	Actual
2018	0

Output #8

Output Measure

- Conduct Farm Bill Training
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of Economics, Markets, and Policy Hatch Research Projects
2	Number of New Participants in the Ag CEO Program
3	Enhance Sustainability and Quality of Life in Rural South Dakota

Outcome #1

1. Outcome Measures

Number of Economics, Markets, and Policy Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The economy is always changing and as new problems arise, research programs are needed to focus on the efficiency of crop and livestock sectors, sustainability of the food and fiber system, and rural development.

What has been done
Within the College of Agriculture, Food and Environmental Sciences, there are 10 Hatch projects that are categorized in the Planned Program of Economics, Markets, and Policy. The research activities in this program are supported by our Department of Economics. Hatch funded projects include but are not limited to the economics of a bio-based industry, price behaviors of agricultural commodity derivatives, enhancing rural sustainability and quality of life, market studies for South Dakota produced beef, and agricultural land market trends.

Results
Through research, our Department of Economics continues to build a scientific knowledge base to improve agricultural marketing and trade, farm and ranch management, and agricultural policies. Examples include: The development of modeling and systems approaches to support sustainable biomass production, scientific and practical needs of flexible models for agricultural commodities, gender-based information for entrepreneurs in rural South Dakota, development of a marketing strategy for finished cattle, agricultural and international trade policy issues in the Northern Great Plains, commodity characteristic values of Hard Red Spring Wheat, and land markets and land management in South Dakota.

4. Associated Knowledge Areas

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

603	Market Economics
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
607	Consumer Economics
610	Domestic Policy Analysis

Outcome #2

1. Outcome Measures

Number of New Participants in the Ag CEO Program

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Enhance Sustainability and Quality of Life in Rural South Dakota

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	57

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
South Dakota has around 390 places (cities, towns, communities). Only eleven of those places have a population of more than 10,000 according to the 2010 US Census. Only 8 more are added if you count places with more than 5,000. Therefore, rural community sustainability in crucial for the state?s vitality. To thrive in South Dakota, rural communities must be resilient which forces communities to innovate. Communities can learn from one another as a way to share successful community innovations.

What has been done
The SDSU Community Vitality Team and the Community of DeSmet (Pop. 1067) hosted the Energize! Exploring Innovative Rural Communities Conference on May 2018. The event was held in downtown De Smet businesses. Shop owners and managers shared their entrepreneurial

journeys, while speakers and presenters shared their experiences & knowledge on a variety of topics: Funding for Community Projects, Entrepreneurial Experiences, Agritourism and Value Added Agriculture, and Engaging Community Members.

Results
The conference was attended by 110 people from 57 communities. The Community Vitality team found, via a survey, that the Energize! Conference had just over an $18,000 economic impact for the community of De Smet. The dollars generated from this event are brought in from outside the area - that means new money circulating within De Smet.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

No Data Entered

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No Data Entered

Key Items of Evaluation

No Data Entered

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Human Nutrition, Food Safety, and Human Health and Well-Being

☑ 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
702	Requirements and Function of Nutrients and Other Food Components	0%		43%	
703	Nutrition Education and Behavior	36%		14%	
704	Nutrition and Hunger in the Population	17%		0%	
724	Healthy Lifestyle	47%		43%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	11.9	0.0	11.7	0.0
Actual Paid	16.9	0.0	13.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
344033	0	296977	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
344033	0	296977	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct Community Garden Workshops
- Conduct Research on Bioactive Food Components
- Conduct Research for the Prevention and Treatment of Obesity
- Conduct Research to Understand Nutrient-gene Interactions
- Teach Food Safety Programs
- Conduct Home Food Preservation Workshops
- Conduct Local Food Entrepreneur Programs
- Develop Nutrition and Physical Activity Curriculum
- Conduct Workshops for the Aging and Senior Citizens

2. Brief description of the target audience

- Nutrition and Food scientists
- Health Educators
- Minority Audiences
- Food Entrepreneurs
- Consumers of Food Products
- Local Schools
- Youth
- Senior Citizens

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	65931	48182	8870	6057

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	6	26	32

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Human Nutrition, Food Safety, and Human Health and Well-Being

Year	Actual
2018	10

Output #2

Output Measure

- Number of Food Processing and Food Marketing Events
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of Gerontology Events Presented

