

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

A quality Environment and Effective Natural Resource Management

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	2%		5%	
102	Soil, Plant, Water, Nutrient Relationships	17%		16%	
111	Conservation and Efficient Use of Water	17%		25%	
112	Watershed Protection and Management	12%		8%	
121	Management of Range Resources	10%		4%	
122	Management and Control of Forest and Range Fires	1%		0%	
123	Management and Sustainability of Forest Resources	1%		2%	
124	Urban Forestry	1%		0%	
125	Agroforestry	1%		0%	
131	Alternative Uses of Land	1%		1%	
132	Weather and Climate	9%		7%	
133	Pollution Prevention and Mitigation	12%		12%	
135	Aquatic and Terrestrial Wildlife	7%		9%	
141	Air Resource Protection and Management	1%		0%	
403	Waste Disposal, Recycling, and Reuse	3%		2%	
404	Instrumentation and Control Systems	1%		6%	
405	Drainage and Irrigation Systems and Facilities	2%		1%	
605	Natural Resource and Environmental Economics	2%		2%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	44.0	0.0	35.0	0.0

Actual	57.0	0.0	36.0	0.0
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2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
697337	0	748935	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
820814	0	1055987	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

IANR will conduct research and deliver extension education programs that will enable Nebraska agricultural water users to use water in ways that maximize efficiency and profitability, protect water quality and meet regulatory requirements. Key elements of this effort include:

- Development of an improved understanding of basic plant, water, soil and climate relationships. Evaluation of alternative water delivery systems including sprinkler irrigation technologies and sub-surface drip irrigation systems.
- Evaluation of alternative irrigation water management strategies for all irrigation system types and particularly for situations where deficit irrigation is necessary.
- Development of adapted crop varieties, using either conventional breeding programs or genetic modification, that are more drought tolerant, perform well in deficit irrigation situations or require less evapotranspiration for profitable production.
- Evaluate alternative crops that require less applied irrigation water or are adapted to non-irrigated production, that will fit into Nebraska cropping systems and for which a market exists.
- Evaluate opportunities for shifting from irrigated to non-irrigated production or other enterprises that will maintain producer and community economic viability and sustainability.
- Develop decision-making support systems that enable producers, policy makers, financial institutions and others to make critical decisions regarding crop production and water resources use.
- Enhance research and extension education programs that will increase the scientific knowledge base and public understanding of the occurrence, movement and quality of ground water; factors that impact the quantity and quality of surface water; the interrelationships between ground water and surface water; and the ecology of Nebraska's ground water and surface water systems.
- Develop research and extension education programs that analyze the water resource and economic impacts of existing or proposed public policies.
- Enhance research and extension education programs that enable Nebraskans to protect ground water and surface water quality and respond to regulatory requirements.
- Enhance research and extension education programs that will enable communities and individuals to better understand and use appropriate technologies to protect the quality of drinking water supplies and to remove contaminants when drinking water standards are exceeded.
- Research-based information will be provided for individuals, groups and decision makers that will enable informed decisions relative to use of limited water supplies and protection of water quality.

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 they make decisions regarding natural resources issues. The program will provide agency staff with the knowledge they need to carry out the agency responsibilities and mandates.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	10000	20000	8000	20000
Actual	82160	310536	61620	81955

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

Patent Applications Submitted

Year: 2010
 Plan: 1
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	15	35	
Actual	21	97	118

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scholarly publications and outputs related to water management and water quality.

Year	Target	Actual
2010	50	70

Output #2

Output Measure

- Number of water management and water quality education workshops/presentations, continuing education programs, web-based curricula and field days/tours.

Year	Target	Actual
2010	150	173

Output #3

Output Measure

- Number of Agricultural Research Division projects that include water management and water quality as a key component.

Year	Target	Actual
2010	50	32

Output #4

Output Measure

- Number of new extension publications and other education resources developed.

Year	Target	Actual
2010	20	26

Output #5

Output Measure

- Number of scholarly publications and outputs addressing environmental and natural resources issues other than water management and water quality.

Year	Target	Actual
2010	30	48

Output #6

Output Measure

- Number of Agricultural Research Division projects that address environment and natural resource issues other than water management and quality.

