Annual Report
University of Nebraska Agricultural Research Division
FY 2000 to 2004

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Annual Report
University of Nebraska
Agricultural Research Division

I. INTRODUCTION:

The University of Nebraska Agricultural Research Division is a division of the University of Nebraska Institute of Agriculture and Natural Resources (IANR). Other divisions include the Cooperative Extension Division and the College of Agricultural Science s and Natural Resources.

This annual report describes the Agricultural Research Division program impacts and accomplishments for fiscal year 2000 as required by the Agricultural Research, Extension, and Education Reform Act of 1998. It includes the elements identified in the USDA document, "Guidelines for Land Grant Institution - Annual Report." This federal annual report is based on the implementation of the current Strategic Plan of the Institute of Agriculture and Natural Resources and on emerging issues identified through stakeholder input in anticipation of beginning the next revision of the IANR Strategic Plan. This federal annual report is for the University of Nebraska Agricultural Research Division only, but was developed in conjunction with Un iversity of Nebraska Cooperative Extension Division's annual report.

In FY 2000, Agricultural Research Division expenditures in support of the programs described in this plan totaled $56,058,995. Of this amount, Federal Formula Funds provided $3,240,652 or 5.8% of the total funds expended.

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Darrell W. Nelson, Dean and Director
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2000 Agricultural Research Division
Plan of Work
Annual Report

A. Planned Programs

Federal Goal I. To achieve an agricultural production system that is highly competitive in the global economy.

Overview - Research Results Related to Goal 1

Under this goal area, research programs relate to the production, marketing and processing of the major livestock species, traditional field crops, speciality crops such as dry edible beans and turf. The research also relates to new crops, increased instate production and processing and development of new products and services. There were a number of significant outputs from the research programs which will be mentioned here. Impact statements are enclosed at the end of this section providing more detail.

The release and initiation of production of Nuplains white wheat variety, the first hard wh ite wheat released in Nebraska, is a prime example. Developed by the University of Nebraska and USDA-ARS wheat breeders, this new variety is being grown by producers for the first time beginning in the Fall, 2000. Since much of Nebraska's winter wheat is exported, the addition of a white wheat will allow the U.S. to be more competitive with other wheat exporting countries such as Australia. Cooperative Extension Division faculty are also involved in the development of the plans for marketing, storage, and handling of this new identity preserved commodity.

In addition to the development of a new white wheat, the overall payoffs from the ARD wheat breading program continue to be very significant. Since wheat breading efforts by private industry are not very significant, public breeding programs such as the UNL program are critical to continue a high quality, improved varieties available to producers in Nebraska and beyond. The breeding program averages about one new improved variety of hard red winter wheat released annually, which has helped to contribute to an average annual wheat yield increase in Nebraska by 19% compared with yields in the 1960s. As result of these high quality public varieties, ARD developed varieties are grown on over 75% of the wheat acreage in Nebraska.

An impact study was completed which quantifies the economic benefit to Nebraska cattle feeders through use of feeding wet by-products from the growing Nebraska ethanol production

industry. Research by ARD faculty was a key factor in this practice being adopted by feedlots. Annual net economic benefits from this technology are estimated currently at $42 million annually in Nebraska. Cooperative Extension faculty had a significant role in transferring this technology to feedlots, helping cattle feeders to successfully shift to this practice. In addition to helping cattle feeders, it has also provided a market to the ethanol industry with their by-products, and has accelerated the development of new production facilities in Nebraska, enhancing corn and grain sorghum markets.

Agricultural Research Division (ARD) and Cooperative Extension Division (CED) faculty have worked closely with a Nebraska poultry processor who has opened the nation's only federally inspected air-chilled poultry plant, a new, potentially much safer, poultry processing technology. The ARD research data and the implementation of other improved food safety practices by the processor have proved that this process can produce a high quality product. There has been significant public media attention to this facility, including the role of ARD and CED faculty in assisting this industry to become successful in Nebraska. Resulting benefits are processing of poultry p roduced in Nebraska and in neighboring states as well as enhancing the consumption of grain products in the poultry production.

Other examples of accomplishments are included in the attached impact statements which are organized by key themes. These examples are ample evidence of the impact that the Agricultural Research Division outputs are making towards the specific Nebraska ARD goals under Federal Goal 1. The Nebraska goals are:

1. Enhance plant and animal production systems to be more profitable and sustainable.
2. Support agribusiness and economic development, including product marketing and value-added processing of agricultural commodities.
3. Increase public/consumer understanding of food systems.

Examples cited each contribute to one or more of these Nebraska goals.

Goal I Resources

Source of Funds	Federal Formula *	State	All other sources	Total
FY 2000 Expenditures ($ x 1000)	2,232	19,444	16,949	$38,625

Faculty SYs in FY 2000 - 98

* Includes Hatch, Multistate, McIntire Stennis and Animal Health Funds

Impact Statements Related to Federal Goal I - Identified by Key Themes

Key Theme: Plant Germplasm

Impact Statement: Nuplains White Wheat

(Relates to Goal 1, Output Indicator 1, and Outcome Indicator 1)

Issue: (Who cares and why?)

Nebraska producers need every edge to successfully compete in growing global markets. Development of the first hard white winter wheat designed for Nebraska's growing conditions should provide such an edge.

What has been done?

A team of USDA-Agricultural Research Service and University of Nebraska scientists developed the new variety called Nuplains. It is expected to be available for farmers to plant in fall 2000. Hard white wheat flour is primarily used to produce whole wheat bread, flat breads (tortillas and pitas) a nd Asian noodles, a large and expanding market. Nuplains is the most winter hardy white wheat available and also may provide a new planting option for wheat growers in other High Plains states. White wheat is new to Nebraska so a committee representing the state's wheat growers, NU's Institute of Agriculture and Natural Resources and state agencies is educating growers, elevator operators and others about white wheat production, handling and potential markets.

Impact:

Hard white wheat offers Nebraska wheat growers a chance to diversify their production and tap a new market. Asia imports 400 million bushels of white wheat annually from Australia and elsewhere. Nuplains should give Nebraska a chance to vie for part of this huge and rapidly growing marke t. Nebraska produced nearly 85 million bushels of hard red winter wheat in 1998 and typically exports half its production.

Funding:

Nebraska Wheat Board, USDA-Agricultural Research Service,
NU Agricultural Research Division, Hatch Act

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Summary:
The first hard white winter wheat adapted to Nebraska's growing conditions will be available for planting in fall 2000. This new variety, called Nuplains, gives Nebraska wheat growers the chance to compete in new markets. Hard white wheat is used for whole wheat breads, tortillas, pitas and Asian noodles, a growing market. University of Nebraska and USDA - Agricultural Research Service scientists, with financial assistance from the Nebraska Wheat Board, developed Nuplains, thee most winter-hardy white wheat available. A committee of representatives from the Institute of Agriculture and Natural Resources, wheat producers and state agencies is educating growers, elevator operators and other about white wheat production, handling and potential markets.

Key Theme: Plant Genomics

Impact Statement: Soybean gene mapping

(Relates to Goal 1, Output Indicator 2, and Outcome Indicator 5)

Issue: (Who cares and why?)
Some of today's most interesting maps chart the molecular world of genes, DNA and chromosomes. Knowing where key genes are located on a chromosome is important to harnessing those genes to develop better crops. University of Nebraska research helped create the first comprehensive genetic map for soybeans.

What has been done?**What has been done?**
An NU Institute of Agriculture and Natural Resources soybean geneticist and his colleagues developed one of three soybean populations used to construct the first comprehensive genetic map for all 20 soybean chromosomes. The map was first published in October 1999 by researchers at Nebraska. Thanks to this research, more than 1,800 genetic markers — specialized DNA segments that simplify identification — now serve as landmarks on the soybean genetic map, identifying critical chromosome segments that are home to key genes.

Impact:**Impact:**
The genome map enables researchers to take a more targeted approach to soybean breeding. Genetic markers help breeders locate specific genes of interest. Once located, these genes can be used to create soybeans with desirable characteristics such as higher yields, greater disease resistance, or high protein

or oil content. The map also is helping scientists better understand which genes govern specifi c traits. For example, the map already has aided NU soybean breeders' discoveries about the relationship between genes controlling yield potential and drought tolerance.

Funding:
Nebraska Soybean Board
United Soybean Board
USDA National Research Initiative competitive grant
NU Agricultural Research Division
Hatch Act

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Summary:
Some of today's most interesting maps chart the molecular world of genes, DNA and chromosomes. A University of Nebraska soybean geneticist and his colleagues created the first comp rehensive genetic map of all 20 soybean chromosomes. The Institute of Agriculture and Natural Resources team developed one of the three populations used to construct the soybean map, which contains more than 1,800 genetic markers identifying critical chrom osome segments. The genetic map speeds the plant breeding process by enabling scientists to target and harness specific genes responsible for important traits such as yield, disease resistance or high protein content. The map also is helping scientists be tter understand which genes govern specific traits.

