2019 Annual Report of Accomplishments and Results

South Dakota
SDSU Extension
SDSU Agricultural Experiment Station

I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your Plan of Work. Use this space to provide updates to your state or institutions as needed.

1. Executive Summary (Optional)

Our activities in 2019 best reflect our critical issues laid out in our 2020 Plan of Work.

No updates.

II. Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Process	Updates
1. The Merit Review Process	No updates
2. The Scientific Peer Review Process	No updates

III. Stakeholder Input

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Stakeholder Input Aspects	Updates
1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation	No updates
2. Methods to identify individuals and groups and brief explanation.	No updates
3. Methods for collecting stakeholder input and brief explanation.	No updates
4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders.	No updates

IV. Planned Program Table of Contents

V. Planned Program Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). See Section V of the Guidance for information on what to include in the qualitative outcomes or impact statements. Add additional rows to convey additional accomplishments. You may expand each row as needed.

No.	Title or Activity Description	Outcome/Impact Statement	Planned Program Name [Critical Issue]/No.
1.	SDSU Extension: **Dakotas Housing Study**	The Dakotas Housing Study project explores the beliefs that residents of North Dakota and South Dakota have about aging in place; and accessible and universal design in residential settings. **What is the issue? Who cares and why?** Older adults across the country report a preference to remain in their home and community as they enter later stages of life. South Dakotans share this preference, with 89% indicating that it was either 'very' or 'somewhat important' to receive end-of-life care at home. Unfortunately, a discrepancy exists between consumer preferences and housing options available in the current stock of homes. Most homes are missing one or more basic accessibility features; so homes may not be aging-in-place ready. A design solution called *Universal Design* is available, but implementation has been sparse. South Dakota has 843,190 people and 125,635 are 65 years and older (14.9 percent of the population). The shortage of individuals to provide direct assistance and support to older adults and people with disabilities is well documented. What is less acknowledged is the role that home design plays in whether or not an individual needs a formal or informal person to provide assistance with activities of daily living. Increasing the implementation of universal design practices in private housing may reduce the demand for informal and formal caregivers. Beyond addressing the demand for caregivers and providing older adults with the independence they have earned, increasing the implementation of	Families, Youth, and Communities / #1

		universal design may offer additional benefits to communities (e.g., improve health and wellness among older adults, which reduces strain on the health care system). **What has been done:** An exploratory research study was conducted in North Dakota and South Dakota to increase knowledge about existing gaps in consumer knowledge, motivation and barriers to implementation of accessible and universal housing design options in housing. A literature review was conducted fall of 2017 to explore current scientific research on housing for older adults. Data collection took place between January and March 2018. **Results reported from this project include:** Over 600 people from South Dakota and North Dakota participated in the Dakotas Housing Study. • Participants were aware that delaying investment in housing designed to support successful aging in place has financial implications for families. • Homes that meet the changing needs of families over time are largely absent in the current housing stock in South Dakota and North Dakota. • Affordable housing for older adults may be poorly understood. • Jargon and terminology play an important role in consumer perception. • Dakotas Housing Study results were presented at five conferences in 2019. Research indicates that individuals, families, and communities may benefit by increasing the implementation of design solutions to support successful aging in place. The project resulted in a published report, Housing Across the Life Span: Consumer knowledge, preferences, and barriers"	

