

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	25%		13%	
111	Conservation and Efficient Use of Water	14%		17%	
132	Weather and Climate	4%		8%	
133	Pollution Prevention and Mitigation	5%		19%	
135	Aquatic and Terrestrial Wildlife	5%		6%	
141	Air Resource Protection and Management	4%		1%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		6%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	7%		13%	
302	Nutrient Utilization in Animals	4%		6%	
305	Animal Physiological Processes	0%		3%	
307	Animal Management Systems	4%		3%	
403	Waste Disposal, Recycling, and Reuse	4%		1%	
405	Drainage and Irrigation Systems and Facilities	14%		0%	
605	Natural Resource and Environmental Economics	10%		4%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	49.0	0.0	38.0	0.0
Actual Paid Professional	55.0	0.0	33.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
1016532	0	942041	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
963933	0	916316	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 underpin and will support future productivity and sustainability advances in agriculture.
- Collect, disseminate, and model climate change data essential for understanding the impact of climate on natural resource and agricultural systems.
- Conduct research and extension programs to develop/deliver new and improved crop and livestock integrated management programs that increase the potential for improved agricultural productivity in the face of environmental stress/climate variability.
- Conduct research and extension programs to develop/deliver new and improved information to help producers create sustainable crop and livestock production programs with improved environmental impacts.

2. Brief description of the target audience

Nebraska farmers and ranchers, along with landowners, are the primary target audience for this work. In addition, target audiences will include land managers, bankers, agricultural consultants and agribusiness professionals who provide products and services to farmers and ranchers. The program's research and education efforts will provide valuable information for state and local policy makers (especially Natural Resource District Boards of Directors) as their make decisions regarding natural resources and climate issues. The program will provide agency staff with the knowledge they need to carry out the agency responsibilities and mandates.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	14300	377000	51600	0

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

Patent Applications Submitted

Year: 2013
 Actual: 1

Patents listed

Drought adaptive root gene in wheat - E2F.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	14	97	111

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of Agricultural Research Division HATCH projects in climate change.

Year	Actual
2013	26

Output #2

Output Measure

- Number of workshops, continuing education programs, web-based curricula and field days/tours related to climate change.

Year	Actual
2013	494

Output #3

Output Measure

- Number of new extension publications and other education resources related to climate change.

Year	Actual
2013	14

Output #4

Output Measure

- Number of new products and decision tools developed and made available to clientele related to climate change.

Year	Actual
2013	6

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Nebraska ranchers will increase sustainability of range resources through adoption of research and extension information provided by IANR programs (measured by value placed on the information by clientele).
2	Consumptive water use by irrigated crops will be reduced. The outcome measure will be the percent reduction of estimated consumptive water use when the current year is compared to the estimated consumptive water use in calendar year 2006. The consumptive water use will be estimated using the irrigation water pumped in Natural Resource Districts that require the use of water measurement devices.
3	Nebraska will not exceed its allocation of water in the Republican River as allowed by the interstate compact with Kansas and Colorado. Nebraskan's allocation is 49% of the average annual water supply. The output measure will be the percent of the Republican River average annual water supply used by Nebraska.
4	Nebraska will have access to higher educated workforce trained in the new biology with skills applied to addressing critical science in climate change.

Outcome #1

1. Outcome Measures

Nebraska ranchers will increase sustainability of range resources through adoption of research and extension information provided by IANR programs (measured by value placed on the information by clientele).

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	6600000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Twenty-four million acres of range and pasture resources are a primary source of feed for 1.8 million head of beef cows in Nebraska. Half of this rangeland is in the Nebraska Sandhills, a unique ecosystem that has transitioned from rich grasslands to desert sand dunes multiple times during its history as a result of climate shifts. Future potential for climate change or increased climate variability will place this fragile ecosystem at risk. Drought conditions dramatically reduced forage production and grazing opportunities in 2012 and weakened the regrowth in 2013. Drought conditions in the southern and central plains states over the last three years have produced declines in cow herd size and resulting calf crop. Nebraska's calf crop has declined by 2.8% from 2003 to 2012 while the US calf crop declined by 8.8%. Lower beef production levels began showing up in the market with record market cattle producers being seen at the end of 2013. In addition, prices for feed grains, and ethanol and distiller's co-products have resulted in profitability returning to cattle production late in 2013. Adapting to drought condition, identifying alternative forage supplies, and considering alternative production systems for the cow herd are becoming increasingly important to the sustainability of Nebraska's 20,000 businesses (beef cow operations) and to the rural infrastructure of Nebraska.