Key Theme: Adding Value to New and Old Agricultural Products

Impact Statement: Economic Benefits of Wet Byproduct Feeds

(Relates to Goal 1, Output Indicator 4, and Outcome Indicator 4)

Issue: (Who cares and why?)
Nebraska's ethanol production capacity grew more than any other state's during the 1990s. This burgeoning ethanol and grain processing industry created markets for farmers' grain and jobs in rural communities. This expansion got a boost from University of Nebraska research that revealed wet ethanol processors' byproducts provide an economical cattle feed.

What has been done?
Research by Institute of Agriculture and Natural Resources animal scientists demonstrated the feasibility and benefits of feeding wet gluten feed, wet distillers grains and steep liquor to cattle directly instead of drying and shipping them to dried feed markets. Studies showed wet byproduct feeds' potential, performance and how to feed them. Researchers found wet byproducts were economical and performed as well as or better than corn in feedlot rations. Processors traditionally had dried byproducts at additional cost, but IANR scientists found drying reduced their nutritional value.

Researchers shared findings with grain processors and cattle producers. In less than a decade, wet byproducts went from unfamiliar material to a major Nebraska feed source. An IANR agricultural economist analyzed the economic benefits of this research by assessing the economic value of feeding processors' byproducts wet instead of dry.

Impact:
This research laid the foundation for a new, economical cattle feed source and helped reduce ethanol production costs. Feeding byproducts wet instead of drying them provided cumulative net economic benefits of $212 million in Nebraska from 1992 through 1999. Processors received about 15 percent of this net benefit while feeders accrued the rest. Annual net economic benefits grew from $1 million in 1992 to an average of $42 million in recent years as new processing plants opened and more feedlots fed wet byproducts. Nebraska feedlots fed nearly 6 million tons (dry matter basis) of wet byproduct feeds from 1992 to 1999.

This research influenced processors' decisions to build plants in Nebraska designed to market wet byproducts. Only one of Nebraska's seven wet and dry milling plants now dries byproducts. The rest sell byproducts wet and most didn't build drying facilities.

Funding:
Ethanol and grain processing companies
Nebraska Corn Board
Nebraska Ethanol Authority
NU Agricultural Research Division
Hatch Act

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Summary:

Wet byproducts from Nebraska's expanding ethanol and grain processing industry have become a major cattle feed during the past decade, thanks partly to University of Nebraska research. Pioneering studies by Institute of Agriculture and Natural Resources animal scientists revealed the feasibility, benefits and economic advantages of feeding byproducts wet instead of drying and shipping them to dried feed markets. Feeding byproducts wet saves drying costs for processors and provides an economical cattle feed. An IANR agricultural economist's analysis showed this wet byprodu cts feed research is paying off handsomely for Nebraska. Feeding byproducts wet instead of drying them provided a $212 million net cumulative economic benefit to Nebraska from 1992 through 1999.

Impact Statement: Beef Muscle Profiling

(Relates to Goal 1, Output Indicator 4, and Outcome Indicator 2)

Issue: (Who cares and why?)

A 1997 cattle industry report showed that the value of chuck and round had decreased more than 20 percent in recent years, a huge loss considering these cuts make up the majority of weight in a beef carcass. Findings of a University of Nebraska study could help turn this situation around and could lead to new products that benefit consumers and the beef industry.

What has been done?

NU Institute of Agriculture and Natural Resources meat scientists teamed with University of Florida colleagues to profile more than 5,500 muscles from the chuck and round in the largest study of its kind ever conducted. Findings show many muscles in the chuck and round are under-valued and could be put to better uses than butchers and chefs traditionally have given them. The team compiled its findings, which provide details needed to develop new products that add value to these cuts, on a CD-ROM that is available to industry and academia. Nebraska scientists now are studying marination with the chuck

and round and developing innovative beef fabrication strategies to provide access to speci fic desirable muscles identified by the profiling.

Impact:
Industry has begun using this information and the findings have sparked interest from national retailers, who are testing ideas in key areas. The National Cattlemen's Beef Associati on hired a top-notch chef to develop recipes using some of the muscles the team identified. As a result, one of the largest beef distributors in the eastern United States began ordering these cuts.

Funding:
National Cattlemen's Beef Association
NU Agricultural Research Division
Hatch Act

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Summary:
University of Nebraska meat science analysis of more than 5,500 muscles from beef chuck and round cuts may lead to new value-added products that benefit consumers and beef producers. This study, the largest of its kind, showed that many muscles in the chuck and round, which often are ground for hamburger, could be put to higher value uses. Industry is using this information and it has sparked interest from national retailers, who are t esting ideas in key areas. The National Cattlemen's Beef Association hired a top-notch chef to develop recipes using some of the muscles the team identified and a major meat distributor now orders these cuts. The Institute of Agriculture and Natural Resour ces team compiled their results, which provide details for developing new products, on a CD-ROM available to industry and academia.

Key Theme: Agricultural Profitability

Impact Statement: Monitoring Bt Susceptibility

(Relates to Goal 1, Output Indicators 1 and 2, and Outcome Indicator 5)

Issue: (Who cares and why?)

The long-term effectiveness of Bt corn, which produces its own natural insecticide toxic to European corn borers, hinges on preventing this multimillion dollar corn pest from becoming resi stant to Bt. Early detection of potential changes in the insect's susceptibility to Bt is critical to nationwide resistance management efforts.

What has been done?

University of Nebraska entomologists developed tests to detect changes in European corn borer susceptibility to Bt. They use them to check corn borer populations nationwide for Bt resistance annually. Institute of Agriculture and Natural Resources entomolo gists began working with seed companies in 1993, before Bt corn was commercialized, to establish baseline information on corn borer susceptibility to Bt across North America. Baseline information allows them to detect potential changes in corn borer susceptibility as Bt plantings expand. While there are limits to the tests' sensitivity, researchers have seen no change in the six years that Bt corn has been registered. Corn borers nationwide remain susceptible to Bt toxins.

This Nebraska lab is responsible for assessing and keeping records on corn borer Bt susceptibility nationwide. This research is funded by seed companies, which must provide annual susceptibility measurements as part of federal requirements for selling Bt seed corn.

Impact:

Baseline data, diagnostic tests and annual monitoring are important for preserving Bt's effectiveness. Annual tests should provide early warning if resistance begins to develop in certain corn borer populations. The goal is to detect changes before resistance becomes wi despread so further steps can be taken to preserve Bt's effectiveness.

Funding:

Seed companies
NU Agricultural Research Division
Hatch Act

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Summary:
If European corn borers begin developing resistance to Bt corn, which produces an insecticide toxic to this major corn pest, University of Nebraska entomologists are likely to spot it first. An Institute of Agriculture and Natural Resources scientist developed tests to detect changes in corn borers' susceptibility to Bt toxins. He uses it to annually check corn borer populations throughout U.S. corn-growing regions. He's seen no changes in the six years since Bt corn has been registered but he'll keep checking. His lab is responsible for assessing and keeping records on corn borer Bt susceptibility nationwide. The goal is to spot potential changes before resistance becomes widespread. The monitoring and early detection of potential susceptibility changes are vital to resistance management strategies designed to preserve Bt's effectiveness.

Impact Statement: Air-chilled Poultry

(Relates to Goal 1, Output Indicator 4, and Outcome Indicator 4)

Issue: (Who cares and why?)
Chilling of poultry carcasses is a key step in processing that inhibits bacterial growth. MBA Poultry in Tecumseh, Neb., opened in 1998 as the Nation's only federally inspected air-chilled poultry plant; all others in the U.S. use immersion chilling, in which birds get a cool -water bath. It's thought the risk of cross-contamination is greater with immersion chilling since broilers come into contact with each other. Immersion chilling also leads to water retention in the broilers, of concern to industry because emerging USDA labeling regulations would require processors to specify how much water their birds contain. University of Nebraska research has sought to determine differences between broilers processed with these two methods.

What has been done?
Institute of Agriculture and Natural Resources food and veterinary scientists have compared MBA's air-chilled broilers with those from an undisclosed immersion -chilling plant. Preliminary findings show both sets had roughly similar counts of non -disease-causing bacteria, but that the air-chilled broilers had less Salmonella and Campylobactor, bacteria that can cause illness. Air -chilled broilers also had significantly fewer psychotrophs, bacteria that grow at refrigeration temperature and cause spoilage.

Impact:

These findings, while still preliminary, indicate air-chilling may produce a broiler less susceptible to disease-causing bacteria, and one with a longer shelf life. The research also is helping a Nebraska business carve out a marketing niche. The research is part of a broader farm-to-table research and extension effort, including study of chicken farms over several growing seasons, aimed at taking safer chicken to market by pinpointing factors throughout the production process that influence safety. This research ultimately could yield new guidelines and recommendations for handling broilers.

Funding:
USDA
NU Agricultural Research Division
Hatch Act
NU Cooperative Extension

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Summary:
Chilling poultry carcasses is a key step in processing that inhibits bacterial growth. MBA Poultry in Tecumseh, Neb., opened in 1998 as the Nation's only federally inspected air-chilled poultry plant; all others use immersion chilling, in which the birds are given a cool-water bath. University of Nebraska scientists comparing broilers processed with these two methods have found that while both sets had roughly similar counts of non-disease-causing bacteria, the air-chilled broilers had less Salmonella and Campylobactor, bacteria that can cause illness. Air-chilled broilers also had significantly fewer psychotrophs, bacteria that grow at refrigeration temperature and cause spoilage. This work is part of broader Institute of Agriculture and Natural Resources farm-to-table research aimed at taking safer chicken to market by pinpointing factors throughout the production process that influence safety. It ultimately could yield new guidelines and recommendations for handling broilers.