Year	Actual
2018	4

Output #4

Output Measure

- Number of Healthy Living Events that Created Learning Opportunities

Year	Actual
2018	11

Output #5

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2018	80

Output #6

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2018	36

Output #7

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2018	5

Output #8

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual
2018	5

Output #9

Output Measure

- Number of Garden Development or Enhancement Workshops and Webinars Conducted

Year	Actual
2018	24

Output #10

Output Measure

- Increase Quality of Life for Refugees in South Dakota
  Not reporting on this Output for this Annual Report

Output #11

Output Measure

- Conduct Research on the Role of Vitamin D, Calcium and Bioactive Food Components
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number of Human Nutrition, Food Safety, and Human Health and Well-Being Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Obesity is a major concern within the United States and specifically within South Dakota. It is related to poor nutrition, the lack of physical activity and increased sedentary behavior. Obesity has been associated with increased risk for many chronic diseases. Obesity research in rural populations is lacking. To improve individual's health, scientific discoveries need to be found and translated to practice.

What has been done
Within the College of Agriculture, Food and Environmental Sciences, there are 7 Hatch projects that are categorized in the Planned Program of Human Nutrition, Food Safety, and Human Health and Well-Being. Research in this program is supported by our partnership with the College of Education and Human Sciences. Hatch funded projects include research involving functionality traits of wheat dough, intervention to improve healthful behaviors in young adults, and dietary influences on obesity and chronic inflammation.

Results
Through research, we continue to build a scientific knowledge base to understand and improve nutritional sciences. Examples include: Development of a vacuum dough expansion system for predicting bread loaf volume, implications that an increased intake of vitamin D and calcium may be beneficial for the prevention of obesity, understanding and preventing the underlying mechanisms of chronic diseases, innovative approaches to increase healthy nutrition and physical activity in rural populations, behaviors that support healthful lifestyles in young adults, and determining the impact of dietary components. In addition, graduate students gain valuable knowledge and skills while collaborating on research projects.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of Food Processing and Food Marketing Participants

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	138

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food safety is a subject that is not well understood by the general public. Many consumers follow unsafe food safety practices when it comes to food preservation. Additionally, there are small food processors that desire to sell products at Farmers Markets and retail stores. Furthermore, there are small food processors in South Dakota that must comply with Food & Drug Administration (FDA) and Food Safety Modernization Act (FSMA) regulations.

What has been done
Twelve food preservation workshops have taken place across the state of South Dakota. During these workshops, participants were provided with the education needed to be able to practice proper home food preservation techniques via hands-on experience of water bath and/or pressure canning fresh foods such as salsa, pickles, or carrots. At the end of the workshop, participants were able to take home a jar of the freshly preserved food they helped prepare. Education was based on the USDA Guidelines for Safe Home Food Processing.

Results
In total, 138 South Dakotans participated in a food preservation workshop provided by SDSU Extension. Participants in workshops in tribal communities gained hands on knowledge in using traditional foods such as chokecherries and other small fruits as well as discussion on how game meats, squash and herbs can be preserved. Twenty-one (21) canned products were evaluated to

allow Food Entrepreneurs to sell the canned goods at Farmers Markets. Reviewed and wrote or assisted in writing 4 FSMA Food Safety Plans. This work allows the small food processors to be FSMA compliant according to the new regulations. Assisted several processors in understanding state and federal regulations to ensure processor compliance to regulations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #3

1. Outcome Measures

Increase Knowledge of Aging Issues to Participants

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	325

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Gerontology is the scientific study of aging at the individual, family and community level. Applying this science in South Dakota has the following potential impacts: (1) Accurate knowledge about aging may enhance health and wellbeing outcomes. (2) South Dakotans with improved health and wellbeing outcomes may require less government resources (Medicaid, Medicare, etc.). (3) Healthy citizens are more likely to be engaged in their communities, and can provide human capital necessary to strengthen their communities.

What has been done
The increase in the number of older people (65+) in South Dakota is arguably one of the most significant social changes of our time. This change will require innovative, collaborative efforts in communities and organizations across the state. Older people are commonly discussed as a uniform group with similar needs and wants. While similarities exists, the differences may be more important to decision makers and planners. South Dakotans of all ages need a more holistic understanding of older South Dakotans.

Results

Aging Gracefully Expo (AGE): Based on lessons learned during the 2017 statewide pilot, a Planning Guide for Remote Locations was developed. Three communities participated in the 2018 Aging Gracefully Expo. 225 people participated in AGE in Rapid City as either vendors, attendees, or volunteers. Approximately 100 people participated remotely by viewing the webcast as either individuals or in coordinated community settings. Lessons learned combined with target audiences feedback will be used to inform the refinement of AGE.

