2018 University of Nebraska Combined Research and Extension Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 08/21/2019

I. Report Overview

1. Executive Summary

The Institute of Agriculture and Natural Resources (IANR) is a part of the University of Nebraska-Lincoln and includes the divisions of teaching, research, and extension. Strategic planning is integral to IANR's function as a land-grant institution, and it prides itself on working as an integrated system and collaborative environment across the three mission areas. To ensure that IANR's priorities reflect the needs of the state's residents there is ongoing, two-way dialogue between IANR and the residents of the state. In 2011 strategic two-way dialogue moved to a new, higher plane as Vision for 2025 was implemented to ensure Nebraska's competitiveness in a world of change and challenge. This visioning process was created to determine how IANR will contribute to the critical need of doubling the world's food supply in order to feed 9 billion people; address the shifting climate and environmental conditions; respond to the increasing need for energy sources; and consider how to help increase economic income opportunities for communities. In Nebraska, one in four jobs is directly tied to agriculture or agribusiness, and the state strives to increase job opportunities in this field of expertise. As a result of the visioning process, the priorities of IANR became food, fuel, water, landscapes, and people.

The future of Rural Communities is a crosscutting thread in each of these five issue areas. The importance was highlighted in 2013 by the establishment of a University of Nebraska system-wide initiative, the Rural Futures Institute (RFI), and the hiring of its executive director and support staff. Nebraska Extension established a new community-focused faculty team called the Community Vitality Initiative for the purpose of partnering with RFI and Nebraska communities.

Recent conditions have proven challenging for many agricultural producers. In response to the economic downturn, Nebraska Extension developed and launched an initiative focused on strengthening Nebraska's agricultural economy in 2017. Research-based information from across multiple disciplines is helping producers reduce input costs, increase efficiencies and improve productivity of farm operations. In addition, agricultural economic systems educators are serving to enhance our capacity in this initiative.

IANR strives to combine research, teaching and extension in a multidisciplinary, collaborative environment that encourages the best thinking and expertise from across the University and private enterprise; to ensure Nebraska's competitiveness in a world of change and challenge. The Vision for 2025 is a guide for IANR for the next decade. Engagement with Nebraska government leaders, stakeholders, representatives of organizations, faculty and students/youth continues. Listening sessions, surveys, departmental reviews, and input from advisory groups maintain public involvement.

These priority outcomes of food, fuel, water, landscapes, and people are representative of the societal challenge areas of the National Institute of Food and Agriculture (NIFA). For example, in the Nebraska planning process "food" represents the continuum of food to fork, which includes production, food security and hunger, childhood obesity, nutrition and food safety, and science/food literacy. Food Production/Security and Landscapes represents the productivity and sustainability of all of our natural resources. Water is highlighted because of the importance of water to our agricultural and natural resource systems in Nebraska. People and Their Well-Being represents the well-being of children, youth,

and families as they interact with their environments.
The following six IANR communities continue to be the backbone of integrated research, teaching and extension efforts: science literacy, stress biology, healthy humans, health systems for agricultural production and natural resources, computational sciences, and drivers of economic vitality for Nebraska. These are areas of strength that IANR faculty and staff determined the institution as a whole could build upon. This type of bold collaboration and thinking is what is needed to propel Nebraska forward. We are striving to strategize and excel in these areas.

The Institute of Agriculture and Natural Resources continues to strive to meet the needs of its Nebraska citizens through engagement in internationally-recognized science and education. This mission is being met by: advancing knowledge along a continuum from fundamental research to application; delivering education that addresses the current and emerging needs of the state's residents; and teaching tomorrow's professionals through formal and nonformal learning settings. The ongoing cultivation of public-private partnerships helps make our mission more achievable.

The importance of integrated missions is evident in the continued upward trajectory of grant/contract dollars received, the rigor/impact of educational programs delivered in both formal and nonformal settings, and in the placement of graduates in careers.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	228.0	0.0	140.0	0.0
Actual	242.2	0.0	178.6	0.0

II. Merit Review Process

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

- Internal University Panel
- External Non-University Panel
- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel

2. Brief Explanation

Interdisciplinary extension issue teams, comprising faculty representing interest groups (beef systems; 4-H youth development; the learning child; community vitality initiative; cropping and water systems; food, nutrition and health; community environment, reaching one, reaching all; next generation extension; and disaster education), update their team plans annually using stakeholder input and evaluation results from delivered programs. Also, every faculty member with a research appointment in the Agricultural Research Division (ARD) has a current approved peer- reviewed project that defines his or her area of research investigation. The peer review process for research projects includes the Unit and (if applicable) Research and Extension Center head, at least two faculty members with relevant expertise, and an Associate Dean of ARD. Following review and acceptable revision (if necessary), the project outline is forwarded to USDA-NIFA for inclusion in the REEport database.

Another review process, which combines merit and peer review, is the annual review of more than 100 research and extension proposals by state commodity check-off boards. Proposals selected for funding address the most significant problems facing the producer members and clearly communicate the research's relevance to user needs. Academic units (subject matter departments and research and extension centers) complete a comprehensive five-year review to ensure program quality and relevance. Teams of three to six external panel members and two or three faculty panel members from other academic units conduct these reviews. The review team assesses the work of the academic unit to ensure that programmatic efforts and research focus on Nebraska's most critical needs. The review team completes its assessment by the development of a report that helps the administrative unit focus its work for the next five years. It is the responsibility of the IANR Deans to assist the unit administrator and faculty to accomplish the goals identified by the unit, as a follow-up to the review process. Stakeholder input remains key to IANR success throughout the process mentioned above.

III. Stakeholder Input

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

- Targeted invitation to traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Other (Development of public value statements for use by stakeholders to promote IANR programs)

Brief explanation.

Ongoing input from stakeholder groups, e.g. advocacy, advisory, and commodity groups, keeps extension team plans current. Ongoing relationships with stakeholder groups such as the Agriculture Builders of Nebraska and Family, Youth and Community Partners, Nebraska Association of County Extension Boards (NACEB), along with listening sessions led by IANR personnel and extension board reviews of local and regional programs, ensure that critical needs are addressed. Continuous listening processes ensure that the plan of work is reviewed and updated regularly. The accuracy of the teams plans is verified using the following methods:

- Extension issue teams meet regularly to assess their goals and progress made toward achieving them. Teams include both faculty of academic departments who understand long- term trends and faculty located in extension offices who see, on a daily basis, the needs of Nebraska residents. Many of these faculty members of academic departments have joint research and extension appointments and can represent fundamental as well as applied research and extension education plans.
- Many issue teams use monthly phone and/or video conferencing to stay on track.
- Issue team leaders talk with subject-matter department administrators annually to ensure that the issue team's goals are congruent with university department research and extension goals.
- Issue teams meet with their stakeholders to garner input to determine future plans.
- Issue teams refine programs to ensure that content goals support needs identified by stakeholders and demographic trends.
- Issue team leaders meet with a member of the Extension Leadership Team monthly to enhance sharing and collaboration efforts.
- Extension-developed public value statements used by stakeholders tell others of the impact/public value of extension and then seek input for programmatic direction. (Go to: https://extension.unl.edu/impact/ to see "Impacting All of Nebraska" impact summaries). Annual impact reports are developed and are available online for each issue team (and related areas); each includes a public value statement, which helps stakeholders understand the value of and differences

being made by today's extension/research programs. Impact reports and public value statements are given to decision-makers and extension board members to help guide their advocacy efforts on behalf of IANR at the local, regional, and national levels.