		https://extension.sdstate.edu/housing-across-life-span-consumer-knowledge-preferences-and-barriers.	
2.	SDSU Extension: **Increasing 4-H Camp Access in South Dakota**	A unique outdoor education partnership strengthened 4-H program equity and social skills among military and tribal youth. These youth audiences face significant barriers to positive youth development (PYD), including frequent relocations, feelings of isolation, and lack of meaningful activities and resources. Many traditional programming efforts to reach these audiences have over-emphasized low dosage interventions with limited success. The Camp Access Grant partnership provided a high dosage intervention to strengthen social and workforce development skills for these underrepresented youth. **What is the issue? Who cares and why?** The USDA-NIFA 2025 National 4-H Strategic plan focuses heavily on increasing participation and equity. The plan envisions a 4-H program that has elements of inclusion, caring adults, serving at minimum 1 in 5 youth, and the volunteers and staff reflect the diversity of the population. Upon reaching the participation benchmark in 2018 by serving 22% of eligible youth, South Dakota 4-H began a comprehensive effort to strengthen equity. A scan of the equity landscape in South Dakota revealed three underrepresented youth audiences: recent immigrants, military, and tribal. This report describes a social development initiative to strengthen equity (and therefore PYD) among two of these audiences--military and tribal. **What has been done?** The South Dakota 4-H program received a $35,000 multi-year grant from the Margaret A. Cargill Philanthropies. In its first year, this Camp Access Grant served 18 youth from the Pine Ridge and Rosebud Reservations, as well as 56 youth from military families. Because many of these youth lack the comprehensive resources to attend an overnight camp, the grant provided not only scholarships, but also transportation and necessary supplies.	Families, Youth, and Communities / #1

		Each camper attended an age-appropriate 4-H camp in their part of the state. These multi-day camps provided opportunities to strengthen social and emotional learning (SEL). SEL helps youth to identify and manage their emotions, make good choices, and overcome challenges with persistence and teamwork. High-dosage youth programs like 4-H camps help youth to develop SEL skills by creating opportunities such as: • Try meaningful roles on behalf of their cabin or small group • Problem-solve challenges during all-camp activities • Navigate the emotional ups and downs of being away from home **Results reported from this project include:** Thanks to the Camp Access Grant, 74 under-represented youth joined 250 others in South Dakota 4-H camps in 2019. Collectively, these youth attained beneficial outcomes in several SEL assessments, including: • Relationships: 92% strengthened problem-solving skills in a team or cabin activity. • Social awareness: 84% tried at least one new leadership or group role. • Self-awareness: 44% experienced a long-term overnight away from home for the first time. • In addition, 96% of participants strengthened workforce development skills by enhancing awareness of at least one new outdoor-based career activity. Outdoors/tourism is the #2 industry in South Dakota.	
3.	SDSU Research: **Identifying Weight Related Behaviors for Obesity Prevention and Wellness**	This project developed a potential framework for creating community-focused, sustainable, and effective adolescent obesity prevention programs using a mixed methods approach. **What is the issue? Who cares and why?** Excessive weight gain is associated with increased risk of developing many serious diseases, including cardiovascular disease, hypertension, and type	Food Systems, Nutrition, Health, and Well-Being / #2

		2 diabetes. Despite extensive efforts to promote weight management, these efforts only reach a small proportion of the at-risk population, while programs promoting individual change may have limited effectiveness in environments that promote weight gain. Obesity currently affects 17% of children and adolescents and greater than 30% of adults in the United States. Using the ecological perspective to understand how different factors interact to influence food and physical activity behaviors, we can inform more tailored interventions that lead to lasting behavior change. Therefore, research is needed to elucidate the combination of individual and environmental factors associated with unhealthy weight gain among our targeted population of young adults. The purpose of this project is to develop and implement a model to measure effectiveness and sustainability of community obesity prevention programs and/or interventions. To begin the work in the lower socioeconomic communities, an in-depth interview was conducted by a South Dakota State University Extension Nutrition Assistant. Participating in the study were 1,052 high school students from two separate high schools in South Dakota and 138 enrolled college students from South Dakota State University. **What has been done:** Many young adults experience unwanted weight gain upon entering college. Making healthy choices, in a food environment with a plethora of convenience and fast foods, is important for preventing unwanted weight gain. This project determined if a Healthy Campus Dining Tour intervention improves perception, behavior, and priorities related to healthier choices on campus. Intervention participants completed a 50-minute Healthy Campus Dining Tour that educated them on how to make healthier choices at each of the campus dining locations. Both intervention and control groups were assessed pre-and post-intervention for agreement with questions assessing perception of healthful food choices in the campus environment, frequency of certain healthful dietary behaviors, and	