Year	Target	Actual
2010	30	48

Output #7

Output Measure

- Number of education workshops/presentations, continuing education programs, web-based curricula and field days/tours that address environment and natural resource issues other than

water management and quality.

Year	Target	Actual
2010	40	55

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Irrigators will gain new knowledge and awareness of water conservation practices, crop water use rates, limited irrigation, irrigation scheduling and new irrigation technologies.
2	Nebraska farmers, ranchers, businesses and home owners will adopt new practices that will improve water management and protect water quality. This will be measured as the percentage of education program participants who indicate that they have adopted or plan to adopt new practices.
3	Livestock producers will continue to gain knowledge and awareness of appropriate practices to manage livestock manure.
4	Livestock producers will develop comprehensive nutrient management plans (CNMPs) and use best management practices for livestock manure handling and storage.
5	Nebraska farmers will increase their knowledge and awareness of how integrated pest management and pesticide best management practices can help protect water quality.
6	Nebraskans will gain increased awareness and knowledge of natural resources including wildlife, forest resources and rangeland and the relationship between natural resources stewardship, sustainability, economic viability and the environment.
7	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 Resources Districts that require the use of water measurement devices.
8	Nebraska will not exceed its allocation of water in the Republican River as allowed by the interstate compact with Kansas and Colorado. Nebraska'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.

Outcome #1

1. Outcome Measures

Irrigators will gain new knowledge and awareness of water conservation practices, crop water use rates, limited irrigation, irrigation scheduling and new irrigation technologies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2000	2400

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 a 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 eleven 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

UNL Extension has delivered educational programs ranging from one-on-one in-field instruction to two-day long workshops. In 2010, over 1,700 producers/consultants (representing 6.6 million acres of cropland) have attended an educational program and participated in program evaluation. UNL Extension initiatives include educational conferences (e.g. Nebraska/Colorado Limited Irrigation Systems), pivot dealers irrigation workshops co-sponsored with the 4 pivot manufacturers, demonstrations and workshops on subsurface drip irrigation (SDSI) engaging over 3,000 producers since 2004, and on-farm demonstration (e.g. Nebraska Agricultural Water Management Demonstration Network-NAWMDN). NAWMDN continues to grow into a robust on-farm extension initiative demonstrating irrigation water savings through in-field ET and soil moisture monitoring on 400 farms and approximately 400,000 acres.

Results

Currently proven technologies and management practices continue to demonstrate the potential to reduce statewide irrigation water pumped by 2 inches (or 460 billion gallons per year) or more

and energy use by 42 million gallons of diesel fuel equivalent per year or more. Examples include installation of approximately 60,000 acres of SDI technology since 2004 (Extension providing the only research and education effort in NE). The Republican River Valley water use efficiency tours and demonstrations produced a water savings of about 29,000 acre-feet/year or a savings of \$1.2 million per year. NAWMDM continues to demonstrate an actual water savings of 2.0 acre-inches/acre for a savings of \$2.5 million. Farmer participants in the Pivot dealers workshops estimated their savings at 30,000 acre-feet/acre and \$1.5 million annually.

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
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities

Outcome #2

1. Outcome Measures

Nebraska farmers, ranchers, businesses and home owners will adopt new practices that will improve water management and protect water quality. This will be measured as the percentage of education program participants who indicate that they have adopted or plan to adopt new practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	70	70

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Agriculture impacts water quality. Atrazine issues are targeted as a critical issue for the Blue River Basin with the potential risk of loss of herbicide registration within parts of this watershed. EPA and industry sponsored monitoring is ongoing with Extension partnering with others on education relative to Atrazine BMPs. A 2009 USGS analysis showed that all of the pesticides assessed (including common corn pesticides such as atrazine, metolachlor, alachlor, cyanazine) on 32 Corn Belt rivers including 3 in Nebraska, were dominated by varying degrees of concentration

downtrends. Only one pesticide-simazine, which is used for both agricultural and urban weed control-increased from 1996 to 2006. Nitrate in ground water continues as our primary pollutant of statewide concern. A 2009 Nebraska groundwater quality report from the Department of Environmental Quality suggests a nitrate trend showed increasing slope about 1.25 ppm per decade from 1973 to 1993 while the trend from 1994 to 2008 is flat.