• ARD faculty currently participating in multistate projects receive research funding through the multistate research component of the federal formula funds. These projects are selected and approved by regional director associations because they are high priority needs identified for multistate activity.

• The IANR fall summit, "Growing Nebraska: Leveraging Partnerships, Programming and Research" invited stakeholders to discuss critical issues in Nebraska and motivated individuals to join together to find sustainable solutions, while thinking globally and acting locally.

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

1. Method to identify individuals and groups

- Use Advisory Committees
- Use External Focus Groups

Brief explanation.

Nebraska is a state in which the public is very engaged with its university; the number of individuals who each year step forward to engage with IANR is commendable. Research and extension's strategic relationships with local, state, and federal decision-makers is valued. Advocacy groups, advisory groups for subject matter, departments, research and extension centers, and extension boards are utilized to gather input. Farm organizations and industries related to agriculture routinely are at the planning table. Below are examples of how research and extension address the needs of underserved and underrepresented populations.

• ARD research programs related to human nutrition and healthy lifestyles were highlighted under the federal goals and key themes. The research results feed science-based information directly into Nebraska Extension programs that target underserved and underrepresented populations.

• Nebraska Extension has built a strong partnership with Little Priest and NICC. Through this partnership, Native American teens have become more involved in outside activities and interact with youth and adults outside their schools. Program leaders say teens are more motivated and more interested in learning about activities. The Expanded Food and Nutrition Program and the Food Stamp Nutrition Education Program annually teach low resource families and youth (many are from the underrepresented populations) how to make nutritionally sound food choices, use their food dollars wisely, and cook meals for their families that adhere to food safety principles.

• The College of Education and Human Sciences, extension and the Nebraska Department of Education have undertaken a programmatic effort with targeted school districts to address needs of first generation families.

• An extension educator addresses the needs of Hispanic and Native American youth in Scotts Bluff County. This program engages middle and high school youth in after-school and community-based programs. Coalitions of Hispanic and Native American individuals contribute to the success of this youth program. An extension educator in northeast Nebraska is connecting Nebraska Extension youth development programs with Hispanic and Native American families in this region.

• Ongoing efforts to recruit and retain a more diverse pool of faculty that can serve as a gateway into underserved and underrepresented populations are underway.

• In 2013, IANR participated in a Civil Rights Review through USDA NIFA and has developed or started several new initiatives to improve connections with underserved audiences. One direct outcome is a $100,000 extension-funded competitive grant program for proposals that reach new audiences. A summary of our commitment to a diverse faculty and diversity of audiences reached by our education programs is found at: https://ianr.unl.edu/diversity

• Nebraska Extension is committed to ensuring access and opportunity for all Nebraskans to receive, and benefit from, our programming. We will demonstrate excellence in valuing everyone as an important member of the communities that we already serve and those we seek to serve. Nebraska Extension began with two pilot sessions, "Navigating Difference (ND) Multicultural and Diversity Training and Intercultural Development Inventory (IDI)." The success of these pilot sessions has led to training three more extension faculty as facilitators and offering at least three trainings per year, which include individual coaching sessions for all participants.

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

Brief explanation.

In 2015, the Nebraska Extension Directions Group, consisting of seven extension faculty from each of the major seven interest groups (programming content areas) and four extension program leaders/administrators, assembled a list of key informants from strategic agencies and organizations. Interviews with key informants were conducted by members of the Directions Group to inform the development of draft issues. The Directions Group subsequently refined the list to approximately 35 issues. Online surveys for the prioritization of the issues were sent to faculty across the state with instructions for the faculty to distribute the survey link to a wide variety of constituents between late July and early August 2015. Approximately 1,900 stakeholders responded to the survey with their assessment of the priorities of the issues. Responses were received from stakeholders as follows: 21% urban (communities >150,000 population); 19% midsize (communities 5,000-150,000); 20% small (communities <5,000); 26% farms; 15% acreages. All age ranges were represented. The Directions Group further refined the list of issues based on stakeholder priorities. The refined list was reviewed by the Nebraska Extension Leadership Team and a final list of issues was confirmed, resulting in the development of 18 multi-disciplinary Issue Teams by December 2015. Another method of collecting input from stakeholders was through face-to-face meetings.

The Nebraska Association of County Extension Boards (NACEB) engaged in a NextGEN NACEB initiative in 2018 designed to strengthen their relationships with extension and to enhance advocacy efforts for both extension and IANR. This effort included 10 face-to-face stakeholder engagement meetings throughout the state and an online engagement opportunity for extension board members. Additionally, there was an ongoing effort by extension boards to talk one-on-one with their neighbors and colleagues about needs within their geographic regions.
Nebraska Extension launched the extension 2025 strategic priorities planning process in 2018. Stakeholder engagement included listening sessions hosted throughout the state designed to help identify extension programming priorities for the next five years. Statewide surveys were sent to 10,000 randomly selected Nebraskans to gather their collective input regarding priorities that extension is well positioned to address.

Extension is a partner with the 1994 land-grant institutions in our state. Extension and the Nebraska

Indian Community College (NICC) have had a continuous partnership to support the implementation and management of tribal college extension programs in three different NICC communities. IANR extension faculty who work routinely with the tribal colleges serve as a conduit to move content and planning information between these entities. Research opportunities are also being explored with these colleges.

The Nebraska Panhandle has both recent and longtime Hispanic residents. An extension educator in the Scottsbluff area works with audiences and local planning groups to ensure a cross-cultural understanding. The program is in three parts: history of Mexican people in the Panhandle, cross-cultural communications, and formal education for audiences working with English language learners. This workshop is presented for public school educators, health professionals, students in education, health and human services employees, community leaders, chambers of commerce members, and companies. This is just one example of extension's engagement as a teacher for other organizations who seek increased understanding and involvement with all of our state's residents. In addition, Nebraska is working to increase the number of extension educators who can target diverse youth audiences. For example, a Spanish-speaking 4-H educator works specifically with underserved audiences in northeast Nebraska; this educator reached over 10,300 people in the past year.

Nebraska Extension continues to partner with Iowa State University on a joint educator position. This person is working on business development and youth entrepreneurship, focusing on Latino audiences in the Sioux City, Nebraska, 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.

Input from stakeholders is used to identify emerging issues for both research and extension, and to help set priorities. Stakeholders are also invited to provide input during the selection of administrators; for example, stakeholders serve as members of search committees for unit administrators, deans, vice chancellors, etc. Local stakeholders are invited to interview extension educators for positions located in their geographic regions.