		importance of food choice priorities. A mixed methods approach was used to collect community food and physical activity environmental data, student health behavior questionnaire data, intervention community focus group data, steering committee annual meeting transcripts and ripple effect mapping (REM) data. **Results reported from this project include:** • A new model (eB4CAST) was implemented to benchmark community, wellness-programming efforts for their effectiveness and sustainability; (90% accomplished). This is an ongoing project to develop an easy-to-use, comprehensive instrument to benchmark outcomes from community wellness programming. This tool was used to provide feedback to the intervention communities in the iCook 4-H obesity prevention program. The next step is to obtain funding to make the tool completely automated. • Continued environment and behavioral instrument development, refinement, and validation of the Behavior Environment Perceptions Survey for college campuses and the Healthy Campus Environmental Audit; (90% accomplished). • Continued exploration of mechanisms of interactions between lifestyle behaviors and environmental factors in influencing healthy behaviors and health status of young adults; (50% accomplished).	
4.	SDSU Extension: **Double Up Dakota Bucks – Supporting Local Economies and Increasing the Demand for Healthy Foods in Rural Tribal Communities**	Partners in South Dakota and North Dakota are in the midst of piloting Double Up Dakota Bucks, a healthy food incentive program with tribal communities on the Standing Rock Sioux, Cheyenne River Sioux, Yankton Sioux, and Turtle Mountain American Indian Reservations. The program has been implemented in farmers markets and is now beginning to be implemented in grocery stores. Double Up Dakota Bucks offers SNAP customers a dollar for dollar match on fresh produce in both of these retail settings.	Food Systems, Nutrition, Health, and Well-Being / #2

		Studies suggest that the ratio of influence of Double Up programs is roughly 1:9, meaning that every Double Up dollar ($1) spent leads to an average of nine dollar increase in direct to consumer sales which opens new opportunities and markets for local producers and economies. Assessing and responding to social needs, like affordability and accessibility of healthy food, is an intermediate step to addressing health disparities. **What is the issue? Who cares and why?** Recent data show that 90% of South Dakotans eat fewer than five servings of fruits and vegetables every day. A report on spending habits indicates that SNAP households dedicate less of their household food budgets to fruits and vegetables. In SNAP households, 12% of the household food budget is spent on fruits and vegetables, compared to 16% in non-SNAP households. While SNAP does not restrict the kind of food purchased, incentivizing fruits and vegetables for tribal communities can help make healthy food more affordable and accessible, which has been shown to significantly improve consumption. **What has been done** As part of a multi-state effort, SDSU Extension piloted Double Up Dakota Bucks within two farmers markets in 2019 – one in South Dakota and one in North Dakota. A manual was developed for utilization with farmers markets. This manual included nutrition education for market managers and SDSU Extension professionals. Nutrition education and promotion were implemented through coordination with SNAP-Ed for farmers market customers, to address gaps in knowledge around fresh produce usage. Cultural relevance and appropriate outreach to tribal communities was prioritized through community conversations/focus groups in each of the pilot communities. In addition, materials were designed for print and social media, for future utilization in statewide expansion of Double Up Dakota Bucks in South Dakota.	

		Within each of the farmers market pilot communities, community champions and SDSU Extension staff educated stakeholders about the Double Up Dakota Bucks program through community wellness coalitions, community events highlighting the program, and printed materials distributed in strategic locations throughout the community. **Results reported from this project include:** The Double Up Dakota Bucks programming effort enhanced local community food systems and economies through support of farmers markets. This was achieved by assessing readiness and providing technical assistance to acquire USDA approval to accept SNAP. Stakeholder engagement at the state, county, and community level was cultivated by developing and engaging a North and South Dakota state agency advisory council. Engagement of state agency partners is critical to outreach and overall coordination of synergistic programs such as SNAP-Ed, TANF, and WIC. Culturally relevant outreach education supporting food systems is critically important to community vitality and the health of communities. For additional information: https://extension.sdstate.edu/double-dakota-bucks.	
5.	SDSU Research: **Increasing Resilience of Small Grains Against Pathogens in South Dakota**	Small grains such as wheat and oats are a major component of the commercial crops grown in South Dakota and they contribute a significant revenue to the state and provide employment opportunities to the States' agricultural sector. Wheat is ranked third among the agricultural crops grown in South Dakota and it was planted on 2.27 million acres with a harvest of 111.28 million bushels in 2016. (USDA-NASS, 2016). **What is the issue? Who cares and why?** Pests and diseases significantly impact field crop productivity worldwide. Losses due to wheat diseases average about 12.4% worldwide. Losses range from 10-22% due to major diseases such as rusts, leaf spots, and	Regenerative Agronomic Systems / #3