What has been done

Extension hosts educational experiences targeting issues related to water quality impairment from nitrogen, erosion, and herbicides and encouraging and best practices for reducing contamination associated with tillage, irrigation, fertilization, chemigation, on-site waste water, and municipal storm water. Examples include (1) Atrazine supplement added to pesticide safety education certification program in southeast NE; (2) Private Well Users educational products on the UNL wide water web site (accessed 59,00 in 2010); (3) workshop series and publications development on bioretention gardens, rain gardens and other green infrastructure topics Phase II Nebraska cities (10,00 to 50,000 people) and (4) and pesticide safety education classes that reach approximately 1/3 of the licensed private pesticide applicators with information on management practices designed to protect human health and water quality.

Results

Sample outcomes or impacts include: (1) 98 participants (engineers, landscape architects, public works administrators) in Bioretention gardens and 95 in rain gardens and 79 in other stormwater management green infrastructure demonstrating significant knowledge increase in design principles, soil evaluation, plant selection; (2) 17 extension events on nutrient management (improved nitrogen management reduces ground water nitrates) reached producers and advisors managing 2,750,000 acres reporting a \$6.8 million value.

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
121	Management of Range Resources
131	Alternative Uses of Land
132	Weather and Climate
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Livestock producers will continue to gain knowledge and awareness of appropriate practices to manage livestock manure.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	500	13000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Individuals involved in public policy issues, animal production, and delivery of technical services for confined animal systems need on-demand access to the nation's best science-based resources. This information is critical to preparing and implementing good public policy and to advising animal producers on nutrient and manure management decisions. In 2010, public policy specific to dust and greenhouse gases associated with livestock systems surfaced with new EPA proposed public policy. In addition, regulatory compliance with CAFO policy on nutrient management planning continues to be targeted by regulatory agencies.

What has been done

Key activities in 2009 include: Nebraska faculty (1) led maintenance of the national eXtension web site on animal manure issues resulting in about 250,000 page views and hosted monthly web cast workshops, each of which is attended on average by 1240 participants that influence decisions made by 180,000 producers (new resources and webinars on climate change issues associated with animal agriculture were added in 2010); (2) Vegetative Treatment Systems (VTS) on-farm demonstration project has installed 36 demonstration over the past 10 years. This year the program focus was on regional tours attended by 130 small and medium feedlot or cow-calf livestock producers representing about 53,000 head of cattle.

Results

Key accomplishments reported by the national eXtension web initiative on animal manure issues are summarized for their 5 year project based upon evaluations of impact in 2008, 2009, and 2010. LPELC resources have contributed to 1) improved nutrient management plans: 78% said "Yes" -51% said moderately or significantly; 2) better advice to producers: 94% said "Yes" -69% moderately or significantly; 3) Improved application of emerging technologies: 93% said "Yes" - 65% moderately or significantly. LPELC resources are used to 1) research client's question by 70% of extension agents 76% of NRCS staff; 2) Assist with recommendation benefitting clientele by 58% of consultants; 3) locate information for educational programs by 74% of extension specialists; 4) assist with permit reviews by 42% of regulatory agency staff. 93% of survey respondents found economic value in information obtained from the LPELC. Their average value placed was \$813. If applied to the eXtension web sites monthly newsletter audience only, the estimated monthly value is more than \$1,200,000.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

Livestock producers will develop comprehensive nutrient management plans (CNMPs) and use best management practices for livestock manure handling and storage.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	300	114

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Animal Manure Management (AMM) team teaches operators and employees of animal feeding operations (AFOs) and concentrated animal feeding operations (CAFOs) about manure management for agronomic efficiency and environmental protection. The AMM team hosts programs on manure nutrient management addressing feeding routines, manure handling techniques, assessing the risks of phosphorus runoff, nutrient management planning tools, and soil management and conservation. The AMM team educates on the value of manure relative to commercial fertilizer.

What has been done

In 2010 alone, AMM educational efforts engaged 91 producers who directly manage more than 356,100 head of livestock and 10,000 chickens and 23 advisors' who influence the decisions of 2807 producers. All 600 plus permitted CAFOs in Nebraska have been trained in use of nutrient management principles and tools using extension developed educational materials.