Brief Explanation of what you learned from your Stakeholders

Stakeholders expect IANR and its divisions of research, extension, and teaching to remain focused on critical issues facing Nebraska. They expect the land-grant institution to do cutting-edge work that is well regarded by the academy, has global impact, and is of value to Nebraska's residents and economy. Stakeholders recognize that programming priorities must be established. During 2015, 18 extension issue teams were developed from the direction of our stakeholders to address the issues and needs of Nebraskans. In addition, 10 interest groups have formed under these issue teams to directly develop research-based programs and information that will positively impact these stakeholders, allowing them to make informed decisions relevant to these issues.

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	5035717	0	4489115	0
Actual Matching	5111603	0	4377957	0
Actual All Other	0	0	0	0
Total Actual Expended	10147320	0	8867072	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	1139252	0	733816	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Food Production/Security and Landscapes

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	4%		9%	
111	Conservation and Efficient Use of Water	8%		9%	
112	Watershed Protection and Management	4%		5%	
132	Weather and Climate	5%		3%	
133	Pollution Prevention and Mitigation	4%		6%	
136	Conservation of Biological Diversity	0%		3%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		8%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	3%		5%	
205	Plant Management Systems	21%		4%	
206	Basic Plant Biology	0%		4%	
211	Insects, Mites, and Other Arthropods Affecting Plants	4%		5%	
212	Pathogens and Nematodes Affecting Plants	3%		8%	
213	Weeds Affecting Plants	4%		5%	
301	Reproductive Performance of Animals	1%		3%	
302	Nutrient Utilization in Animals	1%		6%	
305	Animal Physiological Processes	0%		5%	
307	Animal Management Systems	26%		3%	
311	Animal Diseases	2%		5%	
601	Economics of Agricultural Production and Farm Management	9%		1%	
605	Natural Resource and Environmental Economics	1%		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	152.0	0.0	129.0	0.0
Actual Paid	138.8	0.0	147.7	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**
2976288	0	3690058	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2844477	0	3640477	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 foundational research in the basic sciences that underpins and will support future productivity and sustainability advances in agriculture and Nebraska's environmental resources.
• Conduct research and extension programs to develop and deliver new and improved crop and livestock integrated management programs that increase the potential for improved agricultural productivity.
• Conduct research and extension programs to develop and deliver new and improved information to help producers create sustainable crop and livestock production programs.
• Conduct research and extension programs that will help characterize and maintain the High-Plains ecosystem, and better understand the potential impacts of climate variability and change.
• Conduct research and extension programs that help citizens mitigate the impact of water stress (excess and insufficiency).

2. Brief description of the target audience

Nebraska farmers and ranchers, along with landowners, are the primary target audience for this work. The program's research and education efforts will provide valuable information for state and local policy makers (especially Natural Resources Districts' boards of directors) as they make decisions regarding natural resources, climate, water use and water quality issues. University of Nebraska Extension continues to develop and deliver programming to females in agriculture. The program will provide agency staff with the knowledge they need to carry out agency responsibilities and mandates.

3. How was eXtension used?

All of our faculty are asked to apply for an eXtension email and become a member. eXtension continues to serve as a valuable resource for clients and faculty. For subject areas outside of our focused areas of work, it provides a primary web resource used by faculty and clientele for land-grant university information. For example, eXtension is our primary land-grant web resource for subject areas such as farm safety, freshwater aquaculture, goats, and grapes, all topic areas for which Nebraska Extension provides little or no web content. In addition, Nebraska Extension websites link to eXtension, and eXtension serves as a resource for faculty in answering questions and providing supplemental resources for face-to-face training sessions. Nebraska Extension faculty also use the training and resources of eXtension to expand their skills and expertise in efforts to better serve clientele.

In 2018, Nebraska Extension participated in the Innovation Collaboratives. These allow focused teams from the University of Nebraska to come together in a space outside of Nebraska to explore platforms that can better serve and engage clientele, begin to design engagement opportunities, and get critical feedback that better refines their project(s).

We have also sent educators and specialists to be trained as "Innovative Facilitators". The trained Innovative Facilitators have been used to facilitate internal and external summits and because of these trained facilitators, the summit/workshop outcomes have been achieved. The Innovative Facilitator training is provided through eXtension.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	145000	550000	125000	225000

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

Patent Applications Submitted

Year:	2018
Actual:	17

Patents listed

Filing DatePatent TitleApplication TypeCountry of FilingStatus
10/26/2017USE OF PROBIOTIC BACTERIAL STRAINS AND CELL EXTRACTS TO INHIBIT ACIDOSIS AND LIVER ABSCESSES IN CATTLEPatent Cooperation Treaty (PCT)United StatesActive-Pending
10/31/2017METHODS OF TREATING OR PREVENTING ZIKA VIRUS INFECTIONSProvisionalUnited StatesConverted
12/6/2017PARENTAL RNAI SUPPRESSION OF HUNCHBACK GENE TO CONTROL HEMIPTERAN PESTSPCT National StageCanadaActive-Pending
12/14/2017"LIQUID AND SEMISOLID LUBRICANT COMPOSITIONS, METHODS OF MAKING, AND USES THEREOF
"ProvisionalUnited StatesConverted
12/20/2017Plateau Proso MilletPlant Variety Protection (PVP)United StatesActive-Pending
12/21/2017Methods of Producing Hybrid-Like Seed LotsPatent Cooperation Treaty (PCT)United States Active-Pending
12/27/2017SYNAPTOGYRIN-2 INFLUENCE REPLICATION OF PORCINE CIRCOVIRUS 2Provisional United StatesConverted
1/12/2018Mitochondrial Protease OMA1 as a Marker for Breast CancerPatent Cooperation Treaty (PCT) United StatesActive-Pending
1/19/2018NANOPOROUS STARCH AEROGELS IMPREGNATED WITH PHYTOSTEROLS AND METHODS OF PREPARING THE NANOPOROUS STARCH AEROGELSUtility - ConvertedUnited States Active-Pending
4/16/2018FIRE SUPPRESSION AND IGNITION WITH UNMANNED AERIAL VEHICLESPCT National StageCanadaActive-Pending
4/16/2018FIRE SUPPRESSION AND IGNITION WITH UNMANNED AERIAL VEHICLESPCT National StageUnited StatesActive-Pending
5/25/2018A NON-NATURALLY OCCURING PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME VIRUS (PRRSV) AND METHODS OF USINGPCT National StageHong KongActive-Pending
6/15/2018FIRE SUPPRESSION AND IGNITION WITH UNMANNED AERIAL VEHICLESPCT National StageAustraliaActive-Pending
7/18/2018BIOAVAILABLE CURCUMIN NANOPARTICLES AND METHODS OF MAKINGProvisional United StatesActive-Pending
8/3/2018A NON-NATURALLY OCCURING PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME VIRUS (PRRSV) AND METHODS OF USINGDivisionalUnited StatesActive-Pending
8/6/2018Methods and Compositions for Obtaining Useful Plant TraitsContinuationUnited StatesActive-Pending
8/28/2018SYSTEMS FOR TRACKING INDIVIDUAL ANIMALS IN A GROUP-HOUSED ENVIRONMENT Utility - ConvertedUnited StatesActive-Pending

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	85	286	371

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of Agricultural Research Division HATCH projects in food production/security and landscapes.