		Fusarium head blight which are prevalent in wheat in the US Great Plains. Leaf rust, Fusarium head blight, bacterial leaf streak, leaf spots (tan spot, spot blotch, and Stagonospora nodorum blotch), and root rots are common and yield impacting fungal and bacterial diseases in South Dakota. Additionally, ergot that produces alkaloids which are injurious to human and animal health, also sporadically occurs in small grains in the state. Crown rust and stem rust are the most devastating diseases, causing serious yield losses in oats in South Dakota. Also global warming may change disease patterns in the region and this warrants monitoring crops for any new disease/pathogens that may arise. **What has been done** The overall goal of this study is to understand the biology of small grain pathogens causing economic damage in South Dakota and identify sources of resistance to enhance variety development and effectively manage diseases. Two objectives within this goal during this reporting period include: 1) Monitor aggressiveness of root, leaf, and head disease pathogens and assess their resistance to fungicides. Diseased leaf and head samples were collected from fungicide and non-fungicide sprayed field plots located at SDSU research farms and farmers' fields. 2) Participate in improving resistance to diseases in wheat and oats varieties by establishing disease nurseries and rating trials for multiple diseases. Wheat fields were monitored at SDSU research stations and commercial fields with the assistance of the SDSU Extension Plant Pathologist. i. Under greenhouse conditions, 39 winter wheat and 46 spring wheat genotypes included in the crop performance testing (CPT) program were screened for leaf rust, tan spot, and leaf blotch. The results were shared with SDSU agronomists and wheat breeders.	

		ii. In the greenhouse 291 oat genotypes were evaluated against leaf spot and leaf blotch at the seedling stage in the greenhouse. The results were shared with the SDSU Oat breeder. iii. In greenhouse trials, 37 winter wheat and 42 spring wheat genotypes were screened for leaf rust, tan spot, and blotch. Also, 180 spring wheat and winter wheat lines were tested for their reaction to tan spot, blotch, and leaf rust at seedling stage in the greenhouse. The results were shared with the SDSU Winter Wheat Breeder, Spring Wheat breeder, and Agronomist. iv. A regional spring wheat bacterial leaf streak (BLS) nursery was established in the experimental area at Felt farm. One hundred-twenty wheat genotypes from UM, NDSU, SDSU, and the private sector were planted in early June 2019, inoculated with a BLS causing bacterial pathogen cell suspension, and rated for their reaction. **Results reported from this project include:** • Development of fungicide resistance in leaf and head disease pathogens can enhance the chances of disease epidemics, which can cause severe yield losses and decreased profitability. Further, producers can lose money directly by purchasing fungicides with low effectiveness in disease management. The information generated from this study will help identify effective chemicals and increase wheat yield by minimizing crop losses. • The disease data generated by the Small Grain Pathology lab will help breeders select sources of resistance to use in developing wheat and oats varieties with superior agronomy traits and disease resistance.	