Key Theme: Animal Production Efficiency

Impact Statement: Feedlot Heat Stress

(Relates to Goal 1, Output Indicator 1, and Outcome Indicator 5)

Issue: (Who cares and why?)

Hot, still, humid days are potential killers in feedlots. During 1999's severe heat wave alone, cattle deaths and performance losses cost Nebraska producers more than $20 million.

What has been done?

University of Nebraska animal scientists are collaborating with colleagues at Missouri, Purdue and USDA's Meat Animal Research Center on a three-year project to develop key management strategies feeders can use to reduce heat losses. This comprehensive study aims to better understand, predict, plan for and prevent heat stress. Researchers are combining feedlot and laboratory findings to develop management recommendations that focus on m aking cattle comfortable without sacrificing overall performance.

Impact:

This research is producing specific recommendations that will help feedlot operators keep hot spells from becoming deadly. In the past, severe heat literally forced some Nebraska fe eders out of business when they couldn't recover financially from heavy cattle losses. Researchers are confident that implementing these strategies will keep cattle comfortable and minimize potentially devastating death losses. Adopting these strategies should reduce heat-related death losses by 50 percent to 100 percent; performance losses should be kept at a level where most cattle can comfortably compensate when heat dissipates.

Funding:

USDA National Research Initiative competitive grant
Hatch Act
NU Agricultural Research Division

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Summary:

Hot, still, humid days are potential killers in feedlots. During 1999's severe heat wave alone, cattle deaths and performance losses cost Nebraska producers more than $20 million. A University of Nebraska animal scientist heads multi-state research that's developing management strategies feeders can use to keep severe heat from becoming deadly for cattle. They are developing specific recommendations for keeping cattle comfortable without sacrificing overall performance. Researchers are confident that implementing these strategies will min imize cattle discomfort and potentially devastating death losses.

Key Theme: Agricultural Competitiveness

Impact Statement: Wheat Breeding Payoffs

(Relates to Goal 1, Output Indicators 1 and 2, and Outcome Indicator 1)

Issue: (Who cares and why?)

To be competitive, Nebraska growers need wheat varieties that are top performers in milling and baking as well as in the field, yet few commercial seed companies breed wheat for this region.

What has been done?

University of Nebraska and USDA-Agricultural Research Service scientists based in Lincoln, Neb., collaborate on wheat research and breeding to develop improved varieties that are widely grown throughout Nebraska and beyond. NU's wheat breeding program focuses on improving both agronomic and end use characteristics. The result is higher-yielding varieties with the grain quality demanded by millers, bakers and, ultimately, consumers. In statewide variety trials, researchers compared three recent and widely grown NU varieties — Alliance, Arapahoe and Windstar — to Scout 66, the first great modern wheat variety from Nebraska, which was released in the 1960s and is a longtime industry standard. The three new NU varieties yielded 19 percent more than Scout.

Impact:

NU-developed hard red winter wheat varieties are planted on roughly three-fourths of Nebraska's wheat acres. These improved varieties have boosted Nebraska's annual yields by 12 million bushels since the 1960s. They're worth approximately $31 million to $37 million annually to Nebraska producers based on increased yield alone. These improvemen ts are good for consumers, too. Nebraska wheat growers can feed nearly 5 million more Americans a year than they did on the same acreage in the 1960s.

Funding:

USDA-Agricultural Research Service
Nebraska Wheat Board

Hatch Act
NU Agricultural Research Division

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Summary:

Varieties developed through the University of Nebraska's wheat breeding program provide Nebraska growers with improved wheats that perform well in the field and offer the quality characteristics millers and bakers demand. Nebraska-developed hard red winter wheat varieties are planted on roughly three-fourths of the state's wheat acres. These varieties have increased Nebraska's annual yields by 19 percent compared with the 1960s. These improved varieties are worth roughly $31 million to $37 million annually to Nebraska producers based on increased yield alone. Consumers benefit, too. Yield improvement in these varieties mean Nebraska wheat growers can feed nearly 5 million more Americans a year than they did on the same acreage in the 1960s.

Federal Goal II. A Safe, Secure Food and Fiber System

Food animal production and food processing are major components of the Nebraska economy and the Nebraska Agricultural Research Division maintains a significant food safety research effort. Research faculty working in this area are working closely with the food industry and regulatory industries to focus research efforts in the most critical problems as well as future issues. Significant effort is also being made on research of pre-harvest food safety areas, in particular, working with livestock producers. This work is integrated closely with efforts of Cooperative Extension to use the food safety research outputs to effectively conduct food safety education and demonstration programs.

The Nebraska goals under this federal goal are:

1. Animal and plant production systems and food processing and production systems to be enhanced to improve food safety and quality

2. Research based information will increase awareness of consumers, producers, food processors, food handlers and extension personnel on food safety issues and technologies.

A major component of the food safety research program which has made excellent progress during the year 2000 is the research working with the dangerous *e-coli 0157:H7* bacteria. This bacteria is a major public health threat and has caused significant disease outbreaks as well as causing significant recalls of food products, primarily meat. ARD scientists made two major steps forward in 2000 which can have significant impact on controlling this problem in the future. First, studies of *e-coli 0157:H7* in the feedlot have developed significant new knowledge about the incidence and transmission of this organism among cattle in feedlots. This knowledge will be critical in h elping to reduce pathogen incidence prior to slaughter.

In another thrust, ARD faculty have developed a new genetic finger printing method that is revealing surprising new information about genetic differences between different *0157:H7* populations and may point out that some that most commonly affect humans may be different than those normally found in live feedlot cattle. This can be significant in helping to control human illness from this source in the future.

In another area of research, the focus is on the widespread problem of humans with food allergies. This problem has been given much more national attention due to the discovery that genetically modified corn containing a potential allergen were grown and entered into the food chain during 2000. While this potential allergen does not appear to be a threat to human health presently, the high visibility points out the need to have good information regarding the presence of allergens in many types of food, both conventional and those made from new genetically modified crops.

ARD scientist have recently developed fast, accurate tests which food processors can use in their plants to trace for traces of peanut, egg and milk in processed foods and on equipment. These tests can insure processors of being able to warn people allergic to any of those foods or are found to keep those foods out of the market. These and other new tests that are being developed will be very helpful for industry to detect small traces of allergenic foods in processed foods or on equipment. These tests are licensed and are being commercialized by private company and are being marketed nationwide.

Impact statements related to these accomplishments are attached. The research underway related to this area is making excellent progress on dealing with very serious and complex problems of food safety in Nebraska and beyond.

Goal II Resources

Source of Funds	Federal Formula *	State	All other sources	Total
FY 2000 Expenditures ($ x 1000)	120	1,044	910	$2,074
Faculty SYs in FY 2000 - 8.8				

* Includes Hatch, Multistate, McIntire Stennis and Animal Health Funds

Impact Statements Related to Federal Goal II - Identified by Key Themes

Key Theme: Foodborne Pathogen Protection

Impact Statement: *E. coli* Genetic Differences

(Relates to Goal II, Output Indicator 1, and Outcome Indicators 1, 2, & 3)

Issue: (Who cares and why?)

Potentially deadly *E. coli 0157:H7* bacteria is a major public health threat, but genetic differences among *0157:H7* populations and their role in causing disease aren't well-understood. Such understanding could yield more sensitive, accurate procedures for identifying disease-causing *E. coli* strains and could point to safer production practices, which would benefit both public health and the beef industry.

What has been done?

Food scientists at the University of Nebraska Institute of Agriculture and Natural Resources developed a new genetic fingerprinting method that is revealing surprising new information about *E. coli 0157:H7*. Their octamer-based genome scanning technique allows researchers to pinpoint genetic differences on *E. coli* DNA and to rapidly clone and identify the genes at those DNA sites.
Using this technique, they identified two distinct *0157:H7* populations in cattle: one that causes illness in people and one that appears to be less often successful at causing human illness.
Recent studies tracking these populations' global ancestry suggest the populations diverged some time ago and have since been spread globally. The Nebraska team now is in the midst of a two-year project to pinpoint all of the genetic differences between the populations.

Impact:
Discovery of genetically distinct *E. coli 0157:H7* populations could explode theories about how people are exposed to *0157:H7* strains and the outcomes of those exposures. This research should provide genetic information to help trace the source of *E. coli-related* illnesses, increase understanding about how production practices influence different *E. coli* strains, could lead to a simpler, less expensive way to do large-scale *E. coli* testing and eventually help pin down each population's potential to cause human illness.

Funding:
Hatch Act
NU Agricultural Research Division
USDA National Research Initiative competitive grant
Nebraska Legislative Bill 1206
American Meat Institute

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Summary:
Using a new genetic fingerprinting method they developed, University of Nebraska food scientists team discovered some surprising differences in populations of *E. coli 0157:H7*, the potentially deadly bacteria responsible for ground beef recalls and food poisoning outbreaks. Initial results show that

almost two-thirds of *E. coli 0157:H7* isolates found in cattle appear to be incapable of causing illness in people. These findings and the scientists' powerful new tool should help more accurately trace the source of E. coli-related illness. This technique, called octamer-based genome scanning, eventually could help scientists develop simpler, less expensive tests to detect disease-causing *E. coli 0157:H7* strains in large groups of cattle, such as those in feedlots.

