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Glen Whipple, Ph.D.
Associate Dean and Director
Cooperative Extension Service

Stephen D. Miller, Ph.D.
Associate Dean and Director
Agricultural Experiment Station

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CSREES ANNUAL REPORT
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Wyoming's Accomplishments & Results

Introduction:

Agriculture is at a crossroads and faces many challenges and opportunities in the 21st century. Agriculture, as well as land-grant institutions, is challenged to compete in a global economy while still responding to the needs of a diverse U.S. population. Ensuring that agriculture remains profitable and sustainable, while addressing environmental concerns, places new demands on the industry. Issues involving production agriculture, natural resource management, and quality of life generate diverse research and education directives. Stakeholders have been vital in identification and prioritization of needs.

The College of Agriculture has a mission to serve the educational and information needs of students, Wyoming citizens and communities, and the global community by providing and distributing unbiased, scientifically sound information on production agriculture, natural resource management, and quality of life issues. The mission of the University of Wyoming Cooperative Extension Service is to provide lifelong learning opportunities for the people of Wyoming and empower them to make choices that enhance their quality of life.

A. National Goals

Goal 1: Enhance agricultural systems that are highly competitive in the global economy

Overview:

Wyoming is a rural state where agriculture is a key component of most rural communities and towns. The value of the agricultural sector output annually approaches or exceeds one billion dollars. The Wyoming livestock industry is forage based with both private and public lands being used for livestock. It is important to note that these same private and public lands are important to the other two pillars of the state's economy, energy resources and tourism.

Due to high elevation (average of 6,800') and arid climate Wyoming's agriculture faces many challenges. Stakeholder input suggests that all aspects of profitability and sustainability are important issues for research and extension.

The College of Agriculture conducts research and extension programs to provide knowledge and technology to maintain economically viable and sustainable forage, crop, and animal systems consistent with its resource base. Research and extension efforts in the college range from biotechnology to home lawn and gardening with emphasis on animal production efficiency, plant production efficiency, natural resource management, and profitability. Environmental and natural resource issues include water quality, rangeland health, biodiversity, and wildlife habitat.

The new Sustainable Agriculture Research and Extension Center (SAREC) at Lingle, WY, which opened in 2006 allows UW to integrate forage/livestock/crop systems that will be profitable while maintaining or enhancing natural resources. It provides a unique opportunity for reducing inputs, providing forage for livestock, and extending the grazing season. In addition, in

2006 the Laramie Research and Extension (R&E) Center was established that combined the animal science farms, the plant sciences green houses at UW and the McGuire Ranch into an integrated crops and livestock R&E center which allows UW to conduct inter-disciplinary research near the UW campus.

The focus of research and extension efforts on production practices and production systems is to enhance profitability while maintaining the underlying resource base.

Key Theme - Adding Value to New and Old Agricultural Products

a. Seedborne diseases such as bacterial bean blight can seriously impact dry bean production in areas of the United States. While bacterial bean diseases do not have a serious impact on dry bean yields in the Big Horn Basin, a significant portion of the dry bean seed produced in Wyoming is marketed in areas where bacterial bean diseases can devastate a dry bean crop. It is critical that every possible effort be made to assist the Wyoming seed industry in producing clean, high quality seed. Well-trained field inspectors play a major role in the production of quality seed, and part of that training consists of the Bean Disease Training Nursery, planted at the Sheridan R&E Center by the Wyoming Seed Certification Service (WSCS). The nursery provides hands-on training for WSCS field inspectors as well as interested individuals in the bean industry. Bacterial bean diseases are a serious issue in the upper midwest, so much so that Wyoming certified seed standards dictate a zero tolerance for those diseases in the field.