6.	SDSU Extension/SDSU Research: **SDSU Integrated Pest Management: Agronomic Crops, Specialty Crops, Conservative Partnerships, and Recreational Land**	The overarching goal of the South Dakota Integrated Pest Management Program (SDIPM) is to encourage stakeholders to make informed decisions for pest management to reduce input costs and environmental impacts of pesticides through the reduction of unnecessary and inappropriate applications. This goal has been achieved through the efforts of SDSU Extension Specialists who have provided education and information on the biology of pests, impacts of pesticides, environmental factors that influence pests, and pest forecasts. **What is the issue? Who cares and why?** The SDIPM Program emphasizes providing professional agronomists and land managers up-to-date IPM training, developing a regional resource for insect, plant disease and weed management guidelines to address pesticide resistance management, and developing alternative pest management strategies. Improved knowledge of pest biology, impacts of environmental factors, pest forecasts, and communication that includes available technology, landowners, and managers can prevent unacceptable levels of pest damage by economical means, while posing the least possible risk to people, property, resources, and the environment. **What has been done** The SDIPM program has helped stakeholders throughout South Dakota prevent pests from reaching economically damaging levels, while also minimizing economic inputs and potential risks to people, property, and the environment by minimizing use of pesticides. Extension agronomy personnel use applied IPM research to explore current and alternative pest management strategies to optimize agricultural production in South Dakota while minimizing economic and environmental impacts. The SDIPM program is a broad-based program addressing pest management needs identified through focus and advisory groups. Annual activities include updating and developing publications/factsheets, web	Regenerative Agronomic Systems / #3

		pages (iGrow), digital video, and educational materials and displays. Deliverables are targeted for use at grower meetings in collaboration with Extension pest management personnel, and specialized trainings for agronomy professionals and agency personnel. Newly initiated projects included the development of a comprehensive (BMP) manual for corn, Soybeans, and wheat. Training will continue to focus on pest identification resources, pest monitoring and assessment, pesticide resistance management, and evaluating pest impact through use of economic thresholds. **Results reported from this project include:** • The SDIPM provided professional agronomists, land managers, and stakeholders with up-to-date IPM training: i. IPM Short Course: 143 were trained statewide (2015-2016, 2018-2019). ii. Presented at 56 Commercial Pesticide Recertification Meetings statewide with IPM related topics for the Right-of-Way and Ag Plant sections of the training; 9,657 commercial applicators were trained. (2015-2019). iii. The SDIPM program conducted 74 Private Applicator Training meetings with 3,316 private applicators trained. iv. The SDIPM program participated in 16 state, 20 district, and 46 county Weed and Pest Control meetings with over 4,300 Weed and Pest Control Supervisors and stakeholders trained. • The SDIPM program collaborated with the South Dakota Natural Resources Conservation Service (NRCS) to create a plan for farmers to use IPM documentation in their EQIP program. This included developing a chart for growers to record an IPM strategy for Prevention, Avoidance, Monitoring, and Suppression (the PAMS approach) in their farm operations.	

		• The SDIPM program was actively involved in the educational programming and promotion of the state's biological control of noxious weeds projects. These projects are a collaborative effort with the SD Dept. of Ag, County Weed and Pest Boards, Area Weed Management Districts, and State and Federal Land Management Agencies, including the Bureau of Indian Affairs (B.I.A.). • The SDIPM developed regional resources for insect, plant disease, and weed management guidelines to address pesticide resistance management: i. Two weed control guides (2017-2019): 15,500 hard copies distributed, along with SDSU Extension's iGrow.org (2015-2018) and Extension.sdstate.edu (2019); numerous guide documents downloaded and distributed to clientele. ii. Four Pest Management Guides updated (2015-2019): 44,000 hard copies along with SDSU Extension's iGrow.org (2015-2018) and Extension.sdstate.edu (2019); numerous guide documents downloaded and distributed to clientele. iii. Insect Fact Sheets (2017-2019): 1,000 hard copies distributed. iv. Insect Identification Guides (2017-2019): 36,000 hard copies distributed. • Pest & Crop Newsletter: https://extension.sdstate.edu/sdsu-extension-pest-crop-newsletter (2019)	
7.	SDSU Research: **Improved Diagnostic and Control Strategies for Viral Diseases of Swine**	Viral diseases pose major economic and animal welfare concerns to the swine industry. Accurate, rapid, and well-validated diagnostic tools represent one of the primary means to safeguard livestock populations and are critical tools to prevent disease transmission and spread. Recently, the US swine industry has faced the emergence of several high impact viral	Regenerative Livestock Systems / #4