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Number of Participants Involved in Healthy Living Learning Opportunities

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	10200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Obesity, poor nutritional habits, low levels of physical activity, and chronic diseases adversely affect the quality of life in South Dakota. The problem is not limited to adults; children in South Dakota have higher than average risks for obesity and diabetes. Risk behaviors for all ages need to be modified to prevent or greatly reduce the risk for developing health related problems and diseases.

What has been done
Through partnerships, SDSU Extension is involved in many programs that help create or maintain healthy living environments. Wellness coalitions have been established by several rural communities to address community health and wellness. South Dakotans with chronic diseases learn to live with their conditions through self-management workshops conducted across the state. A worksite wellness program helps businesses target the health and well-being of the South Dakota workplace.

Results
By working with many organizations, including healthcare providers, health professionals, advisory groups, and the South Dakota Department of Health, SDSU Extension impacts thousands of individuals. Wellness coalitions have implemented interventions that promote access to fruits and vegetables, increase healthy eating behaviors, and to provide access to physical activity opportunities. One project in a minority community resulted in school policy changes that will improve academic performance by allowing time for physical activity, healthy eating education, and allowing more time for children to eat breakfast. All these actions are empowering community members to live healthy lifestyles.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number of Community or School Gardens Receiving Assistance with Development or Enhancement

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of New Roots for New Americans Program Participants

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Prevent Obesity and Obesity Related Disorders

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to the Center for Disease Control and Prevention (CDC), 65% of adults and 25% of youth in South Dakota were considered overweight or obese. In addition, 46% of adults and 72% of adolescents in South Dakota are inactive. Evidence shows that low levels of physical activity are a strong contributor to obesity, which can lead to several different chronic conditions that can have negative lifelong affects. Many South Dakota communities lack environments that support regular physical activity.

What has been done
SDSU Extension has aimed to address the scarcity of physical activity access through multiple avenues, educational programming efforts include the following: The Traditional Native American Games, SDSU Extension partnered with local entities to provide opportunities of Pop-up play events, Steps to Wellness (STW) Physical Activity project in South Dakota worksites to enhance or improve the physical activity environment of the worksite, and the Park Rx project.

Results
In partnership with International Traditional Games Society, 55 adults have been trained and certified to teach Traditional Games to others, increasing the total number of trained South Dakotans to 173, with over 1,200 SD participants. Three pop-up play events took place, reaching 223 youth and engaging 10 volunteers. A Let's Get Healthy youth 5K event on the Standing Rock Reservation was held with 40 youth participating. The Steps to Wellness (STW) project has provided training to 39 worksites. The worksites received grant funding and technical assistance to enhance physical activity environments for employees. The Park Rx project had a total of 81 healthcare providers participating, located in over 40 Healthcare Clinics and Locations across the state.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

No Data Entered

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No Data Entered

Key Items of Evaluation

No Data Entered

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Families, Youth and Communities

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
205	Plant Management Systems	3%		40%	
704	Nutrition and Hunger in the Population	18%		0%	
801	Individual and Family Resource Management	13%		0%	
802	Human Development and Family Well-Being	12%		60%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	14%		0%	
806	Youth Development	40%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	42.1	0.0	1.7	0.0
Actual Paid	53.0	0.0	1.3	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**
1081248	0	11700	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1081248	0	11700	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Research that Examines Financial Savings Behavior
- Build Community Capacity
- Conduct Activities on Tribal Reservations
- Promote Financial Literacy
- Conduct Leadership Workshops
- Deliver Healthy Living Programs
- Conduct Character Education Program Training

2. Brief description of the target audience

- Low to Moderate Income Families
- Rural Communities
- Entrepreneurs
- Youth
- Teenagers
- Native Americans
- Consumers of Food Products
- Local Schools
- Youth Program Leaders

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	206034	150570	27719	18929

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	2	4	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Families, Youth and Communities

Year	Actual
2018	1

Output #2

Output Measure

- Number of Teens Trained in the Teens as Teachers Program
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of High School Students Selected as 4-H Hometown Hero Representatives
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of Communities Hosting the Ripple Effect Mapping