Key Theme: Food Safety

Impact Statement: Food Allergen Tests

(Relates to Goal II, Output Indicator 3, and Outcome Indicators 1 & 2)

Issue: (Who cares and why?)

For the roughly 5 percent of children and 1 percent to 2 percent of adults with food allergies, reading ingredient labels sometimes isn't enough to protect them from a serious allergic reaction. Traces of allergenic foods sometimes wind up where they shouldn't be through cross-contamination when manufacturers process foods on shared equipment. University of Nebraska food scientists have developed powerful new tests to help the food industry protect against potentially harmful cross-contamination.

What has been done?

NU Institute of Agriculture and Natural Resources food scientists devised fast, accurate tests that food processors can use in their plants to check for traces of peanut, egg and milk in processed foods and on equipment. These 30-minute tests replace procedures that took days to complete in a laboratory. These tests have been commercialized by Neogen Corp. of Michigan under a university license agreement.

Impact:

The NU-developed tests, which became commercially available to the food industry in the past three years, are the first to provide manufacturers with a quick, easy way to ensure equipment is free of any traces of peanut, egg or milk allergens. Other tests are in the research pipeline. Commercialization and industry adoption of these tests are helping protect allergic consumers.

Funding:
NU Agricultural Research Division
NU Food Allergy Research and Resource Program member companies
Hatch Act

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Summary:
Quick, accurate tests developed by University of Nebraska food scientists are helping the food industry protect people with food allergies. An Institute of Agriculture and Natural Resources team devised fast, accurate tests food processors can use in their plants to detect even minute traces of allergenic foods in processed foods or on equipment. Tests for egg, peanut and milk have been commercialized by a Michigan company that markets the tests to the food industry under a university license agreement. Tests for other food allergens to help protect allergic consumers are in the works.

Key Theme: Food Resource Management

Impact Statement: Food Processing Center

(Relates to Goal II, Output Indicators 2 & 3, and Outcome Indicators 1, 2, & 3)

Issue: (Who cares and why?)
Creating new jobs and diversifying economic opportunities are keys to maintaining Nebraska communities and quality of life. Entrepreneurs and established food processors get help adding value to the state's abundant livestock and grain from the University of Nebraska's Food Processing Center.

What has been done?
NU's Food Processing Center is a one-stop source of food safety, problem-solving, product development, and technical and business information for entrepreneurs and existing food processors. For example, its Nebraska Custom Processing Network matches Nebraska food processors that have

excess plant capacity with companies that need custom or contract production, helping outside processors and Nebraska companies produce food more profitably. The center handles more than 3,000 inquiries annually for this program alone, which it operates in cooperation with the Nebraska Food Industry Association. The center was the first of its kind when it opened in 1983 and became a model for other universities.

Impact:
Nebraska's food processing industry has grown from 220 food processing businesses when the center opened to nearly 400 today. NU Food Processing Center officials estimate that the center's programs and services add an estimated $12.5 million annually of economic value to Nebraska's economy. One company manager said the center's expertise helped the company increase sales by $250,000, reduce operating costs by 7 percent, create 12 new jobs and invest $100,000 in new capital projects.

The center's Custom Processing Network has generated more than $11 million of additional business for Nebraska processors and contributed to 11 plant expansions and four plant relocations to Nebraska.

Funding:
U.S. Department of Commerce
USDA special appropriation
Private sector funding
NU Cooperative Extension
NU Agricultural Research Division
Hatch Act

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Summary:
The University of Nebraska's Food Processing Center offers technical and marketing/business development assistance to entrepreneurs and established food processing firms that has helped Nebraska's food processing industry grow from 220 food processing businesses in 1983 to nearly 400

today. Center officials estimate its programs and services add about $12.5 million of economic value to Nebraska's economy annually. One company manager said the center's expertise helped his company increase sales by $250,000, reduce operating costs 7 percent, create 12 new jobs and invest $100,000 in new capital projects.

Federal Goal III. A Healthy Well-nourished Population

The Nebraska goal in this area is to enhance the quality of life of individuals and families through healthy lifestyles including better nutrition and reduction of high risk activity. Particular areas of research emphasis include lipid metabolism, bioavailability of nutrients, eating behaviors and disorders, biochemistry of cardiac illnesses and function of health care and family support systems. In addition to being incorporated in Cooperate Extension educational programs, research results are also used by a broad range of health care professionals, educators, and marketers and consumers of all ages.

An ARD researcher has developed an entire poultry management system for economically producing eggs rich in omega-3 fatty acids. Omega-3 fatty acids can help reduce some heart disease risks factors, but many Americans don't get enough of these beneficial nutrients. Flax seed, a significant source of omega-3 fatty acid is a key feed ingredient in the patented omega egg production system. The patented system makes omega egg production more economically and efficient. The system has just been licensed to a major Midwestern grocery store supplier and the omega eggs will be produced in the Midwest and marketed through a major supermarket chain in seven Great Plains and Midwest states. In addition to providing a healthier food source for consumers, this technology helps to maintain a profitable poultry industry.

In study results released in 2000, a study of health habit diaries of nearly 7,000 American adults found that chronic bad health habits such as drinking, smoking, or poor nutrition tend to be linked because the habits reinforce each other. For example, compared with non-smokers, smokers tend to eat fewer foods rich in protective anti-oxidants, eat more high fat foods, and drink more alcohol. The behaviors are so interconnected that people have trouble kicking one habit while continuing with the others. These findings show that there is a better chance to develop successful health campaigns that target multiple bad habits. The results of this research have received highly visible coverage in the public media, enhancing public awareness which can lead to increased impact in the future.

In another study related to health lifestyles, ARD faculty developed a 30-question Exercise Habits Inventory to help analyze a person's exercise regimen. This is now undergoing pilot study as a screening tool for physicians and consulting dietitians to assess people's exercise habits and their risk for developing exercise dependance. This inventory relates to research from the same study that indicates some people exercise excessively and become so dependent on workouts that they risk damaging their health, personal relationships and careers.

The research examples described are appropriate accomplishments for the research programs under this goal. This information is already in use by health care professionals and by educators. Impacts on the changes in families and individuals will take much longer.

Goal III Resources

Source of Funds	Federal Formula *	State	All other sources	Total
FY 2000 Expenditures ($ x 1000)	253	2,201	1,919	$4,373
Faculty SYs in FY 2000 - 1.9				

* Includes Hatch, Multistate, McIntire Stennis and Animal Health Funds

Impact Statements Related to Federal Goal III - Identified by Key Themes

Key Theme: Human Health

Impact Statement: Smoking and Diet

(Relates to Goal III, Output Indicators 2 & 3, and Outcome Indicator 1)

Issue: (Who cares and why?)

Traditionally, health campaigns have urged Americans to kick one chronic bad habit — such as drinking, smoking or poor nutrition — at a time. New University of Nebraska research may turn that thinking on its ear and build a case for attacking multiple bad habits at the same time.

What has been done?

University of Nebraska nutritionists examined health habit diaries of nearly 7,000 American adults and found people with one of these bad health habits tend to have them all because the habits reinforce each other. For example, compared with non-smokers, smokers tend to eat fewer foods rich in protective antioxidants, eat more high-fat foods and drink more alcohol. Previous studies identified smokers' lower antioxidant levels. The NU research confirmed those fin dings and was the first to link these lower antioxidant levels to diet.

Impact:

The Nebraska research provides insight about why traditional quit-one-habit-at-a-time approaches often miss the mark: These behaviors are so interconnected that people have tr ouble kicking one habit while continuing the others. These findings and follow up studies exploring why these bad habit clusters tend to form could lead to more successful health campaigns that target multiple bad habits.

Funding:

NU Agricultural Research Division

Hatch Act
NU College of Human Resources and Family Sciences

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Summary:
Traditionally, health campaigns have urged Americans to kick one chronic bad habit — such as drinking, smoking, or poor nutrition — at a time. New University of Nebraska research may turn that conventional wisdom on its ear. The Institute of Agriculture and Natural Resources study of nearly 7,000 American adults found drinking, smoking and poor nutrition reinforce each other. People with one of these bad health habits tend to have them all. That increases health risks considerably and boosts associated social and health care costs. These College of Human Resources and Family Sciences' findings could lead to new, more successful health campaigns that target quitting multiple bad habits at the same time.

Impact Statement: Exercise Dependency Index

(Relates to Goal III, Output Indicator 2, and Outcome Indicator 3)

Issue: (Who cares and why?)
Most everyone knows regular exercise is a key part of a healthy lifestyle. What's less well known is that it's possible to get too much of a good thing. Some people exercise excessively and become so dependent on workouts that they risk damaging their health, personal relationships and careers.

What has been done?
University of Nebraska nutrition scientists developed the 30-question Exercise Habits Inventory that helps analyze a person's exercise regimen. Results provide clues to one's risk for developing exercise dependence. The test is being piloted as a screening tool for physicians and consul ting dietitians to assess peoples' exercise habits and their risk for developing exercise dependence.