		diseases including porcine epidemic diarrhea virus (PEDV), porcine deltacoronavirus (PDCoV), and Senecavirus A (SVA). Robust diagnostic assays and reagents were not readily available in the US to immediately address the rapid spread of these pathogens through the industry. **What is the issue? Who cares and why?** PEDV was first introduced into the United States (U.S.) in 2013 and was rapidly disseminated across the country, causing the deaths of over 7 million piglets (10% of the country's swine population) within the first year. In early 2014, PDCoV was first detected in the U.S. and was linked with clinical disease including acute diarrhea and vomiting. The disease has since spread through most swine raising regions of the U.S. As clinical signs associated with PDCoV are very similar, but typically not as severe as those associated with PEDV, specific reagents and serological assays needed to be developed to provide a full range of diagnostic capabilities. In July 2015, several outbreaks of SVA were reported in U.S. swine herds and were characterized by vesicular lesions along the hoof, snout, and mouth. A number of other swine viruses, including porcine teschovirus, porcine parainfluenza 1 virus, porcine sapelovirus, and others have been associated with disease. Therefore improved diagnostic approaches are needed. Long-term goals are to provide the swine industry with the most accurate and cost-effective diagnostic tools and strategies available to reduce the burdens of infectious disease, and evaluate the risks of swine feed and feed ingredients in the transmission of swine viral pathogens **What has been done and results from this project:** • Serological tests were recently developed to detect antibody responses to Senecavirus A (SVA) and were further optimized and validated. These tests include a monoclonal antibody-based blocking ELISA and a multiplex fluorescent microsphere immunoassay (FMIA).	

		• New monoclonal antibodies (mAbs) for Senecavirus A were developed and characterized for use in an immunohistochemical test (IHC) designed to detect virus antigen in lymphoid and non-lymphoid tissues, as well as in vesicular lesions during the acute phase of infection. This new IHC test provides an important research and diagnostic tool for the industry. • Monoclonal antibodies specific for Influenza D virus (IDV) were developed and used in confirmation of virus isolation, immunohistochemistry tests, and fluorescent antibody staining methods. • A new real-time PCR assay was developed for Swine Acute Diarrhea Syndrome Coronavirus (SADS-CoV). • Metagenomics and Sanger sequencing of clinical samples from swine led to the detection and characterization of Porcine Reproductive and Respiratory Syndrome Virus (PRRSV 1-7-4) type strains in Peru and in the identification of a novel bastrovirus in swine in the US. • Two undergraduate students received extensive training from this project. Numerous additional graduate students received specialized training in hybridoma technology and diagnostic assay development and validation.	
8.	SDSU Extension: **Bovine/Livestock Emergency Response (BERP) Trainings**	Annually in the U.S., billions of livestock are marketed and transported for breeding, feeding, exhibition, and slaughter. Due to this, several hundred thousand head of livestock are on the road on any given day in the U.S., with cattle and other livestock species being transported via semi-truck and trailer or pickup truck and pull type trailers.	Regenerative Livestock Systems / #4

		The transport of livestock is an integral and economically significant part of all livestock industries, especially in South Dakota where animal agriculture ranks number one and animal recreational activities are prevalent. South Dakota roadways are also common truck routes for the movement of livestock within North America. Accidents involving livestock have increased over the years and pose unique challenges to first responders, law enforcement, and the public. **What is the issue? Who cares and why?** The national Bovine/Livestock Emergency Response Plan (BERP) program is designed to train first responders on recommendations to address local accidents involving livestock transport vehicles to protect their safety, public safety, and animal well-being. Creating an awareness of the sensitivity of livestock transport accidents and enhancing the activities of first responders can protect public safety and minimize potential impacts on the livestock industries from accidents or subsequent actions. **What has been done** In May 2018, SDSU Extension collaborated with a NDSU Beef Quality Assurance Specialist and a national BERP Trainer to present a condensed 2-5 hour BERP training workshop. Classroom presentations provided basic information on emergency responses involving livestock, while hands-on sessions engaged participants in application of necessary skills for handling cattle and horses, evaluating trailer designs for extrication, and humane euthanasia. A course pre-post retrospective evaluation was distributed immediately following the class. The need for additional training was expressed by South Dakota firemen and emergency responders regarding emergency responses involving livestock. In May 2019, this resulted in a two-day BERP Train-the-Trainer course being offered to SDSU Extension professionals in Pierre, SD utilizing the BERP curriculum. South Dakota livestock organizations, state	