Results

60% of CAFO operators re-certifying have adopted BMPs for nutrient management and required record keeping. For example, in 2003 only 7% of operators calibrated their manure spreaders, now 70% indicated they do. 95% are observing setbacks to keep manure away from streams. 90% apply manure based on crop needs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Nebraska farmers will increase their knowledge and awareness of how integrated pest management and pesticide best management practices can help protect water quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2000	30900

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A variety of pest problems occur in Nebraska, including insects, weeds and plant diseases. Economically important pest species may vary by location within state and by year. Users of IPM need skills to identify and assess pest problems, and make intelligent management decisions, taking into account relevant economic, environmental, and health issues. The diversity of

cropping systems and environments across Nebraska challenges faculty to identify site-specific IPM systems for adoption. In addition, genetically modified crops have presented new opportunities for reducing pesticide use and created new challenges for minimizing emergence of resistant weeds and insects.

What has been done

Sample pest management Extension programs in 2010 include: 1) pesticide safety education (PPE) resulting in licensing of over 6,800 farmers and ranchers as private pesticide applicators in Nebraska, 2) pesticide safety education resulting in licensing of almost 2,400 people as commercial and noncommercial pesticide applicators in Nebraska, 3) 116 urban pest management professionals learned new pest management techniques and gained new knowledge on major pests through the Urban Pest Management conference, 4) release in 2010 of an updated final version of Pest Private Eye and the CASE of IPM in Schools, 2008 Association of Communication Excellence "Best of the Best" Gold Award, and continued implementation of this tool in schools; and 5) publishing of an annual Guide to Weed Management in Nebraska to provide research-based information on safe and effective application of herbicides and other pesticides; 6) Crop Production Clinics and Crop Management and Diagnostic Clinics attended by 331 participants which address multiple crop issues including IPM reach an audience that manages or influences over 5 million acres of crops.

Results

Evaluation of participants in 2010 Crop Production Clinics: 1) 76% reported improved knowledge of practices to minimize environmental contamination from pesticide applications; 2) 80% reported that knowledge gained at the clinic would help increase the profitability or success of their operation; they valued this knowledge at \$3.12 per acre. Evaluation of participants in July 2010 Crop Management & Diagnostic Clinics suggest: 1) knowledge gain is valued at \$6.44 per acre; 2) 51% improved ability to id agronomic crop weeds; 3) 52% intend to make increased use of insect resistant alfalfa varieties; 4) 43% intend to do better job managing soybean cyst nematode. 2010 private PSEP participants reported that they will always or sometimes change their behaviors as follows: 1) 100% will take steps to prevent carrying pesticide residues into the home; 2) 99% will consider economic thresholds when using pesticides; 3) 99% will use drift reduction spray nozzles; 4) 99% will calibrate equipment at least once per year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
124	Urban Forestry
125	Agroforestry
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #6

1. Outcome Measures

Nebraskans will gain increased awareness and knowledge of natural resources including wildlife, forest resources and rangeland and the relationship between natural resources stewardship, sustainability, economic viability and the environment.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	6000	13100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Nebraska natural resources are critical to sustaining the state's population and economy. Approximately 50% of the state's land is pasture or rangeland and nearly 40% is crop land which is the foundation for a \$12 billion agricultural economy (2006) and a rapidly expanding ethanol industry. The water resources sustain production on 50% of the cropland resources. The land and water resources also support a myriad of biological resources critical to outdoor recreation. Energy is also emerging as a critical issue to Nebraska with the developments in biofuels and wind energy.

What has been done

Extension provides a wide variety of activities in 2010. Examples include: (1) wind energy development and land owner rights workshops (760 participants in 2010) (2) Master Naturalist program (570 people in 2010); 3) 110 onsite wastewater treatment professionals have taken advantage of 6-hour training opportunities addressing onsite wastewater issues; (3) sample range management programs include Nebraska Ranch Practicum which directly or indirectly influenced decisions on 510,000 acres and 41,000 head of cattle and West Central Cattleman's Days and Ranching for Profitability which engaged 250 producers, lenders, and consultants attended these programs, representing over 62,000 head of cattle and over 400,000 acres.