Impact:

Early detection of exercise dependence may help health professionals address this potentially addictive behavior in both men and women and detect eating disorders. If successful, the pilot test could become a national model leading to earlier detection and treatment of exercise addiction and eating disorders.

Funding:
NU Agricultural Research Division
Hatch Act
NU College of Human Resources and Family Sciences

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Summary:
Regular exercise is healthy, but too much of a good thing can signal potentially serious problems, such as eating disorders. University of Nebraska nutrition scientists have developed a test to help health professionals analyze a person's exercise regimen and assess their risk for developing exercise dependence. Early detection of excessive exercise habits may help control this potentially addictive behavior in both men and women and detect eating disorders earlier. The NU-developed test is being piloted as a screening tool for physicians and consulting dietitians. If successful, the test could become a national model.

Key Theme: Human Nutrition

Impact Statement: Omega Eggs

(Relates to Goal III, Output Indicator 3, and Outcome Indicators 2 & 3)

Issue: (Who cares and why?)

Omega-3 fatty acids can help reduce some heart disease risk factors, but many Americans don't get enough of these beneficial nutrients. A University of Nebraska scientist hopes her research helps change this situation.

What's been done?

This NU Institute of Agriculture and Natural Resources researcher developed an entire poultry management system for economically producing eggs rich in omega-3 fatty acids. Flax seed, a significant source of omega-3 fatty acid, is a key feed ingredient in her patented Omega egg production system. The system provides good nutrition for hens, produces a consistent product and addresses food safety needs.

Each Omega egg produced using the NU system contains 350 milligrams of omega-3 fatty acids compared with 40 milligrams in conventional eggs. They're also lower in cholesterol. NU research show that eating up to two Omega eggs can reduce blood serum triglyceride levels 14 percent. High triglyceride levels are one risk factor for heart disease. Omega-3 fatty acids also have been shown to increase the ratio of good to bad cholesterol and reduce the occurrence of blood clots, another heart disease risk factor.

Impact:

The patented NU system makes Omega egg production more economical and efficient. That should lead to increased availability of the heart-healthy eggs for consumers. Commercial production of Omega eggs using the NU system began in early 2001 under a university agreement with a Midwestern grocery store supplier. The supplier distributes Omega eggs to a major supermarket chain in seven Plains and Midwest states, making them commercially available to consumers.

Funding:

NU Agricultural Research Division
Hatch Act
U.S. Flax Institute
North Dakota Oil Seed Council

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Summary:
Omega-3 fatty acids help reduce heart disease risk factors, but many Americans don't get enough of these beneficial nutrients. A University of Nebraska poultry scientist's research makes it more economical to produce eggs rich in these beneficial fatty acids. Than, in turn, could make them more widely available to consumers. She developed a complete management system that egg producers can use to efficiently produce Omega eggs. The university patented her production system and has licensed it. One licensee is supplying Omega eggs to a major grocery chain in Nebraska and six other states.

Federal Goal IV. To Achieve Greater Harmony (Balance) Between Agriculture and the Environment

Research activities in support of federal goal area 4 have increased in recent years as a result of redirected research resources and of improved external grant support. Improved natural resources management and environmental quality, while maintaining a productive and profitable agricu ltural industry, is clearly identified as one of the three major themes in the Nebraska ARD Strategic Plan. The Nebraska goals under this federal goal area are:

1. Programs that focus on conserving and enhancing air, soil and water resources and improv ing environmental quality.

2. Improve ecosystem management for sustained productivity and enhance biodiversity.

3. Provide information and expertise on natural resources and environmental issues that facilitate policy development and successful implement ation programs.

A significant research effort has been underway in the last three years on assessing the effectiveness of use of riparian buffer strips to protect surface waters. This practice is receiving a great deal of attention nationwide with USDA-NRCS having the goal of providing cost share systems to install two million miles of new buffer strips nationwide by year 2002. There is no question that these provide benefits to surface water quality, but mo re research is needed for the practice in order to evaluate effectiveness under real world conditions and to improve designs for enhancing effectiveness.

ARD researchers have developed a simple and inexpensive field monitoring system to assess the effectiveness of riparian buffers. In the last two years, there has been an active program involving ARD researchers, as well as Cooperative Extension and Nebraska Corn Growers, to install buffer strips in Nebraska. The monitoring methodology recently develop ed is helping to improve the design and construction of these riparian buffers to make them as efficient as possible under Great Plains cropping conditions.

ARD researchers associated with the National Drought Mitigation Center, located at the University of Nebraska, have developed a new nationwide drought tracking system called the Drought Monitor. This web-based monitor combines several drought and water idiocies into a simple, colorful map showing where drought is emerging, lingering, or subsiding nat ionwide. The occurrence of significant droughts in Nebraska and the Great Plains, as well as several other areas of the nation in 2000 and continuing into 2001, make the use of this Drought Monitor important for planning purposes. Several states in addition to Nebraska are currently using the Drought Monitor to aid in their drought planning and response efforts.

ARD scientists have developed a simple, low-tech and low-cost way to clean up soil contaminated with pesticides and the problem associated with accidental pesticide spills. This is a simple method involving mixing iron and water into pesticide-contaminated soil. The contaminated soil is windrowed with earth moving equipment, then mixed with high speed soil mixing and fracturing equipment. The windrows are covered with plastic sheeting and kept moist for three months. The technique has been found to eliminate up to 95% of the contamination, allowing once toxic soil to reach a quality that can be returned to the ground. It is much lower in cost than the current technology commonly used in pesticide spill clean up of transporting soil and incinerating the soil.

The University of Nebraska Center for Advanced Land Management Information Technologies is collaborating with NASA on an economic development venture to develop commercial applications for remote sensing, global positioning systems, geographic information systems, and related technologies for the Great Plains. The program works with companies to adapt these technologies to a specific application which a participating company identifies. One promising application is for remotely verifying tillage practices that store carbon and crop residue. Another involves creating a digital map of agricultural ecology linked to a web-based tool to support cropping choices. These technologies offer great potential for economical use in natural resource management and agricultural management. It broadens significantly the application for which NASA collected information can be used as well as offers commercial opportunities. It is consistent with recent NASA efforts to work with Cooperative Extension to develop agricultural applications for NASA data. Agricultural producers are learning how to use much more sophisticated data and global positioning systems help make management decisions.

These are some of the examples which relate to the major ARD research areas of agricultural meteorology and climatology, water science and irrigation management, riparian zone ecology and management, and remote sensing for natural resource management. The strengthening efforts through reallocation of resources have helped lead to the developments mentioned above and are expected to continue to strengthen research under this national goal.

Goal IV Resources

Source of Funds	Federal Formula *	State	All other sources	Total
FY 2000 Expenditures ($ x 1000)	561	4,882	4,255	$9,698
Faculty SYs in FY 2000 - 34				

* Includes Hatch, Multistate, McIntire Stennis and Animal Health Funds

Impact Statements Related to Federal Goal IV - Identified by Key Themes

Key Theme: Riparian Management

Impact Statement: Riparian Strip Assessment

(Relates to Goal IV, Output Indicator 2, and Outcome Indicators 3 & 4)

Issue: (Who cares and why?)

Runoff from farm fields can carry chemicals and sediments that pollute streams, rivers and lakes. Strips of vegetation planted between fields and surface water are commonly used to protect water quality by slowing runoff and containing contaminants. However, there's no simple, practical way to evaluate their performance under real-world conditions.

What has been done?

Existing filter or buffer strip assessment techniques are expensive and labor-intensive, and are used mostly on small research plots under controlled conditions. University of Nebraska researchers are developing simple, inexpensive in-field devices to measure water flow into and out of buffers. They've tested several of their designs and are refining the most promising techniques. The idea is to create sampling systems that catch a small fraction of the runoff flowing into, through and out of the buffers, near a stream. By collecting and testing samples, researchers can determine by how much the buffer strip is reducing contaminants reaching the stream. Ultimately, this research will provide a simple tool for researchers and natural resource managers to check filter strips' effectiveness.

Impact:

USDA's Conservation Filter Strip Initiative to publicly fund 2 million miles of new buffer strips nationwide by 2002 is the latest in federal, state and local efforts to expand use of these strips to protect water quality. The simple tool the Nebraska team is developing will enable researchers and others to more accurately assess buffer strips' design and construction to make them as efficient as possible under Great Plains' cropping conditions.

Funding:

NU Agricultural Research Division interdisciplinary grant
Hatch Act, Nebraska Corn Board

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Summary:

Riparian buffer strips, or strips of vegetation planted between farm fields and streams and lakes, are widely used to protect water quality by keeping sediments and chemicals from contaminating the water. While the strips are promising, there's been no simple, low-cost way to measure their effectiveness in the field. University of Nebraska researchers are devising a simple technique for evaluating filter strips' effectiveness under real-world conditions. Eventually, this Institute of Agriculture and Natural Resources research will provide an easy-to-use technique to more accurately assess buffer strips' design and construction to make them as efficient as possible under Great Plains' cropping conditions.

Key Theme: Weather and Climate

Impact Statement: Drought Monitor

(Relates to Goal IV, Output Indicators 5 & 6, and Outcome Indicators 1 & 2)

Issue: (Who cares and why?)