Year	Actual
2018	78

Output #2

Output Measure

- Number of workshops, continuing education programs, Web-based curricula and field days/tours related to food production/security and landscapes.

Year	Actual
2018	720

Output #3

Output Measure

- Number of new extension publications and other education resources related to food production/security and landscapes.

Year	Actual
2018	34

Output #4

Output Measure

- Number of new products and decision tools developed and made available to clientele related to food production/security and landscapes.

Year	Actual
2018	9

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	New knowledge will be generated that will allow Nebraska farmers and ranchers to increase productivity, profitability, and sustainability of food, feed, fuel, or fiber production systems through adoption of research and extension information provided by IANR programs.
2	Nebraska farmers and ranchers will increase their knowledge and awareness of how integrated pest management and pesticide best management practices can help protect water quality and human health while providing acceptable crop pest protection.
3	New knowledge will be generated that will allow Nebraska farmers, ranchers, businesses, and home owners to adopt new practices that will reduce water use, improve water management and protect water quality.

Outcome #1

1. Outcome Measures

New knowledge will be generated that will allow Nebraska farmers and ranchers to increase productivity, profitability, and sustainability of food, feed, fuel, or fiber production systems through adoption of research and extension information provided by IANR programs.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	45320

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agri-business is vital to the state's economy and having a ready and willing workforce has helped those businesses thrive. Nebraska's beef industry generates approximately $7.2 billion in annual cash receipts. The multiplied impact of the $6.5 billion in cattle sales each year is $12.1 billion.

We have engaged 20,000 beef producers and 4,500 feedlot managers in efficient use of resources and use of by-product feeds. The global demand for meat and milk is projected to double by 2050; thus, ruminant-based food production is expected to continue to be a major contributor to global methane emissions and climate change.

Understanding the process: Issues that underpin microbial-mediated methane fluxes in the methanogenic microbial community in the rumen is essential to improve feed efficiency and mitigate methane emissions.

Soil Health: The Nebraska economy relies on agriculture. Healthy soils are vital for row crop production. Building soil health continues to be a focus of UNL and producers. Crop diversification adds to healthy soils. Production of food to feed people, communities, states, and countries is a focus. We have engaged 25,000 crop producers and 500 crop consultants about techniques to reduce soil movement.

Crops and grasses: In Nebraska, many acres of perennial grass pastures have recently been converted to crop production. Corn residue is available on about 9 million acres of corn harvested each year and represents a tremendous forage resource for livestock production that is currently underutilized. Real-time crop forecasting can help producers and crop consultants adjust management decisions during the current season, including adjustments in fertilizer amounts and

irrigation. Inclusion of weather and soil information enhances robustness of the yield forecast. Availability of a robust, transparent, and open-source Yield Forecast Center in the public sector would level the playing field for all who trade corn and other crops in the open market.

What has been done
Studies were conducted to evaluate the impacts of several cover crops on soil quality in a three-year corn-soybean-wheat organic crop rotation by measuring several soil quality parameters. The impact of grazing corn residue compared with baling corn residue on soil microbial biomass and community structure was examined. Also, the research and use of Pulse Crops in rotations allows for diversity and increase in profit potential.

Bacterial species in the rumen of 597 animals were sequenced to evaluate microbial features that influence feed efficiency. High-depth, metagenome sequencing of rumen samples from 50 animals on high- and low-quality forage was also conducted. The rumen virome was also sequenced and factors driving rumen viral populations and their effects on rumen ecosystem function were studied.

Methods were developed and evaluated to incorporate genomic data from multiple sources into genomic selection and to predict sparsely recorded traits and allow portability of these predictions to larger populations using real and simulated data, various training and evaluation methods to estimate accuracy of genomic predictors for growth and carcass data in scenarios.

A team of faculty from UNL and 10 land-grant universities was assembled to provide real-time yield forecasts and phenology every two weeks during the 2011-2014 corn growing seasons for 41 locations in the U.S. corn belt.

A simulation model was used to compare the impact of fed-batch hydrolysis with batch hydrolysis for ethanol production. Crop and biofuel systems were integrated in a modeling framework by connecting the existing DSSAT and GREET models. The effect of fertilizer was analyzed in this new model. The beef system BCNRM model was then added to study the integrated corn-ethanol-beef system in Nebraska.

Results
Responses from meeting focused on ag economics:
Participants reported the following impacts.
* 91% said the workshop will help them make better risk management decisions in the future
* 86% intended to implement something they learned
* Total projected gross revenue of $5.95 million
* Average value of education received
--- $6,048 per producer participant
--- $21.57 per head of cattle marketed

CropWatch.unl.edu and Beef.unl.edu deliver research-based information. Articles on these websites were viewed over 43,000 times and many were reprinted via multiple media formats, multiplying impact.

Beef Cattle: Beef Cattle Production Systems Decision Support Tools to Enable Improved Genetic, Environmental, and Economic Resource Management is a three-year $300,000 project. This project aims to develop a web-based platform for producers to enter herd- level data to be used in forming herd-specific economic selection indices to choose breeding animals. Co-PIs include faculty from Kansas State, the US Meat Animal Research Center, and Theta Solutions, LLC.

Soil Health: Pulse Crops are a way to diversify crop production. A Pulse Crops Expo was held at Grant, Nebraska, where 370 producers and consultants from seven states representing 500,000 acres of cropland learned about growing and marketing pulse crops. The estimated value of knowledge gained was $1,494,000 with 95% saying they think the information gained and contacts developed will help their farms be more profitable.

In cattle growing diets, betaproteobacteria play a key role in reducing methane emissions in syntrophic eubacteria. Hydrogen sinks such as propionate production in the rumen can be used to reduce methane production in the rumen while increasing animal performance. Differences in microbiome composition accounted for about 20% of the variation across feed efficiency traits for both heifers and steers.

Working with International Genetic Solutions (a collaboration among 15 breed associations), a multi-breed genomic evaluation was developed and deployed, enabling more accurate (less biased) estimates of the impact of genomic predictions in genetic evaluations of beef cattle. The haplotype-based model had greater resolution in identifying quantitative trait loci than standard SNP-based models for the traits of gain and feed intake in a crossbred beef cattle population. This scenario could result in 400,000 acres that could produce 1-2 tons (on a dry matter basis) of high quality and cost-effective forage, with calves gaining 1.5-2.2 pounds per day.

A fed-batch operation decreased facilities costs by 41%, labor costs by 21%, and capital costs by 15%. The cost of biomass had the greatest effect on the cost of ethanol production (20% increase). The cost of ethanol production increased 16% when enzyme cost was increased by 75%. Up to 100 kg nitrogen per hectare led to increased yield potential and lower greenhouse gas footprint of the crop biofuel system because more E85 energy can be produced to displace E10. However, more than 100 kg nitrogen per hectare results in flat yields and increased greenhouse gas footprint.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
132	Weather and Climate
133	Pollution Prevention and Mitigation
136	Conservation of Biological Diversity
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
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
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems

311	Animal Diseases
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics

Outcome #2

1. Outcome Measures

Nebraska farmers and ranchers will increase their knowledge and awareness of how integrated pest management and pesticide best management practices can help protect water quality and human health while providing acceptable crop pest protection.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This groundwater availability has been essential to the success of agriculture in the state. Center pivot irrigation is the most common method of providing water to row crops in the state, and as a result, four of the largest manufacturers of center pivot systems in the world are located in Nebraska.