What has been done

Faculty collaborated with the National Drought Mitigation Center to present a webinar series, "Drought Preparedness of Great Plains Ranches." This five-part series had an average of 100 live participants and was recorded for later viewing. Additional resources were developed for Nebraska's drought response including six archived webinars and three Nebguides.

The West Central Cattlemen programs, conducted at 10 locations in Nebraska, Colorado and

Kansas, addressed economic implications of herd management decisions during drought, feeding corn stalks to cows, and pasture weed management after drought. A Panhandle faculty team taught 19 sessions to 606 individuals on dry-lotting cows, limit feeding cows, and alternative forages during drought as part of the previously mentioned beef educational programs. A Beef Profit Team presented four educational programs in northeast Nebraska on drought strategies for cow/calf producers on management and production options such as herd culling strategies and feeding low quality feedstuffs. Finally, a central Nebraska faculty team targeted drought management in seven educational programs.

The Web continues to be used extensively for providing access to research based information on drought topics. The beef team has authored a wide range of written resources, webinars, and short videos that have been made accessible through UNL Extension Drought Resources (<http://droughtresources.unl.edu>), UNL Extension beef (<http://beef.unl.edu>), and YouTube (<http://www.youtube.com/user/NUBeef>).

Results

The central Nebraska drought educational programs reached 593 livestock producers, bankers, veterinarians and businessmen, representing 386,098 livestock animals and 626,498 acres. Producer profitability increased \$22 per head with a 60% adoption rate (72% of producers said they were likely to make a change), creating a value of \$5,100,000 to their operation. The northeast Nebraska beef series reached 164 producers and reported 65% would likely make changes in their operation as a result of attending the program. More than 50% plan to modify their current practices, and estimated an average value in profitability of \$21 per head which translates into \$996,000. The West Central Cattlemen programs reached 450 Nebraska, Colorado, and Kansas producers and other attendees representing over 250,000 head of cattle and more than 700,000 acres of rangeland. A survey of the Mid-Plains BEEF Educational Series (N=2 session, N=34 participants) suggested an increase in profitability of \$515,000 for attendees through plans to modify current practices on utilizing crop residues and managing forage resources during a drought.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
132	Weather and Climate
141	Air Resource Protection and Management
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems
605	Natural Resource and Environmental Economics

Outcome #2

1. Outcome Measures

Consumptive water use by irrigated crops will be reduced. The outcome measure will be the percent reduction of estimated consumptive water use when the current year is compared to the estimated consumptive water use in calendar year 2006. The consumptive water use will be estimated using the irrigation water pumped in Natural Resource Districts that require the use of water measurement devices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the USDA 2007 Farm and Ranch Irrigation Survey, Nebraska irrigates approximately 8.45 million acres with more than 6.70 million acre-feet of water annually. This represents an 11% increase in acres irrigated with 21% less water. This change is likely a result of both difference in rainfall patterns and concerted efforts promoting efficient irrigation water use. In 2004, state policy established a process for defining watersheds as a fully or over-appropriated. Part or all of 11 Natural Resource Districts are currently defined as fully or over-appropriated. Over-appropriated basins are required to reduce water use to 1997 levels. Discussion continues on defining additional areas of Nebraska as over or fully appropriated. State public policy continues to emerge and change annually on a variety of topics related to water use by irrigation.

What has been done

The Panhandle irrigation program started with the Pumpkin Creek project and has transformed into a regional effort to conduct education of producers about surviving under deficit irrigation conditions. Educational efforts from that project have been expanded in cooperation with three Natural Resource Districts with a focus on use of no-till for soil water conservation, timing of deficit irrigation, and dividing of limited water among different crops for maximum profitability.