Drought plagues at least 10 percent to 18 percent of the nation annually, costing $6 billion to $8 billion. While it is the costliest natural disaster, drought's slow, creeping nature makes it hard to pr edict and monitor, which is important for reducing its catastrophic effects.

What has been done?

University of Nebraska researchers at the National Drought Mitigation Center helped develop and now maintain a new nationwide drought tracking system, called the Drought Monitor. Launched in August 1999, this web-based monitor combines several drought and water indices in a single, simple, colorful map showing where drought is emerging, lingering or subsiding nationwide. Frequent updates highlight emerging trouble spots so state and federal officials can take steps to reduce drought's impacts. NU Institute of Agriculture and Natural Resources researchers collaborated with USDA and the National Oceanic and Atmospheric Administration on this project, which is the first to consolidate scientific data from numerous sources into a single, simple format.

Impact:

The Drought Monitor fills a nationwide need for timely, user-friendly information to improve drought tracking and to characterize its severity. It's estimated that more than a million people used the monitor in its first year. Major media nationwide, including The Weather Channel, use the monitor in some form. While it was primarily designed for drought and water planners, the monitor's wide use and simple format are increasing public awareness of drought. Alabama, Florida, Georgia, Oklahoma, Nebraska and South Carolina are among numerous states using the Drought Monitor in some form to better monitor, plan and respond to drought.

Funding:

USDA
National Drought Mitigation Center
NU Agricultural Research Division
Hatch Act

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Summary:

A new drought tracking system that University of Nebraska researchers helped develop is improving drought monitoring nationwide. Institute of Agriculture and Nat ural Resources scientists at the NU-based National Drought Mitigation Center teamed with scientists at two federal agencies to develop the

Drought Monitor, an easily understood, web-based tool for tracking widespread drought. The monitor combines information from several drought and water indices in a single map showing where drought is emerging, lingering and subsiding. It highlights emerging trouble spots so state and federal agencies can work to reduce drought's impacts. Launched in 1999, it's estimated that more than a million people used the monitor in its first year. State and federal agencies use the monitor in their drought planning and response efforts.

Key Theme: Hazardous Materials

Impact Statement: Cleaning Up Pesticide-Contaminated Soil

(Relates to Goal IV, Output Indicator 2, and Outcome Indicator 3)

Issue: (Who cares and why?)

Pesticides help farmers grow abundant crops, but chemical spills can contaminate soil and groundwater, threaten the environment and cost millions to clean up. University of Nebraska scientists devised a simple, low-tech and low-cost way to clean up soil contaminated with pesticides.

What has been done?

Their simple method involves mixing iron and water into pesticide-contaminated soil. Iron is the key. It shows the potential to quickly, effectively attenuate a variety of pesticides. The NU Institute of Agriculture and Natural Resources technique involves windrowing soil with earth-moving equipment and mixing it with a high-speed soil mixing and fracturing implement. Iron particles and water are added during mixing. Windrows are covered with plastic sheeting and kept moist for three months. This technique eliminates up to 95 percent of the contamination, allowing once-toxic soil to be returned to the ground. This approach is adaptable to many contamination situations, uses readily available material and equipment and can be easily taught to almost anyone.

Impact:

This method is up to 95 percent effective in removing pesticide contamination from soil. Researchers believe more pesticide spills may be reported if business owners know simple, economical and environmentally safe cleanup methods are available. Using iron to treat contaminated soil can cost as little as $30 dollars per cubic yard compared with more than $600 per yard with current cleanup methods that usually involve removing, transporting and incinerating soil. During successful field tests, researchers helped a southwest Nebraska company decontaminate soil from an herbicide spill five years earlier. Cleanup using the NU technique cost $62,500, compared with a potential cost of more than $604,000 had the soil been transported and incinerated.

Funding:
NU Agricultural Research Division
Hatch Act
U.S. Geological Survey water resources research grant
UNL Water Center

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Summary:

Current soil decontamination techniques can cost millions of dollars. Institute of Agriculture and Natural Resources researchers have developed a simple cleanup technique that involves mixing iron particles and water into pesticide-contaminated soil. This method shows potential to quickly and cost-effectively clean up a variety of pesticides and allow once-toxic soil to be returned to the ground. This technique uses readily available materials and equipment, and the methods can be easily taught to almost an yone. Using iron to decontaminate soil can cost as little as $30 dollars per cubic yard compared with more than $600 per yard for current methods that usually involve removing, transporting and incinerating soil. During successful field tests, researchers helped a southwest Nebraska company decontaminate soil from an herbicide spill five years earlier. Cleanup using the NU technique cost $62,500, compared with a potential cost of more than $604,000 had the soil been transported and incinerated.

Key Theme: Natural Resources Management

Impact Statement: Commercializing Remote Sensing

(Relates to Goal IV, Output Indicator 7, and Outcome Indicators 2 & 4)

Issue: (Who cares and why?)

Remote sensing and related technologies are powerful tools for assessing natural and human-made environments but have been too costly for private companies to pioneer.

What has been done?

The University of Nebraska's Center for Advanced Land Management Information Technologies collaborates with NASA on an economic development venture to develop commercial applications for remote sensing, global positioning systems, geographic information systems and related technologies for the Great Plains. The program works with companies to adapt these technologies to a specific application a participating company identifies. In one recent promising project, center staff evaluated the potential for remotely verifying tillage practices that store carbon in crop residue. This work was for a company that helps farmers sell carbon-storage credits to industry. Other recent successes involved remotely detecting nutrient deficiencies in corn in a genetics project and creating a digital map of agricultural ecology linked to a web-based tool to support crop choices.

Impact:

This program is developing practical commercial uses for spatial information technology and saving money for companies as they learn to use it. For example, verification of carbon-storing tillage practices is crucial to companies seeking to trade carbon credits. Using remote sensing to verify residue cover reduced costs 50 percent compared with doing so in person. Farming practices that reduce atmospheric carbon, which contributes to global warming, might provide participating farmers with 75 cents to $1.25 per acre annually if they maintain at least 30 percent residue cover on crop ground. If 25 percent of the nation's farmers with such cover sold credits at $1 per acre, it would generate about $27 million annually in added income on those 109 million acres .

Funding:

NU Agricultural Research Division
NASA
NU Center for Advanced Land Management Information Technologies
Hatch Act

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Summary:

A collaboration between NASA and University of Nebraska researchers puts remote sensing and related technologies into the hands of private companies. Technology that otherwise would be too expensive for companies to develop is pioneered by NU's Center for Advanced Land Management

Information Technologies in cooperation with private company partners. In one recent promising project, center staff evaluated the potential for remotely verifying tillage practices that store carbon in crop residue for a company that helps farmers sell carbon-storage credits to utilities and other companies. Remote sensing cuts verification costs in half compared with visiting the site for verification.

Federal Goal V. To Enhance Economic Opportunities and the Quality of Life Among Families and Communities

The changing demography of Nebraska reflects greater cultural diversity, more older persons, declines in rural population and more children and families living at poverty level incomes. Many areas of the state need enhanced entrepreneurial opportunities, business management and computer skills for small home-based and family owned businesses. ARD research programs deal with policy issues as well as research to assist educational programs in this area. The research programs are heavily linked to Cooperative Extension educational program activities. The specific Nebraska goals related to this area are:

1. Enhanced basic life skills for Nebraska's children, youth and adults.

2. To improve human nutrition and health.

3. To enhance business and livable employment opportunities.

The Nebraska Food Processing Center administered jointly by the Agricultural Research Division and Cooperative Extension Division has provided assistance in value-added food processing to many companies since it first opened in 1983. One focus of the program is the Entrepreneur Assistance Program which saves participating entrepreneurs about $20,000 in food business startup costs. Since the program begin in 1989, 71% of the participants that started food businesses remain in business today. This is a high percentage for this industry.

The Food Processing Center offers a number of other programs which have continued to make significant impact on the growth of Nebraska's food processing industry.

To create value-added market for several alternative crops and aid community economic development in Western Nebraska, ARD and Cooperative Extension faculty worked with Cheyenne County to attract grass and bird seed company to Sidney, Nebraska. ARD research has resulted in proso-millet, sunflower, and safflower that perform well in this region and provide the foundation for expanded bird seed production. The plant has created new jobs in economic activity for Sidney and provides a new, value-added market for farmers. It is estimated that bird seed production in Nebraska's Panhandle has increased by more than 100,000 acres since the plant opened, translating to a new market worth $10 million annually.

In another Western Nebraska research effort, cultural practices have been developed to allow efficient production of turf and forage grass seed. This is a very high value crop which has encountered problems in the more traditional grass seed producing area due to environmental concerns. Commercial

grass seed production in Western Nebraska in 2000 totaled about 1,500 acres, up significantly from about 300 acres in 1996. While not huge in terms of area and market share yet, the rapid growth and success provides addition diversification opportunities for Western Nebraska farmers and demonstrates that this can be a growth industry for that part of the state.

The above examples of accomplishments contribute directly to this goal area and are indications of progress, particularly in the economic development area. Individual impacts of different programs may not be huge at this point, but the combined impacts of a number of these positive contribute to a significant economic impact.