Abundance of wild bees has declined 23% while annual mortality of commercially managed honey bee colonies averaged 40% in the last decade. Major causes of these declines include agricultural intensification resulting in loss of habitat and forage resources, pests and pathogens, and exposure to agrochemicals.

What has been done
During 2018, over 8,500 Nebraskans were directly reached by Water and Soil Protection team programming. Participants represented diverse interests across the state, including homeowners, producers, agribusiness, crop consultants, industry, landowners, K-12 students, and public agencies. Participants impacted by team programming manage or influence soil and water resources on over 2.8 million acres of both private and public lands, and almost 2 million head of livestock across the state.

Studies were conducted to understand the potential risk of pesticide exposure by quantifying residue levels in pollinator habitats next to corn/soy fields and to characterize the beneficial insect

communities that utilize pollinator habitats. UNL faculty collaborated with the Honey Bee Health Coalition to develop and deliver a CEU-accredited educational module with best management guidelines for beekeepers, crop consultants, advisors, and applicators at the National and State Specific Independent Crop Consultant meetings.

Results

Nebraska producers are increasingly using cover crops to protect soil, build soil health, and retain nutrients. Producers often look to Nebraska Extension for information on managing these cover crops. To meet producer need and demand, our team offered educational opportunities statewide. Attendees from Nebraska, Iowa, and Kansas estimated the value of the Nebraska Cover Crop Conference at $11/acre on the 2.8 million acres they managed.

During the 2018 certification season, Nebraska Department of Agriculture staff monitored 7 private applicator sessions. Monitoring was conducted to determine compliance with requirements as defined in Title 24, Chapter 2 of the Nebraska Administrative Code.

Educators continue to use a variety of training resources to develop training appropriate to their part of the state. Training resources include: lecture outlines, University of Nebraska developed DVDs and videos, PowerPoint presentations, personal protective equipment demonstrations, label exercises, private applicator reference study guides, record keeping books, and various editions of the University of Nebraska Guide for Weed Management in Nebraska publication. The topic that received the highest marks from participants was "Integrated Pest Management". The people that attended manage, directly or indirectly, at least 10 million acres of crop land in NE.

Corn pollen was found on 62% of milkweed leaf samples and all expressed Bt proteins. Milkweed plants unprotected by drift barriers had 31% higher corn pollen levels compared to milkweed plants protected by drift barriers. These results will help elucidate the environmental fate of neonicotinoid residues and Bt toxins, how far residues travel, how much is expressed in plant nectar and pollen, and relevant field exposure levels for non-target beneficial insects. All workshop participants learned something new about pollinator protection and were able to list at least one correct honey bee pesticide protection strategy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

New knowledge will be generated that will allow Nebraska farmers, ranchers, businesses, and home owners to adopt new practices that will reduce water use, improve water management and protect water quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	45000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Water is an important resource for row crop production in Nebraska. It is a resource that needs to be used efficiently and effectively to produce feed-stock resources, and communities need a fresh, safe water resource.

Soil and water contain elevated levels of natural geogenic contaminants such as arsenic, cadmium, chromium, selenium, and uranium throughout the U.S. Edible plants accumulate trace element contaminants, especially in areas associated with high levels of contaminants in soil and irrigation water. A better understanding of the root zone-soil-pore water interface with respect to the uptake of these contaminants at different stages of plant development is needed to predict the fate of these contaminants in the environment and their potential impacts on animal and human health.

Availability of freshwater resources for agroecosystems is important for sustainable food production. The Nebraska Water and Energy Flux Measurement, Modeling, and Research Network (NEBFLUX) was established in 2004 to provide actual evapotranspiration data (continuous and long-term) for water resource policy makers, planners, regulators, and users.

What has been done
Team members focus on delivering research based information to water users across the state. Delivery methods included direct and indirect methods to provide needed information wherever and whenever needed by constituents. Direct teaching methods include field days, hands-on workshops, student interns, interactive contests, and youth activities. Clientele from around the world were reached indirectly through websites, social media, news articles, and print materials.

NEBFLUX is a network of micrometeorological tower sites to measure surface water vapor and energy fluxes between terrestrial agroecosystems and microclimates, including tilled and untilled irrigated and rainfed croplands; irrigated and rainfed grasslands and irrigated alfalfa. Hourly data were collected on surface energy fluxes and environmental variables. Hourly and daily crop coefficients were developed for maize and soybean for full and limited irrigation and rainfed conditions. Extensive crop yield and climate datasets from 1968-2013 were used to evaluate climate impacts and effects of irrigation on maize, sorghum, and soybean yields.

Results
A total of 120.3 million gallons of water was saved by 34 clients after receiving technical assistance from Partners in Pollution

The Partners in Pollution Prevention Program (P3) provided an opportunity for college students to provide technical assistance to businesses to help identify waste. They performed a preliminary survey of the five clients using NDEQ Waste Reduction Funds. Findings indicate that the impacts from these projects are projected to include annual cost savings of $1.7 million, increased investment of $7.7 million, and the creation of 27 jobs.

Irrigation Scheduling Equipment Workshops held in partnership with Natural Resource Districts and Corn Grower Associations, encouraged the adoption of technology to improve the efficiency of irrigation water applications. Surveyed participants reported potential water savings totaling over 69,500 acre inches.

Soil core profiles indicated significant differences in the concentrations of iron, arsenic, selenium, and uranium at both locations during the irrigation season. Iron transformation in soil pore water is likely one of the key factors controlling mobilization and bioavailability of arsenic, selenium, and uranium in irrigated soils. Highest uptakes rates were found in soybeans with selenium uptake highest followed by arsenic and uranium.

Evaporative losses at night were high early in the season and late in the season. Climate variability explained a quarter of the variability in crop yields. The observed temperature trend was beneficial for maize yields, but detrimental for sorghum and soybean yields whereas the observed precipitation trend was beneficial for all three crops. Crop yields under irrigation demonstrated increased robustness. Irrigation was a very effective mitigation strategy against climate impacts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
132	Weather and Climate
133	Pollution Prevention and Mitigation
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Nebraskans are more resilient and sustainable to climate variation and extreme weather events by adopting best practices and preparing for risks. Nebraska Extension is trusted for science-based information and education that improves climate and extreme weather resiliency.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Climate and weather science, impacts, trends, or projections were taught to more than 4,400 learners at 78 in-person events and 97% of those surveyed (n=173) indicated they increased their knowledge of climate science in Nebraska.

Our two-day networking and climate professional development workshop reached 65 extension and USDA professionals. One-hundred percent of attendees reported that they increased their knowledge of climate resources, and 75% of extension attendees said they now plan to incorporate climate resources into their programming.

Engaging Clients in Scenario Planning Discussions, 85% extension and cropping system stakeholders came together to discuss key climate and crop growing scenarios through a two-year, $15,000 grant project with South Dakota State University. These discussions determined scenarios and impacts most relevant to the crop industry, potential management options, and guided the creation of the interactive learning tool. Producers(n=40) said they are now more aware of climate trends and projections (98%) and strategies to mitigate the impact from climate and weather (95%).