   Detection of the disease can have a significant financial impact on the value of the crop for the producer. In some years, seed prices are significantly higher than edible bean prices, making the financial considerations associated with a positive test for bacterial bean diseases a costly one for the grower. One grower indicated that the difference between seed price and edible bean price on his 60 acre field was around $30,000. While it is easy to put a figure to the cost of seedborne bean diseases to the Wyoming seed producer, it is very difficult to put a price on the damage to the Wyoming bean seed industry if every effort was not made to produce disease-free seed.

   Seven inspectors attended the training session, which included a slide presentation at the Sheridan R&E Center facilities covering disease life cycles, inspection techniques, and other pertinent issues. The training continued in the field where inoculated beans were planted in alternating rows with “clean” beans, which provided varying stages of disease development. The disease moved from the inoculated rows to the non-inoculated rows. Specific techniques were demonstrated for identifying the diseases in the field, such as shading leaves to identify the mottling of the leaf surface caused by Bean Common Mosaic Virus (BCMV), using the appearance of the underside of the leaf to identify bacterial diseases, and the effects of leaf venation on symptoms similar to the disease versus actual disease symptoms. Inspectors who are able to differentiate between symptoms similar to the diseases in question and actual disease symptoms will limit anxiety level of producers and contractors. Those same inspectors are also able to discuss the issues surrounding bean diseases with the growers, providing additional educational opportunities. The high level of training afforded to WSCS inspectors is a vital part of quality, disease free seed production in Wyoming.

b. **Impact -** Seven inspectors for the Wyoming Seed Certification Service participated in the 2006 training. This is the only such training in the U.S. to our knowledge, and those trained inspectors provide a level of service to the seed industry that is second to none. The training assisted in the recognition and eventual confirmation of bacterial wilt in a field near Powell, the first confirmed incidence of the disease in the state.

Dry bean seed production continues to be a significant part of production agriculture in the Big Horn Basin, with 8,100 acres of seed beans inspected in 2006. Using the state average of 22 cwt. per acre, production would equal 178,200 cwt. with a value to the producer of over $4 million. The majority of the bean seed is sold outside Wyoming, and quality dry bean seed is critical to maintaining that production opportunity.

c. **Source of Funding-** Smith-Lever, State

d. **Scope of Impact-** State Specific
Multi-State Integrated Research & Extension (WY, NE, ID, ND, MT)

Key Theme – Agricultural Profitability

a. The value of the agricultural sector output in Wyoming annually approaches or exceeds one billion dollars with cash income over $900 million in 2005. Economic profitability is vital to the sustainability of agriculture since no practice or agricultural operation is sustainable unless it is first profitable. Cooperative Extension Educators in Wyoming conducted 183 workshops, multi-day seminars, or classes reaching over 6,868 individuals. A sample of the topics ranged from Ag Profitability, Beef Marketing, Importance of Winter Forages, Plant Anatomy, Risk Management for Ag Families, and Small Acreage Management.

Farm policy enacted since 1996 has punctuated the need for agriculture producers to understand and manage risk. Risk management is difficult to understand and teach, both because the concepts are difficult and the breadth of problems and solutions are great. The economy agriculture faces now is a higher-risk economic environment than agricultural families have seen since the 1930s (Fetsch, Bastian, Kaan, and Koontz, 2000). The need for further education is confirmed by a recent survey of producers (Kaan, et al., 2000). Improvements in technology translate into an increased power to teach complex risk management education that is more effective than we have seen in the past. In the face of declining state and Federal budgets, the Insuring Success for Wyoming Agriculture program was developed.

Onsite educational presentations have been offered to both livestock and crop producer audiences. Topics have included heifer development, genetics testing, animal identification, optimizing heifer reproduction, irrigation management with limited water supply, weed control research in row crops, energy crops for Wyoming, manure management, insurance products for livestock operators, crop insurance for Wyoming farmers, and Ag Survivor (a RightRisk simulation).