NAWMN: The Nebraska Agricultural Water Management Network has grown to be the largest and most comprehensive water management network in the U.S. Network participants learn how to utilize soil moisture and evapotranspiration field measurement tools to make better-informed decisions in their irrigation management operations. Through extensive demonstration projects,

the information is shared and delivered to Network participants and others through field days, seminars, workshops, outreach publications, website, Twitter, media reports, refereed journal articles, etc.

Monsanto Partnership: A partnership with Monsanto's Water Utilization Center resulted in a total of 24 sessions/tours at the Monsanto center, reaching 707 adults and youth. A total of 4,584 individuals have visited the center this past year and were exposed to UNL Extension materials and plot demonstrations. Three demonstrations and three research projects were planned and implemented at the Learning Center in 2013.

Results

Water use in eight reporting Nebraska NRDs returned to levels approximately equal to pumping levels in 2005. Water use had steadily declined from 2006 to 2011 to about 65% of the 2005 level, increased to 208% of the 2005 level during the drought of 2012 and returned to a similar level as pumped in 2005 during 2013. In 2013, UNL Extension agriculture water management programs reached over 4,885 producers/consultants (representing 23.4 million acres of cropland) and over 2,080 youth.

The NAWMN has expanded from 15 farmer collaborators/partners in 2004 to over 1,100 in 2013. Since the beginning of the NAWMN, over 16,000 producers, crop consultants, and agricultural industry personnel have been reached and educated at over 600 Extension/outreach and in-service trainings. The irrigated acreage that was represented by the NAWMN partners increased from 1,482 acres in 2005 to near 1,500,000 acres in 2012. Participant surveys showed average irrigation water savings of 2.1 inch for maize and soybean consistently for the last nine years. With the total irrigated acreage represented by the Network partners, this resulted in a total of 310,000 ac-ft of reduction in water withdrawals, which represents roughly one-fifth of the total capacity of Lake McConaughy. This resulted in estimated total energy savings of over \$60 million since 2005 statewide.

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
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Nebraska will not exceed its allocation of water in the Republican River as allowed by the interstate compact with Kansas and Colorado. Nebraskan's allocation is 49% of the average annual water supply. The output measure will be the percent of the Republican River average annual water supply used by Nebraska.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Republican River Compact allocates the water supply of the Republican River, originally set at 11% to Colorado, 49% to Nebraska and 40% to Kansas. Natural Resource Districts have developed plans that are contributing toward achieving the targeted allocation than includes retirement of irrigated acres, improvements in efficiency of irrigation water use, and limitations on irrigation development. Observed reductions in Nebraska water use (discussed later) are a result of extension education, public policy, and changes in rainfall patterns. Increases in 2012 due to drought have overshadowed water savings from recent years and returned to more normal levels in 2013.

The measure for Nebraska's consumptive water use in the Republican River basin are not available for public use for 2011, 2012, or 2013 due to litigation between Nebraska and Kansas.

What has been done

In addition, a joint UNL/Monsanto Deficit Irrigation program in the Republican Basin was hosted at three locations with 197 attendees. No additional new initiatives targeting the Republican River basin were reported in 2013. Extension Educators in the Republican River region are expanding NAWMN onto more producer farms in 2013. No accomplishment data specific to this region was reported in 2013.

Results

No new information for 2013.

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
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

Nebraska will have access to higher educated workforce trained in the new biology with skills applied to addressing critical science in climate change.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

To remain economically viable and environmentally compatible in a rapidly changing world, Nebraska farmers and related agribusiness representatives must have access to a highly educated and trained work force in order to take advantage of new information, incorporate new technologies, and adjust to changing economic, social, and environmental conditions.

What has been done

Results

In 2013, there were 451 Baccalaureate and 158 Masters/Doctoral degrees conferred at the University of Nebraska in agricultural and natural resources related areas. Over 85% of our Baccalaureate degree students find jobs in their fields or continue with their professional education; approximately 70% take their first job in Nebraska.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
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133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
141	Air Resource Protection and Management

201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Natural disasters: Extreme drought conditions arrive in Nebraska during the spring of 2012 and persisted all year. Residual effects of this drought reoccurred in central and southern regions of Nebraska into 2013. Most grasslands recovered but reduced grass productions was common in 2013. An early winter storm in northwest Nebraska caused the death of several thousand head of cattle.