The Field to Market team utilized a grant from the Nebraska Environmental Trust to train three summer interns to engage with a dozen crop advisors in Nebraska to measure field sustainability using the Fieldprint Calculator. The team collaborated with the crop advisors to input data and generate sustainability reports for their clients, which provided peer-to-peer comparisons on water-use efficiency, greenhouse gas production, soil conservation, and nitrogen use efficiency, among other variables. Through post-presentation surveys, crop advisors reported advising farmers on multiple sustainability factors: nitrogen use efficiency (79%), water use efficiency (69%) and soil conservation (64%).

Key Items of Evaluation

The Nebraska Agricultural Experiment Station measures its success in its ability to provide extension with cutting-edge research results that impact Nebraska. In addition, we have

begun to use a commercial product (Academic Analytics) to assess faculty productivity measures.

Nebraska Extension continues to identify signature outcomes and indicators in each of its programming areas and is collecting statewide data to assess progress made toward achieving those outcomes. Each year, each extension Issue Team completes an impact report highlighting its efforts and the impact of those efforts on clientele. These are available at: http://extension.unl.edu/impact/. These reports have been instrumental in working with stakeholders, who in turn used them to advocate on behalf of the extension program. Additional efforts are underway to enhance the skills of Issue Team leaders to strengthen selected indicators and evaluation strategies.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

People and Their 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
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		21%	
204	Plant Product Quality and Utility (Preharvest)	0%		6%	
303	Genetic Improvement of Animals	0%		1%	
308	Improved Animal Products (Before Harvest)	0%		1%	
403	Waste Disposal, Recycling, and Reuse	0%		5%	
501	New and Improved Food Processing Technologies	0%		4%	
502	New and Improved Food Products	0%		9%	
503	Quality Maintenance in Storing and Marketing Food Products	0%		4%	
607	Consumer Economics	0%		2%	
608	Community Resource Planning and Development	15%		1%	
610	Domestic Policy Analysis	0%		5%	
702	Requirements and Function of Nutrients and Other Food Components	0%		13%	
703	Nutrition Education and Behavior	20%		1%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		1%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		4%	
724	Healthy Lifestyle	15%		5%	
802	Human Development and Family Well-Being	0%		12%	
806	Youth Development	50%		5%	
	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	76.0	0.0	11.0	0.0
Actual Paid	103.4	0.0	30.9	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**
2059429	0	799057	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2267126	0	737480	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

Basic and applied research will focus on rural and urban family life and lifestyles; human nutrition, with particular emphasis on how foods, our molecular and macro-environments, and food systems interact to impact our well-being; food sciences, including food processing safety, food production waste reduction, and processing technologies to ensure human well-being and nutritious food choices.

Planned program activities include a cascaded approach to creating long-term behavior change. Each program area will include mass-media educational efforts (websites, news articles, general contacts) to reach the general public; 1-2 hour workshops that focus on increasing knowledge; longer-term (4-6 hour) learning experiences that begin to change attitudes and practices; and in-depth training designed to create behavior change that involves multiple contact opportunities over an extended period. By using this approach, a variety of learners is engaged in programming that best fits their needs.

Examples of program activities include:

- Workshops for child care providers to increase their skills in developing social-emotional strengths in young children.
- Web-based learning modules designed to give divorced or separated parents the skills to better interact with their families.
- Campus-based career camps that enable high school students to interact with faculty while exploring post-secondary options.
- Nutrition education workshops to help high risk families make healthy choices on limited budgets.
- Technology-based experiences (using apps, social media, etc.) to help engage users in learning around core topics.
- Workshops for food service providers and post-harvest producers on cutting-edge resources to

enhance food safety and quality.

All of these program activities will be purposefully designed to reach targeted outcomes and achieve long-term impact.

2. Brief description of the target audience

The target audience includes:

- High-risk families
- Children and youth
- Families of young children (young children defined as those 0-8)
- Producers
- Good processing and retail establishment owners/workers
- Consumers
- Business and community leaders

3. How was eXtension used?

All of our faculty are asked to apply for an eXtension email and become a member. eXtension continues to serve as a valuable resource for clients and faculty. For subject areas outside of our focused areas of work, it provides a primary web resource used by faculty and clientele for land-grant university information. For example, eXtension is our primary land-grant web resource for subject areas such as farm safety, freshwater aquaculture, goats, and grapes, all topic areas for which Nebraska Extension provides little or no web content. In addition, Nebraska Extension websites link to eXtension, and eXtension serves as a resource for faculty in answering questions and providing supplemental resources for face-to-face training sessions. Nebraska Extension faculty also use the training and resources of eXtension to expand their skills and expertise in efforts to better serve clientele.
In 2018, Nebraska Extension participated in the Innovation Collaboratives. These allow focused teams from the University of Nebraska to come together in a space outside of Nebraska to explore platforms that can better serve and engage clientele, begin to design engagement opportunities, and get critical feedback that better refines their project(s).
We have also sent educators and specialists to be trained as "Innovative Facilitators". The trained Innovative Facilitators have been used to facilitate internal and external summits and because of these trained facilitators, the summit/workshop outcomes have been achieved. The Innovative Facilitator training is provided through eXtension.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	502931	1653022	288723	478459

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

Patent Applications Submitted

Year:	2018
Actual:	2

Patents listed
Filing DatePatent TitleApplication TypeCountry of FilingStatus
3/15/2018EXTRACELLULAR VESICLES AND METHODS OF USING Patent Cooperation Treaty (PCT) United StatesActive-Pending
6/6/2018EXTRACELLULAR VESICLES AND METHODS OF USINGProvisionalUnited StatesActive-Pending

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	339	65	404

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of extension in-depth workshops.

Year	Actual
2018	10208

Output #2

Output Measure

- Percentage of Agricultural Research Division HATCH projects in nutrition, family health and well-being, food safety, and career development.

Year	Actual
2018	22

Output #3

Output Measure

- Number of scholarly publications and curricula related to nutritional sciences and family well-being.

Year	Actual
2018	9

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	New knowledge will be generated that will allow increased adoption of preharvest methods for food quality and safety.
2	Nebraska will have access to a more highly educated workforce to meet the needs of the 21st century workplace.
3	Youth will increase behaviors that result in healthier lifestyles.

Outcome #1

1. Outcome Measures

New knowledge will be generated that will allow increased adoption of preharvest methods for food quality and safety.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	5040

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Antimicrobial resistance is a major global health threat. The animal production environment may be an important component for the emergence and spread of resistant bacteria and genes that confer resistance to antibiotics.

Antibiotic resistance and virulence genes on mobile genetic elements facilitates transfer among pathogenic microbes, making many of these organisms refractory to treatment or possessing enhanced pathogenicity in humans and animals. Understanding pathogen dynamics enables prudent treatment and antimicrobial usage and provides insight into transmission of virulence factors and antibiotic resistance through next generation testing methods in livestock populations.