		veterinarian, and Brand Board were invited to attend and provide input on tailoring the curriculum for state and local needs. In collaboration with South Dakota State Fire School organizers, SDSU Extension conducted two, 8-hour SD State Fire School BERP courses in Mitchell, SD in June 2019. SDSU Extension and NDSU Extension conducted the courses. Following these courses, an email to all county emergency managers in South Dakota was sent introducing the BERP program and inviting individuals to reach out if they wanted more information or to schedule a local training. **Results reported from this project include:** • Trained 39 individuals with fire and rescue or EMS responsibilities with a condensed 2.5 hour BERP training (Brookings, SD 2018). • Trained 9 individuals and 2 instructors during a BERP Train-the-Trainer course; 6 of them will be actively involved with conducting future trainings in South Dakota (Pierre, SD 2019). • Trained 17 firefighters, plus 3 instructors at the SD State Fire School during two BERP trainings (Mitchell, SD 2019). • Total number of individuals trained by four separate BERP programs: 56 first responders and 9 BERP trainers. BERP participants have begun writing local response plans and expanded discussions with their teams on their response to incidents involving livestock. The BERP courses offered by SDSU Extension increased awareness of the sensitivity around incidents involving livestock and prepared first responders in South Dakota to develop local plans to enhance their responses to these livestock incidents to protect their safety, public safety, and animal well-being. Emergency managers in several counties have requested additional BERP trainings.	

9.	SDSU Research: **Protecting the South Dakota Environment with Good Water Management**	Good management of our natural resources is important for many reasons. One of the most important resources to manage well is our water. First, water is a vital part of our lives and is used directly for many purposes. Second, water moves in the landscape and can carry with it many other things that shouldn't leave the field, especially nutrients and sediment. This project focuses on both direct and indirect effects of water movement, specifically the movement of manure and its constituents in runoff water (on the soil surface) and the capture and reuse of water from subsurface drainage systems. **What is the issue? Who cares and why?** Livestock are a vital part of agriculture in South Dakota. In 2017, the agricultural census reported 3.85 M cattle, including calves, in South Dakota (USDA NASS, 2017). The cattle and their facilities must be managed carefully to ensure that the direct economic benefits continue, while maintaining positive indirect benefits. One indirect benefit of cattle production is the manure produced by the cattle. That manure contains valuable nutrients that can be used by crops. However, if manure is managed improperly or inefficiently, those same nutrients can leave the field and affect the water quality downstream of the field. Crop nutrients applied as commercial fertilizer can also leave the field and have adverse impacts on water quality downstream. The nutrients in manure would be used most efficiently if the manure were applied when the crop required the nutrients. However, such timing is not possible because manure is produced continuously while crops need the nutrients only during the summer growing season. Thus, strategies and facilities are needed to allow producers to apply manure using methods to maximize nutrient use by the crop, while minimizing adverse effects such as nutrient loss into water. This project will have positive impacts on management practices available to producers and on the impacts of those practices on the environment. For example, cattle producers will have efficient ways to manage and use	Natural Resources and Environmental Systems / #5

		the nutrients in manure from the 3.85 M cattle in South Dakota without causing harm to the water. The use of drain water for irrigation will have positive economic benefits to agricultural producers and will have positive water quality effects on the environment by capturing the water and all the dissolved constituents such as salts and nitrate-nitrogen and preventing their release into downstream waterways. The overall goal of this project is to improve water and resource management to increase agricultural production and reduce adverse environmental impacts. **What has been done** In 2019, the focus objective was to evaluate the runoff water quality impacts of winter manure application to the upper or lower half of a watershed. In the field research, the treatments applied to the three watersheds were: i. Manure applied during the winter to the top half of the watershed by elevation, ii. Manure applied during the winter to the bottom half of the watershed, iii. The control treatments of only commercial fertilizer (no manure) to provide the same levels of nitrogen and phosphorus as the manure in the other treatments, applied according to best management practices. The commercial fertilizers were applied to the entire control watershed as early as possible in the spring. **Results reported from this project include:** Field data collection has ended and a summary analysis of the data has begun. External funds were not procured this year so progress was minimal. Field Runoff modeling results indicated a poor fit between the field data and the tested models.	