Year	Actual
2018	12

Output #5

Output Measure

- Number of Events Conducted on Native American Reservations

Year	Actual
2018	550

Output #6

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2018	74

Output #7

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2018	171

Output #8

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2018	8

Output #9

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual
2018	8

Output #10

Output Measure

- Conduct Activities that Build Community Capacity

Year	Actual
2018	8

Output #11

Output Measure

- Create Financial Literacy Learning Opportunities

Year	Actual
2018	34

Output #12

Output Measure

- Conduct Character Education Programs and Activities

Year	Actual
2018	12

Output #13

Output Measure

- Create Learning Opportunities for Youth

Year	Actual
2018	21

Output #14

Output Measure

- Create Resource Management Learning Opportunities
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number of Families, Youth and Communities Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There are concerns that the savings rate of American households, especially low and moderate income households is inadequate, leaving families extremely vulnerable to economic setbacks. Additionally, research indicates that there is a link between financial security and over-all health. Unhealthy families are not able to fully socially and economically contribute to their communities.

What has been done
Within the College of Agriculture, Food and Environmental Sciences, there is five Hatch projects categorized in the Planned Program of Families, Youth and Communities. The research activity in this program is supported by our partnership with College of Education and Human Sciences.

Results
Through research, we continue to build a scientific knowledge base to improve and understand the sociological factors associated with personal finance. A cross-cultural survey on college student financial management behavior was created and administered at South Dakota State University and in Korea. Compared to Korean college students, the SDSU students had more debt and financial stress, but were more optimistic about their economic future.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #2

1. **Outcome Measures**

Number of Students Taught by Teens as Teachers

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Number of Elementary Students Impacted by 4-H Hometown Hero Representatives

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Ripple Effect Mapping Participants

2. **Associated Institution Types**

- 1862 Extension

3a. **Outcome Type:**

Change in Knowledge Outcome Measure

3b. **Quantitative Outcome**

Year	Actual
2018	65

3c. **Qualitative Outcome or Impact Statement**

Issue (Who cares and Why)
South Dakota communities seeking to understand impacts of community initiatives have an evaluation tool at their disposal. Ripple Effects Mapping (REM) is implemented by SDSU Extension with community groups to capture and communicate accomplishments, as well as further community member's enthusiasm for taking action on issues. REM sessions combine several evaluation techniques to produce "maps" that tell the story of a program. The depth and specificity of information captured in a ripple map also benefits communications.

What has been done

In 2018 twelve communities wanted to document the work of their wellness coalitions. Ripple Effect Mapping was conducted in Kyle, Martin, Lakota Homes (Rapid City), Parmalee, Herreid, Elk Point, Lower Brule, Fort Thompson, Wagner, Dupree, McLaughlin and Lake Andes. The process energizes the community as they reflect on all the impacts that have happened in the community.

Results
Ripple Effects Mapping engaged and re-energized 65 participants from 12 South Dakota communities. With the REM completed SDSU Extension and the communities have evidence of impacts. With careful analysis of the impacts SDSU Extension can adjust programming to better meet the needs of South Dakota communities. Overall this will make the effort more sustainable because funding will only be used in areas and programming that has the greatest impact.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number of Participants Involved in Native American Reservation Events

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	12105

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There are many agriculture related issues that need to be addressed on South Dakota's reservations. Access to nutritious food is limited. The knowledge of traditional foods is getting lost. Many tribal land owners own fractionated allotments of land and lack the knowledge of how to lease the land or obtain funding. The rangelands are sometimes overgrazed or the plants are exposed to pesticide overspray. There is a huge interest for agriculture programs on the reservations.

What has been done

SDSU Extension has Tribal Extension Program offices at Cheyenne River, Pine Ridge, Rosebud, and Lower Brule Reservations. Nutrition Assistants, 4-H Program Advisors, and Field Specialists all provide leadership and outreach activities to the Native American communities. In collaboration with its partners, SDSU Extension conducted horticulture, agriculture, and gardening workshops, food preparation and preservation classes, workshops that focus on wild and native foods and herbs, and participated in farmers markets.

Results
Native American Reservation communities in South Dakota benefit greatly from SDSU Extension's efforts. Members of all ages gained knowledge in many areas. Wellness coalitions have helped in the implementation of interventions that promote healthy behaviors. New community gardens are providing access to fresh fruits and vegetables that were otherwise not available. Participants in workshops in tribal communities gained hands on knowledge in using traditional foods such as chokecherries and other small fruits, as well as discussion on how game meats, squash and herbs can be preserved. The Partnership with Native Americans program assisted with implementing emergency preparedness in SD Native American communities.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Enhance Rural Community Sustainability in South Dakota

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	57

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
South Dakota has around 390 places (cities, towns, communities). Only eleven of those places have a population of more than 10,000 according to the 2010 US Census. Only 8 more are

added, if you count places with more than 5,000. Therefore, rural community sustainability is crucial for the state's vitality. To thrive in South Dakota, rural communities must be resilient, which forces communities to innovate. Communities can learn from one another as a way to share successful community innovations.