What has been done
Samples were collected from feedlot pens, animal hide swabs, and rectal feces on individual animals before cattle entered the feedlot pens, before treatment with Tylan or chlortetracycline antibiotics, and at the time of harvest. Manure samples were collected after three months of stockpiling and amended soil samples were collected after two months. Samples were cultured for the presence of generic E. coli, Salmonella, and Enterococcus. Metagenomic sequencing was also conducted to monitor the resistome of antibiotic resistant genes.

A real-time, multiplexed PCR assay was developed and validated to facilitate identification of bacterial pathogens from nasal and deep nasopharyngeal swabs from cattle. A real-time assay was also developed that enables testing for, and quantification of macrolide resistance genes, a class of antibiotics critically important to treating infections in livestock that includes three of the newest approved antimicrobials for cattle.

Results

Neither antimicrobial resistant bacteria nor antimicrobial resistant genes in the environment were observed at significantly different levels across different antibiotic treatments from pen surfaces in the feedlot through aged manure during stockpiling and amended soil after manure application. Thus, antibiotic use during beef cattle production might not be associated with the risk of contamination of antimicrobial resistant bacteria or antimicrobial resistant genes in animal waste or in manure applied to soil. Furthermore, restricted use of antibiotics in beef production may not be a direct solution to lowering the risk of antibiotic resistance in the environment. However, stockpiling manure before land application can be an effective strategy to limit the potential of antimicrobial resistance to the environment or transmission to crops for human consumption.

Antimicrobial resistance islands were identified and characterized in 22 M. bovoculi genomes. These included up to 10 individual antimicrobial resistant genes co-located on a genetic island and having varying combinations. The new test for macrolide resistant genes provides relative quantification of the macrolide resistance determinant genes msrE, mphE, and erm(42). Translation to diagnostic tests will enhance the understanding of the composition of circulating pathogens and the presence or absence of resistance determinants in pathogenic and non-pathogenic organisms.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
308	Improved Animal Products (Before Harvest)
608	Community Resource Planning and Development
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Nebraska will have access to a more highly educated workforce to meet the needs of the 21st century workplace.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2018 67495

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Equipping Nebraska youth with the skills needed to succeed after high school and empowering them to make decisions about their future is the primary focus of all College and Career Success programs. Programming was offered to youth in grades 5 through 12, with the greatest reach being high school youth. In 2018 more than 10,000 youth from across Nebraska were impacted through a variety of College and Career Success programming efforts.

What has been done
Many methods were used by the College and Career Success Team to engage youth. Programs were delivered in schools, communities, and through on-campus experiences. A common thread embedded in many of the College and Career Success programs is the intentional connection between a young person and an employer from the community who can share real-life knowledge and experiences.

Through the delivery of the Connecting the Dots program, the College and Career Success Team was well positioned to provide a unique and strategic method of engaging its learners. In this program, students experience a "real life" simulation through hands on activities to learn how their high school choices impact their post-secondary and workplace experiences. This simulation involves multiple rounds of face to face interaction with employers from their local communities as well as representatives from universities, colleges, and military.

Next Chapter is co-branding and building partnerships in Tennessee, New Mexico, and Illinois. "I want to say thank you to you and your team for helping the University of Tennessee get this program up and running. What you have shared with us has been extremely helpful THANK YOU!" - Michael Smith-Porter, University of Tennessee.

Partnerships with the Educational Service Units (ESU) across the state greatly increased in 2018. ESU 10 based in Kearney and ESU 11, Holdrege, supported all schools in their service area to participate in Connecting the Dots. In 2019, ESU 9, 10, and 11 will host trainings for the Mapping Your Success curriculum.
Beyond these examples, many ESU staff members partner with Issue Team members for college and career programs.

Results
NEXT CHAPTER AT NEBRASKA
Next Chapter, a college readiness and UNL pre-admittance program, is offered to 8th grade students enrolled in 4-H. Throughout high school, pre-admitted students engage in events, activities, and curriculum during which they will learn how to successfully transition from high school to college. This unique program meshes college and career readiness programming with traditional 4-H programs and activities. In two years, Next Chapter at Nebraska has served over 1,800 youth in all five extension districts.
* 738 youth participated in Next Chapter learning opportunities during the 2017-18 school year
* Over 1,000 9th and 10th grade youth are projected to complete Next Chapter's 1 and 2 at the completion of the 2018-2019 school year
* In 2018, Next Chapter launched new regional retreat initiatives serving 35 youth in four retreat locations

* 120 Bryan High School freshmen were the first to receive their Next Chapter pre-admission letters in the first ever OPS Next Chapter retreat on UNL City Campus in March of 2019
* Next Chapter Online, launching statewide via Canvas in fall 2019, will increase the reach of the program.

CONNECTING THE DOTS
In 2018, this interactive career exploration simulation program tripled the number of youth reached, engaging over 4,700 9th and 10th grade students in opportunities to learn about careers of interest as well as how to "connect the dots" from ninth grade, through postsecondary, to the workplace. As a result of the program, youth increased their ability to demonstrate professional communication and can make informed decisions about their college and career aspirations. Connecting the Dots hosted 26-day-long programs throughout Nebraska engaging 66 school districts. More than 550 community partners participated, an increase of 300 partners from 2017.

As a result of the Connecting the Dots program:
* 97% think it is important that they do their job well
* 84% learned how to act professionally through CTD
* 80% say 4-H has helped them identify things they are good at and explore their future career options

MAPPING YOUR SUCCESS
Mapping Your Success, a new curriculum developed by issue team members, was developed in 2018. Designed for high school juniors and seniors, the 10-session curriculum which is connected to the Nebraska Career and College Readiness educational standards is focused on students? taking ownership of their own career paths.
Skills taught include:
* critical thinking
* initiative and enterprise
* prioritization
* self image
* relationships and culture
* skill seeking
* personal and financial well-being and
* capstone experience.

A train-the-trainer model, in which extension staff train teachers and school counselors to facilitate the curriculum was used in the delivery of this program. The team also spent time in 2018, building partnerships with ESU professional development staff and Nebraska Department of Education career specialists to start promoting the program and began establishing a 2019 training schedule.

INVENTURE DAY
More than 250 mentors, volunteers, and businesses supported Youth Entrepreneurship and Business Opportunity activities. More than 900 youth participated in the entrepreneurship curriculum, and 676 students participated in INVENTURE Day. During INVENTURE Day, youth familiarize themselves with local businesses and business owners, identify potential entrepreneurial careers, and develop a business around a given product.
* 72% of participants have a better understanding of the process of creating a business.
* 68% have learned skills that will help them to be successful in running/ operating their own business.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
724	Healthy Lifestyle
802	Human Development and Family Well-Being
806	Youth Development

Outcome #3

1. Outcome Measures

Youth will increase behaviors that result in healthier lifestyles.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	159470

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nebraska ranked 15 in the United Health Foundation America's Health Ranking for 2018. Obesity increased 2% from 32% to 32.8% of adults. The state ranks 25th for senior health and 22nd for the health of women and children. This has a negative impact on Nebraska's economy because of missed work and higher health care costs. In addition, because parents are often the food providers in the home, negative food behavior of adults leads to negative behavior in children and a more serious obesity spiral.