Results

In 2009, sample outcomes from Extension education include: 1) onsite wastewater treatment participants estimated they worked on 4,678 systems per year and impact treatment of 196 million gallons of wastewater annually and improved their skills by modifying how they conduct soil percolation tests (29% "usually" and "always" response), changing how they design systems (27%), changing how they install systems (23%), and changing how they discussed system

management with owners (72%); 2) the Nebraska Ranch Practicum participants reported that this educational experience produced a savings of \$17.28 per head or a total economic impact of \$133,955, improved skills in monitoring vegetation and livestock for 96% of participants, and resulted in management changes on 100% participant ranches; 3) Cattleman's Days and Ranching for Profitability participants indicated that 80% of participants had moderate to significant knowledge gain, 59% of participants will make changes to increase their operations' profitability, and 59% of participants indicated they have made changes to their operations as a result of previous years' attendance at these programs; and 3) Going Green workshop youth participants reported that they learned how their 4-H projects could affect the environment (79%), will make at least one or more 4-H projects that are environmentally friendly (77%), understand how to create an entrepreneurial business that recycles old items into new products (72%), and are more aware of how the products they use effect the environment (92%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
124	Urban Forestry
125	Agroforestry
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
141	Air Resource Protection and Management
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities

Outcome #7

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 Resources 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	Quantitative Target	Actual
2010	5	16

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 a 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 eleven 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

UNL Extension has delivered educational programs ranging from one-on-one in-field instruction to two-day long workshops. In 2010, over 1,700 producers/consultants (representing 6.6 million acres of cropland) have attended an educational program and participated in program evaluation. UNL Extension initiatives include educational conferences (e.g. Nebraska/Colorado Limited Irrigation Systems), pivot dealers irrigation workshops co-sponsored with the 4 pivot manufacturers, demonstrations and workshops on subsurface drip irrigation (SDSI) engaging over 3,000 producers since 2004, and on-farm demonstration (e.g. Nebraska Agricultural Water Management Demonstration Network-NAWMDN). NAWMDN continues to grow into a robust on-farm extension initiative demonstrating irrigation water savings through in-field ET and soil moisture monitoring on 400 farms and approximately 400,000 acres.

Results

Water pumped (consumptive use estimates are not generally available) was 68% of water pumped for irrigation in 2005-2007 based upon information from 5 Natural Resource Districts. Currently proven technologies and management practices continue to demonstrate the potential to reduce statewide irrigation water pumped by 2 inches (or 460 billion gallons per year) or more and energy use by 42 million gallons of diesel fuel equivalent per year or more. Examples include installation of approximately 60,000 acres of SDI technology since 2004 (Extension providing the only research and education effort in NE). The Republican River Valley water use efficiency tours and demonstrations produced a water savings of about 29,000 acre-feet/year or a savings of \$1.2 million per year. NAWMDM continues to demonstration an actual water savings of 2.0 acre-inches/acre for a savings of \$2.5 million. Farmer participants in the Pivot dealers workshops estimated their savings at 30,000 acre-feet/acre and \$1.5 million annually.

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

123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land
132	Weather and Climate
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

Outcome #8

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. Nebraska'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	Quantitative Target	Actual
2010	49	47

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 CO, 49% to NE and 40% to KS. 2008 consumptive use estimates suggest the Nebraska was under its allocation by 78,000 acre-feet. For the five year running average, it exceeds its allocation by less than 200 acre-feet. Natural Resource Districts have developed plans that are contributing towards achieving the targeted allocation that includes retirement of irrigated acres, improvements in efficiency of irrigation water use, and limitations on irrigation development. These reductions are a result of extension education, public policy pressure, and changes in rainfall patterns.

What has been done

Our West Central Research and Extension Center conducts research and field demonstrations that targets agricultural systems relevant to the Republican River Basin. A 2010 Field Days on Improving Crop Water Productivity was held at the newly acquired West Central Water Resources Field Laboratory where farm scale research and demonstrations can be implemented on systems applicable to Western Nebraska. Additional irrigation or water conserving extension program in

this region include 1) 2010 Nebraska No-Till Conference held in two locations and attended by 434 participants; 2) Nebraska/Colorado Limited Irrigation Systems; 3) pivot dealers irrigation workshops co-sponsored with the 4 pivot manufacturers, demonstrations and workshops on subsurface drip irrigation (SDSI) engaging over 3,000 producers since 2004, 4) Crop Water Use Efficiency Field Tour Series and Demonstration Project which impacted 180 people through field tours and unknown others through weekly live and archived webinars updating producers on evapotranspiration and field moisture status for making irrigation decisions.