What has been done
The SDSU Community Vitality Team and the community of DeSmet (Pop. 1067) hosted the Energize! Exploring Innovative Rural Communities Conference on May 2018. The event was held in downtown DeSmet businesses. Shop owners and managers shared their entrepreneurial journeys, while speakers and presenters shared their experiences & knowledge on a variety of topics: Funding for Community Projects, Entrepreneurial Experiences, Agritourism and Value Added Agriculture, and Engaging Community Members.

Results
The Energize! Exploring Innovative Rural Communities Conference was attended by 110 adults from 57 South Dakota communities. The Community Vitality team found, via a survey, that the Energize! Conference had more than an $18,000 economic impact for the community of DeSmet. The dollars generated from this event were brought in from outside the area; this means new money circulating within DeSmet.

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

Increase Family and Personal Financial Literacy to Participants

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	406

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
College student's limited experience managing their finances independently, coupled with low

financial knowledge, creates a long-term issue with financial well-being. Additionally, students leaving college do not fully understand their options regarding student loan repayment. Research has found that borrowers: are not well informed; are not provided with information necessary to make an informed decision; and lack accurate knowledge about student loans and their repayment.

What has been done
To learn more about SDSU student's financial knowledge, during the fall 2017, a survey was administered to 2,000 freshman. Two hundred and ten (210) participants completed the survey for a response rate of 10.5%. To address college student financial wellness, the free personal finance website, CashCourse, was used as a tool to teach college students about personal financial management. SDSU Extension presented twenty-nine (29) presentations to 678 students about developing budgeting, saving, and tracking spending skills.

Results
Four hundred six (406) students completed at least one CashCourse (financial knowledge) activity with 86% accuracy and eight-nine (22%) students completed at least 2 CashCourse activities. Freshman survey results: 67% reported knowing more about personal finance after taking a course in high school, objective financial knowledge mean score was 70.4% and 76% indicated being interested in a campus course about personal finance.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #8

1. Outcome Measures

Build Good Character in South Dakota's Youth

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1295

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Today's youth are continually exposed to negative role models and high risk behaviors, leading to higher incidences of bad decision making. With 82% of South Dakota's parents working outside of the home it is essential for educators and practitioners to assist youth in learning how to make better decisions.

What has been done
Character All Stars is an SDSU Extension 4-H train-the-trainer program which selects teens from numerous high schools across South Dakota and then provides these teens with character development training. Once trained, the teens return to their local school districts and provide a version of the training to their peers.

Results
Twelve (12) teens were selected as a Character All Star in 2018. Collectively, they reached 1,295 youth with a positive leadership and character education message using an Extension curriculum titled, iRespect.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #9

1. Outcome Measures

Develop Life Skills for Youth

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	300

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Less than 1% of the population is now directly involved in farming. In addition, it is extremely difficult for the Millennial Generation to get started in farming due to the lack of capital resources. And there is a shortage of qualified workers in certain areas of the agriculture industry. We must reach rural and urban youth to educate them about the possibilities of careers in agriculture.

What has been done

With many partners, SDSU Extension reached South Dakota youth through many programs and events. A three-day Dairy Fest celebration was held. Through this event, dairy farmers, processors, and industry leaders brought the community together for the public to learn about dairy production. Seven (7) Dairy Cattle Judging schools were conducted for youth ages 8 to 18 throughout South Dakota that teach youth important life skills such as decision making, enhanced public speaking skills, and how to properly evaluate an animal.

Results
As our South Dakota youth continue to learn about agriculture and life skills, many will be the next generation that will keep the agriculture industry in South Dakota sustainable. Our youth gained valuable life skills in animal evaluation, quality standards, processed dairy products, profitable production practices, confidence and resilience building, decision making, and public speaking. It is extremely important that we reach out to the young to prevent a shortage of people working in the agriculture industry. More than 300 youth participated in 10 educational events.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #10

1. Outcome Measures

Increase Individual and Family Quality of Life

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

No Data Entered

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No Data Entered

Key Items of Evaluation

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
4638	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)	
133	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.