Despite these sobering statistics, changes are occurring.
- in the past three years, drug deaths decreased 7% from 7.3 to 6.8 deaths per 100,000 population
- in the last year, children (age 0 to 17) in poverty decreased 1% from 14.2% to 14.1%
- in the past three years, Tdap immunization increased 12% from 82.2% to 92.3% of adolescents ages 13 to 17
- in the last year, frequent mental distress increased 11% from 9.5% to 10.5% for adults
- in the past five years, cancer deaths increased 3% from 182.2 to 187.4 deaths per 100,000 population
- in the past five years, diabetes increased 25% from 8.1% to 10.1% of adults
- in the past three years, infant mortality increased 20% from 5.0 to 6.0 deaths per 1,000 live

births

What has been done
Nebraska Extension helps children and youth improve eating and physical activity patterns with direct education and healthier home, school, and community environments. By supporting healthy behaviors and environments, we help reduce food and health care costs by helping prevent chronic health conditions.

Extension implemented nutrition education and physical activity programs, as well as environmental strategies. Programs impacted individuals and families where they eat, live, work, learn, shop, and play through group education classes, field days, summer/day camps, health fairs, workshops, and demonstrations. Learners received information via website, social media, newsletters, and radio. To learn more about how our issue team engages learners, view our video: https://go.unl.edu/hhhu.

Funds garnered by team members totaled more than $1,000,000 to support programming and included: USDA (including SNAP-Ed and EFNEP), Nebraska Department of Health and Human Services, Nebraska Department of Education, National 4-H Council, Nebraska Extension, and NU Foundation. The following partners provided/assisted with space, human resources, recruitment, program implementation, planning, materials, and advertising:
- 148 Schools (Preschools, K-12, Colleges and Universities)
- 37 Organizations (Human Service, Healthcare, and Public Health)
- 35 Facilities (Child Care Centers, Daycare Homes, and Head Start)
- 21 Agencies (Federal, State, and Local Government)

To strengthen programs, collaborations included internal and external partners spanning different sectors such as education, government, community coalitions and councils, media outlets, faith-based groups, public health, healthcare, and public safety. One example of a successful program with productive partnerships is the Go NAP SACC: Nutrition and Physical Activity Self-Assessment for Child Care program. Nine partners supported the Nebraska collaborative and contributed employee resources, operating funds, program delivery, program evaluation, website, and/or data/resources to deliver the program in 70 counties.

Results
Nebraska Extension directly taught over 7,000 hours of healthy lifestyles programming to 32,152 children and youth and 3,576 adults (e.g. teachers, caregivers, parents) for a total of 35,728 Nebraskans. More than 290,000 individuals were reached through indirect activities.

2019 marks the 50th Anniversary of the Expanded Food and Nutrition Education Program (EFNEP), which began in 1969 through extension programs in 1862 and 1890 Institutions. EFNEP uses a peer educator model and influences the nutrition and physical activity behaviors of limited-resource families, particularly those with young children, through community-based, relationship-driven, hands-on education. In 2018, ten extension assistants across seven counties taught over 3,500 K-12th grade youth. Improvements in healthy living occurred after receiving a minimum of six hours of education through EFNEP:
* 85% of youth made healthier food choices.
* 50% of middle and high school youth ate one extra serving of vegetables per day.
* 48% of high school youth increased the number of days they were active for at least 60 minutes, with * 54% increasing the intensity of the activity.

EFNEP classes can involve the whole family where parents and youth learn about healthy

cooking and eating together. EFNEP partners with Title I schools, non-profit youth centers, alternative education programs and culture centers to reach youth with limited resources. Through a partnership with Grand Island Public Schools Workforce Prep Academy in Hall County, high school youth learned the importance of health and how to plan, budget and cook meals.

The 4-H Healthy Habits grant, sponsored by National 4-H Council and Walmart Foundation, mobilized youth to take action around healthy food and activity choices. Thirty-six extension professionals from 28 counties developed over 75 partnerships. More than 2,700 K-12th grade youth received at least six hours of nutrition, physical activity and food preparation education. A subset of youth participants (n=1823) showed 83% learned about healthy food choices. Extension professionals mentored teen ambassador volunteers as part of the grant. Fifty-four teens spent over 800 hours helping plan, prepare and deliver programs to youth in their communities. Teen survey respondents (n=48) reported giving their family healthy meal or snack ideas (60%) and learning about healthy food choices (91%). From open-ended responses, teens reported learning about cooking skills, trying new things, and healthier lifestyles

Go NAP SACC improves the health of young children through better nutrition and physical activity in early care and education programs. The team worked with 82 child care facilities. Over 270 child care providers were reached through workshops and technical assistance. Child care providers that participated in Go NAP SACC positively influenced about 3,500 young children by making improvements in nutrition, physical activity and infant feeding best practices. These improvements will help build a strong foundation for young children to establish healthier habits across their lifespan.

Improvements in Go NAP SACC Best Practices from Pre- to Post-program
* 34% improved infant feeding
* 23% better child nutrition
* 35% increased physical activity
* 25% more outdoor play
* 28% less screen time

Approximately 3,500 adults participated in nutrition and health programming. In addition, 1,570 adults participated in the Eating Smart Moving More series of lessons, which teaches adults how to eat healthy and be active. Participants are required to complete seven lessons, as well as a pre- and post-evaluation. The adult program resulted in statistically significant improvements in diet quality, dietary behaviors, physical activity and decreased screen time for participants who completed the program (n=676).

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
703	Nutrition Education and Behavior
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
724	Healthy Lifestyle
802	Human Development and Family Well-Being

806 Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities

Brief Explanation

Research and extension have been able to successfully meet goals as planned in the area of people and their well-being. Nebraska Extension continues to be cognizant of over-arching issues such as feeding 9 billion people, global water supplies, and how those will impact our work related to educating Nebraskans on healthier lifestyles and creating a well-educated workforce.

Research and extension faculty continue to be watchful for emerging issues and world conditions that could change food systems and the global trust that consumers have of U.S. agriculture. In addition, Nebraska faculty are at the forefront of basic research in food allergies, food safety through the food chain, and microbiome profiling.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Nebraska Extension has developed an impact report for each of its Issue Teams. These can be found on our extension impact page at: https://extension.unl.edu/impact/.

The Nebraska Agricultural Experiment Station measures its success in its ability to provide extension with cutting-edge research results that impact Nebraska. In addition, we have begun to use a commercial product (Academic Analytics) to assess faculty productivity measures.

Key Items of Evaluation

Nebraska Extension continues to identify signature outcomes and indicators in each of its programming areas and is collecting statewide data to assess progress made toward achieving those outcomes. Each year, each extension Issue Team completes an impact report highlighting its efforts and the impact of those efforts on clientele. These are available at: https://extension.unl.edu/impact/. These reports have been instrumental in working with stakeholders, who in turn used them to advocate on behalf of the extension program. Additional efforts are underway to enhance the skills of Issue Team leaders to

strengthen selected indicators and evaluation strategies.

Information regarding Academic Analytics can be found at: http://www.academicanalytics.com/.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

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