Goal V Resources

Source of Funds	Federal Formula *	State	All other sources	Total
FY 2000 Expenditures ($ x 1000)	74	649	566	$1,289
Faculty SYs in FY 2000 - 2.3				

* Includes Hatch, Multistate, McIntire Stennis and Animal Health Funds

Impact Statements Related to Federal Goal V - Identified by Key Themes

Key Theme: Jobs/Employment

Impact Statement: Pennington Seed

(Relates to Goal V, Output Indicator 6, and Outcome Indicator 3)

Issue: (Who cares and why?)

The fate of promising new alternative crops hinges on finding markets. If farmers can't sell the newcomer, it's not worth the ground it grown on. To create a value-added market for several alternative crops and aid community economic development, University of Nebraska faculty worked with Cheyenne County to attract a grass and birdseed company to Sidney, NE.

What has been done?

As part of a long-term commitment to developing alternative crops for Nebraska's Panhandle, NU Institute of Agriculture and Natural Resources researchers over the years developed a proso millet breeding program and tested sunflower and safflower varieties. This led to varieties that are particularly

well-suited to the region and laid the scientific groundwork for expanded birdseed production. In addition to crop development and feasibility studies, IANR research and Cooperative Extension staff met with owners of the Pennington Seed Co. and worked with Cheyenne County economic development staff to provide background information on these crops and the region's ability to produce them. The company opened its Sidney processing plant in the mid-1990s.

Impact:

This plant has created new jobs and economic activity for Sidney and provides a new, value-added market for farmers. It's estimated that birdseed production in Nebraska's Panhandle has increased by more than 100,000 acres since the plant opened. With a gross return of $100 per acre, that additional acreage translates to a new market worth $10 million annually. Integration of proso millet and sunflowers into the regions's dryland cropping rotation also helps stabilize financial return for Panhandle farmers by diversifying their crop base.

Funding:

Hatch Act
Smith-Lever 3 (b) and (c)
NU Agricultural Research Division & NU Cooperative Extension

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Summary:

To create a value-added market for several alternative crops and aid community economic development, University of Nebraska worked with Cheyenne county to attract Pennington Seed Co., a grass and birdseed company, to Sidney, NE. Earlier NU Institute of Agriculture and Natural Resources research led to proso millet, sunflower and safflower varieties that perform well in the region and laid the foundation for expanded birdseed production. In addition to crop development and feasibility studies, IANR research and extension staff met with seed company owners and provided Cheyenne County economic development staff with information on these cro ps and the region's ability to produce them. Since the Pennington Seed Co. plant opened in the mid-1990s, Panhandle birdseed production has increased by about 100,000 acres, which translates into a new market worth $10 million annually. These new crops help Panhandle farmers diversify their crop base. The new plant also provides jobs and other economic benefits to the community.

B. Stakeholder Input Process

The processes used for stakeholder input for the Agricultural Research Division were described in detail in the initial ARD Plan of Work. Nebraska has had an extensive system of stakeholder input in place for many years and no new processes were initiated in the year 2000. Statewide stakeholder input was obtained for the Nebraska Institute of Agriculture and Natural Resources for the 2000-2008 Strategic Plan. Comprehensive statewide stakeholder input will not be done again until preparations are begun to revise the Strategic Plan. Major changes in strategic direction do not happen as frequently as annually, so major stakeholder input processes designed to support this overall effort are done on a less frequent basis. However, there are many other stakeholder input processes in place which provide input on an annual or more frequent basis.

The Agricultural Research Division and the Cooperative Extension Division collaborate routinely in the planning and development of programs. These divisions, as part of the Institute of Agricultural and Natural Resources (IANR), have been partners in development of Strategic Plans for over 10 years. Several of the stakeholder input processes described in the 2000 Annual Progress Report for the Cooperative Extension Division will impact Agriculture Research Division planning.

a) Actions Taken to Seek Stakeholder Input

Several IANR departments, research and extension centers, interdisciplinary centers and program areas have external advisory groups representing stakeholders and users. These groups meet at least annually and provide input on current and future programs of the units. The Agronomy Department Advisory Board has 25 members who met twice in 2000. They provided information on strategic issues related to Agronomy and Horticulture teaching, research and extension.

The Northeast Nebraska Experimental Farm Association serves as the stakeholder input group for the Northeast Research and Extension Center and Haskell Agricultural Laboratory. This group consists of representatives from each of the counties in the northeast district and meets annually to provide input on program needs at NEREC. Other research centers with advisory committees which meet annually include the High Plains Agricultural Lab and the Gudmundsen Sandhills Lab. Examples of programs which have advisory committee meetings which meet at least annually include the Republican River Basin Irrigation Management Demonstration Project and the *E-coli 0157:H7* Food Safety Research Program.

b) Brief Statement of the Process Used by the Recipient Institution to Identify Individuals in Groups Who are Stakeholders and to Elect Input from Them

The Southeast Research and Extension District, in preparation for comprehensive annual program review, conducted a system of interviews with key leaders and knowledgeable observers. Groups of interviewees were identified to assure that under-served groups would be included.

The Department of Nutritional Science and Dietetics gets stakeholder input from two meetings annually of the Community Nutrition Partnership Council which coordinates with nutrition education for a limited resource audience. The members of the Council represent a broad group of state and local agencies, volunteer organizations, school officials, and others. They provide valuable input both on extension needs for Cooperative Extension and for research needs for these types of programs.

The Department of Biological Systems Engineering uses advisory council consisting of both in-state and out-of-state stakeholders that help to provide a perspective on research and education needs on a regional and national basis.

The Department of Agricultural Leadership, Education, and Communication's Advisory Council meets twice annually and consists of representative from clientele groups throughout the state.

The above examples are only a part of the on-going stakeholder process. While the types of membership for these advisory groups vary, in all cases the intent is to have a membership selection process which allows for good representation from all clientele groups and rotation of membership to allow different views to be brought in.

c) A Statement of How Collected Input was Considered

In nearly every case with the examples of advisory groups mentioned above, minutes of meetings and reports are maintained and revisited periodically to see if programs are adjusted to respond to the recommendations. It is essential for active advisory groups to continue that the membership is able to review and reflect upon what impact a group has had in earlier recommendations. Stakeholder input has been valuable to units in making decisions on which programs to emphasize or initiate as well as which programs to de-emphasize. Stakeholder input is often critical in helping units and administrators make decisions on which areas are highest priorities for filling a faculty positions. Since the filling of faculty positions is a critical element in refocusing programs, reaffirming priorities, or identifying emerging issues to address, the stakeholder input is very valuable in helping units and the Agricultural Research Division in making these decisions.

C. Program Review Process

Nebraska has made no significant changes in program review processes since the 5-Year Plan of Work was submitted. The scientific peer review process used the by Agricultural Research Division as described in the 5-Year Plan of Work remains the same.

D. Evaluation of the Success of Multi and Joint Activities

a) Did the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

Critical issues of strategic importance identified by stakeholders are directly reflected in the IANR Strategic Plan. The Strategic Plan serves as a fundamental document which guides decision-making process on programs to emphasize and staffing decisions. ARD faculty currently participate in multi-state projects which are provided research funding support 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.

b) Did the planned programs address the needs of under-served and under-represented populations of the state?

ARD research programs related to human nutrition and healthy lifestyles were highlighted under the federal goals and key themes. The results of this research feed science-based information directly into Cooperative Extension programs which target under-served and under-represented populations. Nutritional sciences research includes the project on evaluating the nutritional characteristics of meat from American bison. This is important because the growth, production and use of American bison as a healthy meat source is increasing and the fact that bison herds have been started on Nebraska's Native American reservations.

c) Did the planned programs describe the expected outcomes and impacts?

Output and outcome indicators were described in the 5-Year Plan of Work submitted in 2000. The impacts of the example projects described in the accomplishments and results section relate directly to these output and outcome indicators.

d) Did the planned programs result in improved program effectiveness and/or efficiency?

Effective documentation of research programs, joint program output and outcomes, and ultimately impacts is an important part of our program activity. Individual facu lty members are expected to identify outcomes and impacts in their annual faculty reports. The impact reports that are included in the accomplishment section of this report are developed for use by stakeholders and originate with the impacts identified by individual faculty annually. Having to document individual impacts, as well as interdisciplinary and joint program impacts keeps faculty focused on the need for productive programs.

The joint planning of multistate project activity results in less duplication and more cooperative program efforts. Many University of Nebraska IANR faculty have joint Agricultural Research Division and Cooperative Extension Division appointments. Theref ore, joint planning is assured and this results in research programs that are directly related to Cooperative Extension's education needs. This arrangement definitely improved program effectiveness and/or efficiency.