		The potential impact is that there are 430 permitted livestock facilities in SD, based on the 2017 revision of the SD General Water Pollution Control Permit. The manure from these facilities and other, non-regulated facilities must be managed appropriately to prevent pollution and must not unduly burden the facility managers and thus become financially burdensome. Winter application of manure brings operational flexibility to the livestock facilities. If manure can be applied during the winter without increasing the potential for adverse water quality impacts, producers will gain a management option that brings greater flexibility to their operations.	
10.	SDSU Extension: **South Dakota State University Extension RREA Program**	South Dakota ranks 7th in the nation in the market value of cattle and calves, and 8th in the market value of sheep. These two components of the state's agricultural industry account over $3.2 billion in sales, or over 30% of the state's total cash receipts (USDA National Agricultural Statistics Service, 2017). Rangelands and pasture lands are critical in ensuring the sustainability of the over 16,000 ranching operations across the state that depend on them for grazing. In addition, rangelands are invaluable to the general public, providing water, minerals, open spaces, opportunities for recreation, and a way to preserve American and western heritage. Grasslands of the Northern Great Plains, including South Dakota, have long been recognized as an ecosystem at high risk. Conservation of this resource is best ensured through the prosperity of private land ranching. **What is the issue? Who cares and why?** With approximately 22 million acres of South Dakota's rangeland under private ownership, it is critical that landowners and managers have a thorough understanding of best management practices to improve long-term rangeland health, utilization, and productivity. Important considerations in development of best management practices include analysis of range condition, knowledge of the ecology of range and pasture systems, and scientific principles guiding response of rangelands to various management strategies. The South Dakota State University RREA project works with the South Dakota Grassland Coalition, state and federal	Natural Resources and Environmental Systems / #5

		agencies, and other partners to provide educational programs and materials for landowners. **What has been done** The overall goal of this project is to promote grazing land management and best management practices through a variety of educational events including grazing schools, tours, workshops, conferences, and individual consultations with landowners and land managers. • A South Dakota Grazing School was offered in 2019. Over 90 ranchers and grassland managers received intensive training in grazing management, plant identification, and holistic management. • Professionals' Range Camp was offered to new, seasonal, and established Federal agency personnel (NRCS, BLM, and USFS) to increase communication between agencies monitoring rangelands on federal and private lands. • Rangeland monitoring workshops and pasture walks for public and private land managers were conducted to assist with establishing sustainable stocking rates, discuss invasive species control, and monitor rangeland health. • The SDgrassinfo listserve was created to disseminate current information to (and from) producers and agencies and serves as a moderated question/answer forum on rangeland management related issues for more than 700 subscribers. **Results reported from this project include:** • Youth Range Days, the Black Hills Stock Show, Teen Camp, and National Land and Range Judging Contest were held with over 400 youth participating in these four events. • SDSU Extension maintains the SD Grassland Coalition website which supports 8,125 site visits and 17,770 page views annually. • Over 26 new educational products (e.g., educational aids or curricula) were contributed by educators that focus on rangeland management, monitoring, wildlife habitat, prescribed fire, and native species	

		development and are available through SDSU Extension's website at: https://extension.sdstate.edu/. • A total of 5,050 individuals participated in a variety of educational events/activities to promote grazing land management and best practices in South Dakota including: drone, prescribed burn, ranch visits, workshops, youth activities, tours, presentations, radio interviews, and meetings with 55,190 total acres affected. • For additional information: https://extension.sdstate.edu/tags/range.	