Economy: As the 2013 harvest neared, prices declined compared to 2012's record-setting prices. Because of the high grain and forage costs through the first half of the year, livestock farmers experienced continued high feed costs and losses until late in 2013. In addition, the decline in cow numbers, in part, from the 2012 drought resulted in fewer calves and yearlings for placement in feedlots and declining meat supplies. By the end of 2013, beef prices were setting record highs. In addition, the appearance of the PED virus in Nebraska swine herds as well as in many other swine producing regions produced smaller supply of pork and record pork prices by the end of 2013. As a result of declining crop prices, land value increased by only 5% in 2013 and land rental rates declined.

There are currently 24 active ethanol production plants in Nebraska, with a combined production capacity of over 2.1 billion gallons of ethanol each year, and requiring more than 700 million bushels of grain in the process. These ethanol plants represent more than \$5 billion in capital investment in the state and provide direct employment for some 1,200 Nebraskans. As of December 2013, Nebraska's operating production was 1.82 billion gallons per year, approximately the same level as this same time the previous year. With the decline in corn prices, Nebraska plants are expected to return to production levels closer to full capacity. However, California restrictions, RFS policy debates in Washington, and limitations of ethanol sales resulting from E-10 mixes of ethanol and gasoline are currently restricting growth of ethanol production.

Public policy and Government Regulations: Lack of a five-year farm bill was the

primary public policy discussion in 2013. Disappearance of all USDA safety net for ranchers experiencing extreme drought and other weather related losses will prevent cow numbers from recovering anytime into the near future.

Appropriation Changes: Steady state tax collection and soaring federal deficits have led to static state and declining federal budget support in 2012. The end of federal sequester should allow Extension programs to hold steady into 2014. However, the continued growth in student enrollment has resulted in UNL adding 36 new positions in 2013, with approximately six having Extension responsibility, with more faculty position additions anticipated in 2014.

Competing public priorities: A customer base that has little connection and no understanding of modern agricultural production systems and a desire to use public policy to design agricultural systems continues as a frustration within the agricultural community. Some aspects of this public oversight of food production is seen as beneficial such as local organic food production, because of the potential for premium prices. However, the lack of acceptance by some groups of many production technologies for reducing inputs (e.g. genetically modified seeds) or increasing production efficiencies and yields (e.g. use of antibiotics and growth promotants in animal production) comes at the same time that society is asking for greater production to meet a growing food and energy feedstock need. These competing public priorities are leaving farmers frustrated with consumer and policy maker scrutiny.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

UNL Extension has five spires of excellence with two action teams specifically targeting global food security issues: 1) Beef Systems and 2) Crops for the Future. The Action Team supporting each spire has identified one or more "Signature Outcomes" that first became active at the start of 2010. These "Signature Outcomes" continue to be delivered statewide in 2014 and methodologies established for measuring statewide impact allowed capture of a significant part of our 2013 impact (see "Making a Difference" at <http://extension.unl.edu>). The faculty team supporting each spire is in the process of implementing 2014 statewide delivery and evaluation procedures identified in the statewide action plans. These methods developed by our Action Teams provided our third statewide snapshots of educational program impacts including knowledge gain, intended and actual practice change, and likely conditional changes.

The Nebraska Agricultural Experiment Station measures its success in our 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. We are still in the process of determining the robustness of this dataset.

Key Items of Evaluation

Extension action team implementation plans, evaluation indicators and tools as well as 2013 Impact reports are all found at <http://www.extension.unl.edu/web/Extension/progfocus>. A review of the specifics of these implantation and evaluation plans are found for the two most relevant action teams by going to <http://www.extension.unl.edu/web/Extension/progfocus/actionteam-beef> and <http://www.extension.unl.edu/progfocus/actionteam-crops-of-the-future>