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the 5-Year Plan of Work
for Multistate Extension Activities and Integrated Activities

Institution: **University of Nebraska Agricultural Experiment Station**
State: **Nebraska**

Check one: ____ Multistate Extension Activities
_X_ Integrated Activities (Hatch Act Funds)
____ Integrated Activities (Smith-Lever Act Funds)

		Estimated Costs				
Title of Planned Program/Activity		**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
Goal 1:	Integrated Crop Management Integrated Livestock Systems Management Integrated Pest Management Sustainable Agricultural Production Systems	$562,880	$562,880	$562,880	$562,880	$562,880
Goal 2:	Pre and Post Harvest Plant and Animal Food Safety Food Processing and Food Service Management Food Safety	$113,754	$113,754	$113,754	$113,754	$113,754
Goal 3:	Human Nutrition, Health and Safety Health Care	$21,645	$21,645	$21,645	$21,645	$21,645
Goal 4:	Natural Resources Management and Protection Environmental protection Environmental and Natural Resources Policy	$182,627	$182,627	$182,627	$182,627	$182,627
Goal 5:	Family Strengths Family Housing Telecommunications for Rural Areas Community Strengths	$130,934	$130,934	$130,934	$130,934	$130,934

Total		$1,011,840	$1,011,840	$1,011,840	$1,011,840	$1,011,840

_____ _____

Darrell W. Nelson, Director Date

F. Integrated Research and Extension Activities

Goal I. Activity: Integrated Crop Management

The research and extension program activity in the integrated crop management is an ongoing effort with leadership provided by the Extension Integrated Crop Management Action Team. Specialists on the team have joint research-extension appointments so they are able to move research results directly into their extension education program. A key example of use of research output for educational programs are the Crop Management and Diagnostic Clinics where the research forms the base for the in-field clinic activity. These clinics are conducted on University of Nebraska research facilities which helps to make the research-extension linkage. Key components of the clinics include insect management, weed management, nutrient management, and plant genetics.

Goal I. Activity: Integrated Livestock Systems Management

The Integrated Animal Systems Management Extension Action Team provides leadership for the educational program effort in this area. As with all the Extension Action Teams most of the specialist members of the team have joint research-extension appointments. A major recent focus of this effort has been research and education addressing livestock manure management. Research on livestock manure lagoon design and management has been used to provide education that will help producers better manage lagoon odors. Research on livestock nutrient management is providing information that may be able to reduce the phosphorous output in the livestock waste stream. This information is being shared with producers and nutritionists to help in ration formulation that can reduce potential pollution.

Goal I. Activity: Integrated Pest Management

A key example of the integrated research-extension effort related to IPM is the insect management effort targeting European corn borer. The research effort has addressed alternative control options including chemical control and the use of genetically engineered plants that provide biological control. The research results are used directly in a variety of educational programs including Research Center Field Days, Crop Protection Clinics, Corn/Soybean Expos, and Crop Management and Diagnostic Clinics. The target audience of the clinics is agribusiness and crop consultants which helps to multiply the transfer the research result to agricultural producers. The results of a new research effort in integrated weed management are being used in integrated weed management workshops and research center field days.

Goal I. Activity: Sustainable Agricultural Production Systems

The USDA North Central Region Sustainable Agricultural Research and Education Program (NCR-SARE) is located at the University of Nebraska-Lincoln and is operated as a component of the Institute of Agriculture and Natural Resources. Agricultural Research Division and Cooperative Extension Division are active in the administration of this program. Through this program, over $1 million is

allocated annually for research and education/demonstration activities th roughout the North Central region. The NCR-SARE program also operates Professional Development Grant program. The projects funded by SARE are intended to explore and apply economically profitable, environmentally sound, and socially supporting farming sy stems. The projects funded in soil management, cover crops, integrated crop and livestock systems, management - intensive grazing, pest management, and innovative marketing practices has made a difference in the agriculture landscape and in people's lives.

Goal II. Activity: Pre and Post Harvest - Plant and Animal Food Safety

Major grant funding has been obtained to support both the Agricultural Research Division food safety activity and the Cooperative Extension Division food safety activity. This acti vity is highly integrated between the two divisions. The Cooperative Extension action team which coordinates the program, entitled "Enhancing Food Safety in the Food Chain," includes specialists with joint research and extension appointments. The research team which addresses a major component of the food safety research, *E-coli 0157:H7.* includes faculty with both research and extension appointments. Initial research findings on the occurrence of *E-coli 0157:H7* in pens of live cattle has produced results with potential short term application on reducing the *E-coli* incidence in cattle feedlots. The highly integrated teams involved will be able to transfer this technology into application quickly when appropriate.

Goal II. Activity: Food Processing and Food Service Management Food Safety

The research and extension program activity in the food processing and food service management area is an ongoing effort with leadership provided by members of the Food Safety in the Food Chain. This team which coordinates programming has faculty with joint research and extension appointments. This effort represents work from the farm feedlot to the consumer's table. Examples of this work are the research completed to assist a chicken processing plant study the impact of their air chilled processing plant, the HACCP implementation assistance provided to Food Processing Plants, ServSafe (a food safety for institutions serving food) taught to food managers of restaurants and other units such as hospitals and nursing home s. In each case it is the integrative work of researchers and extension faculty that is making the quick transfer of technology into application.

Goal III. Activities: Human Nutrition, Health and Safety and Health Care

The research and extension pro gram activity in Nutrition, Health and Safety is an ongoing effort with the leadership provided by members of the Preventive Health and Wellness Team. This team which coordinates programming has faculty with joint research and extension appointments. Add itional research input is received through collaborative relationships with the University of Nebraska Medical Center. Major foci of this effort are reducing high risk behaviors of individuals (adoption of healthy life style practices) and increasing farm safety practices. One integrated effort studied a farm family as they learned skills for better managing hazardous farm practices. Research studies on tobacco and exposure to sun resulted in programs directed at school age children. The integrative wor k of this team resulted in rapid development of programming to meet the needs of clientele.

Goal IV. Activity: Natural Resources Management and Protection

Herbicide runoff from fields in the Blue River Basin area of Nebraska and Kansas can hurt drinking water quality in downstream in Kansas. Joint research, extension, and education efforts by University of Nebraska and Kansas State University are targeted at reducing the threats to drinking water. Researchers have identified the most promising herbicide management and tillage practices for reducing herbicide runoff from farm fields. Early results indicate several tillage and herbicide management practices potentially could cut annual average atrazine runoff by 50% or more. Findings provide the framework for Cooperative Extension efforts to encourage farmers to increase proven best management practices to reduce the potential for atrazine and sediment runoff.

Goal IV. Activity: Environmental Protection

In the Central Platte Valley Nebraska, intensive production of row crops under irrigation and fertilization for many years has resulted in high nitrate - nitrogen levels in the shallow ground - water aquifer. A major USDA grant funded Agricultural Research Division and USDA Agricultural Research Service to study irrigation and nitrogen management methods to reduce the movement of nitrogen into the groundwater. Management practices were developed which have significantly reduced the fertilizer movement to groundwater. Education efforts by the Cooperative Extension Division have been used to transfer this information to area producers which has resulted in both reduction in the level of irrigation water application and nitrogen application over large areas. Several faculty involved in this project have joint extension and research appointments.

Goal IV. Activity: Natural Resources Management and Protection

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Goal V. Activity: Family Strengths

The research and extension program activity in Family Strengths is an ongoing effort with the lea dership provided by members of the Sustainable Families Action Team. This team which coordinates programming has faculty with joint research and extension appointments in areas related to families. A significant component of this program is based on the family strengths research which has been developed into application based programs. Building on the six strengths of families research a month

long statewide promotion was completed to promote the importance of families, workshops, web based educational information. The integrative work of research and extension has made this a successful program effort.

Goal V. Activity: Family Housing

A faculty member with joint Agricultural Research Division and Cooperative Extension Division appointment works with the impacts of environmental disclosure policies and constraints on housing transaction practices. Both federal and Nebraska environmental regulations and policies impact existing housing environmental conditions and transactions and the property values as residential property changes owners. A journal article, "Effects of Constraints on Household Recycling Practices in a Five - State Area," was completed and accepted for publication in 2000.
Results of this and other associated research are incorporated directly into extension programing with this faculty member. The faculty member also participates in a multistate research project related to family housing.

Goal V. Activity: Telecommunications for Rural Areas

The research and extension program activity in Telecommunications for Rural Areas is an ongoing effort with leadership provided by members of the Community Resource Development Action Team. This team which coordinates programming has faculty with joint re search and extension appointments in areas related to community development and technology. One large component of this program is built upon the research of assets of rural communities. Two target populations of this program are community leaders and businesses located in rural areas.

Goal V. Activity: Community Strengths

The Community Resource Development Extension Action Team uses the research conducted by team members and other University of Nebraska faculty as a basis for its educational progra m. The annual Nebraska rural poll conducted by NU's Center for Applied Rural Innovation (CARI) helps to provide direction for both education and research programs. The poll has tracked rural Nebraskans' views, helping frame a broader picture of trends, attitudes, opinions and concerns and giving rural Nebraskans a voice. In addition to helping guide education and research efforts, federal, state and local policy - makers, lawmakers and rural communities use such results to help with planning, policies, and de cision-making. The Nebraska Cooperative Development Center was formed in 2000 to assist with the formation of new generation cooperatives and will help connect cooperative businesses to customized technical assistance and research. An IFAFS funded project will address value - added opportunities for small to medium - sized farms in an integrated research and extension effort. The University of Nebraska is a member of the Rural Policy Research Institute (RUPRI) which conducts policy - relevant research and facilitates public dialogue to assist policymakers in understanding the rural impacts of public polices and programs. This effort helps to facilitate public policy issue education.