Results

47% of Republican River allocation is 2009 value. 2010 will be available about April 15, 2011. The Republican River basin and nearby educational programs produced impacts such as 1) Nebraska No-Till Conference participants reported increased no-till acres by over 981,400 acres (7% of Nebraska corn acres); 2) Center Pivot Water Conservation Project survey indicated center pivot irrigators attending project workshops were able to reduce pumping by 30,000 acre-feet with an associated savings of \$1.5 million annually; 3) Crop Water Use Efficiency Field Tour Series and Demonstration Project survey results of 73 producers (180 in attendance) showed more than \$1.2 million per year savings and a potential water savings of 2.9 acre-inches/acre represents at least a 15-20 percent savings (28,900 acre-feet/year).

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
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: Drought conditions continue to moderate in 2010. Only parts of the Panhandle and much of the southern tier of Nebraska counties were listed as abnormally dry during the start of the 2011 growing season. During 2010, 20% to 40% of the state were listed as abnormally dry or moderate drought, significantly less than the first half of the decade.

Economy: 2010 was a year of high crop costs and prices for crops and generally positive economic conditions for crop producers. The recession and trade protection policies of key trading partners have moderated and demand for meat products is holding steady or growing within all animal production sectors. Animal industry is enjoying stronger product prices but balancing that against very high feed costs.

The continued strength of the corn-based ethanol industry has brought significant economic development and income potential to many rural areas. There are currently 24 active ethanol production plants in Nebraska, with a combined production capacity of over 2 billion gallons of ethanol each year--and requiring 769 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.

Public policy and Government Regulations: Public pressure by the Human Society of the US is causing significant concerns among all agricultural organizations. Policy implementation in California and other states sponsored by HSUS is seen as promoting economically unsustainable animal agricultural practices in the US by agricultural organizations. HSUS has established an office in Nebraska and is hosting public meetings.

Appropriation Changes: Reduced state tax collection and soaring federal deficits has led to static state and federal budget support in 2010 with significant federal reductions possible in 2011. Additional elimination of some research and extension program areas is anticipated.

Competing public priorities: A customer base that has little connection and no understanding of modern agricultural production systems and values of the farming community and a desire to use public policy to design agricultural systems is very frustrating to the agricultural community. Some aspects of this public oversight of food production is seen as beneficial such as local foods production and organic systems because of 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 meddling by their customers and policy makers that the agricultural community believes to be poorly informed.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)

Evaluation Results

UNL Extension has divided into five spires of excellence with one specifically targeting agriculture and natural resource issues: 1) Water Climate and the Environment for Agriculture and 2) Water Climate and the Environment for Communities. The Action Team supporting each spire has identified one or more "Signature Outcomes" that first became active at the start of 2010. The "Signature Outcomes" were delivered statewide for the first time in 2010 and establish methodologies for measuring statewide impact allowed capture of a significant part of our 2010 impact (see Making a Difference at <http://extension.unl.edu>). The faculty team supporting each spire is in the process of planning 2011 statewide delivery and evaluation procedures identified in the statewide action plans. These tools

have produced our first statewide snapshots of educational program impacts including knowledge gain, intended practice change, and likely conditional changes.

Key Items of Evaluation

Impact indicators and supporting statewide survey are being completed for one to three Signature Programs (initiated for 2010) associated with each Action Team. The preliminary statewide measures of impact that will be utilized for the next several years are as follows:

Agricultural Water Management(Water, Climate, and Environment Action Team)

1. Survey clientele current management practices and dollars saved from new practices adopted
2. NASS agricultural statistics and NRD water use records.

Agricultural Manure Management (Water, Climate, and Environment Action Team)

1. Survey clientele on current management practices and dollars saved from practice changes.
2. Assemble NDEQ records of compliance.

Maintain and Improve Community Water Quality/Quantity (Water, Climate, and Environment Action Team)

1. Practice changes that lead to conservation of water quality and quantity.
2. Financial savings for homeowners, businesses and industry.

Resource Efficient Community Landscapes

1. Practice changes that lead to conservation of water quality and quantity.
2. Financial savings for homeowners, businesses and green industry.