Wyoming agricultural producers encounter drought (below average precipitation at key times of year) half or more years. Anticipating drought would allow for adjusting stocking

numbers before the resource is drought stressed and livestock prices fall. Long term precipitation records have been correlated with herbage yields at several locations to determine the temporal window when precipitation amounts will effectively predict the annual forage yield. This information has been conveyed to livestock producers and land managers in a variety of forums.

Rangeland forage yields and seasonal precipitation relationship models have been developed through an applied research project funded by United States Geological Survey (USGS) and Wyoming Water Development Commission (WWDC). These models were developed from long term data developed near Saratoga, Cheyenne, and Casper. These models, while each are different, indicate with relatively high reliability that intervals of late winter/spring precipitation are the primary factors determining forage yields for the summer over most of Wyoming rangelands. The best model, from Saratoga data, indicates that late April precipitation is highly reliable in predicting summer forage yields. Lower elevation sites appear to respond to precipitation in a window extending from March to late May. These differences among models appear to be related to varying times of warming of air and soil, frost free soil, and ratio of warm season to cool season grasses. The variation among models suggests that localities around the state would be well served by developing their own model from local data to serve the interests of producers needing to proactively manage for drought or exceptional forage yields.

To foster the development of locally applicable models, forage yield sampling sites around Wyoming were developed through the cooperation of local resource managers or advisors. These 18 sites are located in a variety of soil and precipitation zones except montane areas. Assistance in sampling these sites and processing samples has been provided as time was available. These areas have been sampled two to three years so far.

Soil moisture data from around Wyoming has been lacking. Soil moisture monitoring probes have been installed to three depths at 19 locations, mostly adjacent to the forage sampling sites. While most of these installations have been functional for the 2006 growing season, there remains the need for calibration of the data logger to individual site soil properties. These data will provide much needed indications of growing conditions for the localities.

AGREN is an agricultural consulting company contracted by USDA to develop forage production profiles for ecologically similar regions of the Great Plains and western region of the U.S. where livestock ranching is an important enterprise. Through cooperative efforts with state Agricultural Experiment Stations in the region, forage production profiles are being developed and incorporated into a ranch stocking management model that promises to be useful in proactively managing for drought and efficiently utilizing available forage production. Wyoming production information has resulted in accurate forage production models for the state.

The important features of the forage yield profiles of this area are the sharp increase in standing crop of cool season species in spring, rapid maturity mediated by available moisture, and a lack of re-growth after plant maturity. The important message for producers

is that timely decisions for de-stocking, finding additional forage, providing stock drinking water, or adjusting grazing management can and should be made in spring. Waiting until later is not appropriate. Summer rains in this region at best result in a greening of vegetation but little new growth.

Variability exists in the expression of ram behavior. Approximately 23 percent of rams exhibit less than normal breeding behavior which necessitates the use of additional rams during the breeding season. Ram selection is a complex process that is dependent in part on production and phenotypic traits desired by producers. Structural and breeding soundness and ram health are commonalities essential to a successful breeding flock. Although sexual interest, or libido, of rams is essential for the incorporation of superior genetics into a flock, ram mating behavior is rarely evaluated due to constraints of time, labor, and physical facilities necessary for such tests. The use of mating behavior tests and/or the development of marker assisted methods for identification of low-and non-sexually performing rams should allow producers to reduce ram costs and improve the incorporation of desired genetics in their flocks.

b. **Impact** – Research and Cooperative Extension efforts resulted in the following impacts:

- Development and release of a computer CD entitled Insuring Success for Wyoming Agriculture: Insurance and Risk Management. This 6-hour course covers topics ranging from an introduction to risk management, a description of the sources of risk, and strategic planning and goal setting, to an overview of RMA insurance products, production risk management in the absence of RMA products, and livestock insurance.
- The Insuring Success web site provides information on locations for onsite programs and a place to register to attend. The site provides a link to the web version of the Insuring Success CD and links to the over 75 articles previously assembled.
- Popular press-based educational articles targeted at agriculture land owners and small acreage landowners have been printed under the banner Barnyards & Backyards in the Wyoming Livestock Roundup newspaper and through inserts in many of the state's rural newspapers. Over 75 articles have been published. Evaluations of these efforts have reported increased knowledge and raised awareness.
- Numerous seed crops are produced in Wyoming. In 2006, the WSCS inspectors inspected alfalfa, red clover, crownvetch, cicer milkvetch, sainfoin, sweetvetch, barley, winter wheat, dry beans, oats, and 24 species of turf, forage, and reclamation grasses. The program also offers pre-variety germplasm inspections for wild land collections and cultivated selections of native plants. In 2006, inspectors examined 8,645 acres of alfalfa and miscellaneous legume seed, 7,938 acres of dry beans, 2,847 acres of small grains, and 1,117 acres of grass. The grand total for 2006 was 20,719 acres inspected. The WSCS office staff handles the documentation necessary to track inspection efforts and assure compliance with standards. The information from the field inspection and an analysis from an approved seed lab are reviewed by the WSCS to determine if a seed lot meets all standards. Seed lots meeting standards are issued certified seed tags, a symbol of quality recognized by knowledgeable seed purchasers.
- The Wyoming Seed Certification Service (WSCS) is an ongoing effort, with measurable short-term improvement difficult to identify. Changes in farm income and financial benefit to the state from seed production or certified seed acres are affected by many factors, not just

this program. In the long term, a program that serves the seed industry is critical to the ability of the seed industry to provide certified seed to customers, and thus provide a value added product that pays the added value directly to the producer and provides production diversity.

- Two hundred producers participated in the CES sponsored Agriculture Profitability conference held in conjunction with Wyoming Stock Growers and Wool Growers conference. Evaluations from the twenty-two sessions offered indicated participants increased their knowledge and over half indicated they planned to change management practices and incorporate the knowledge learned into daily practices.
- Program evaluations from the Agriculture Profitability conference indicated short term impacts were increased awareness of information on sustainability and profitability; long term results indicated that participants increased their knowledge, learned how to maintain and how to keep their cost down, learned new trends in agriculture, and to evaluate their marketing alternatives and choices.
- Reduced Agent and Area Treatments (ATV-RAATs) are increasingly adopted for grasshopper control by ranchers and farmers. This IPM strategy can reduce the cost of control and the amount of insecticide used by more than 60 percent. Human health and environment benefit from ATV-RAATs strategy for two reasons. First, the total acreage treated with ATV-RAATs programs is lower than in the conventional, aerial applications. Consequently, it lowers the negative contaminant impact on the environment. Second, during ATV-RAATs, lower doses of insecticides are used contributing to a further decrease of environmental pollution by pesticides. In 2006 tests of an insecticide belonging to the group of Insect Growth Regulators (IGRs), pyriproxyfen, have continued using an ATV spray rig. The IGRs affect only immature insects and therefore they represent a better targeted way to control pest grasshoppers. Consequently, the non-target effects of grasshopper control program are reduced to a minimum.
    - Although the USDA subsidies for grasshopper control became recently available, the expenses of a management program remain largely a producer's burden because of high insecticide and treatment costs. Therefore, an ATV-RAATs program becomes the preferred option for many land-users in the West. The use of RAATs reduces the costs of grasshopper control by approximately 50 to 60 percent, depending on the agent and swath width. If a standard insecticide application costs about $3.00 per acre, the equivalent RAATs program costs approximately $1.75 per acre *protected*.
    - Besides the economic advantages, RAATs strategy has tangible environmental benefits: using RAATs, 60 to 75 percent less insecticide is applied to the rangelands for grasshopper control. Less insecticide in the environment lowers the risk to non-target organisms including fish and wildlife, water quality, and humans. The untreated swaths provide refuges for non-target species, and even if those organisms move into the treated swaths they will be largely unaffected unless they feed on the foliage.
- Research results from studies on the profitability of individual production practices as well as crop and livestock systems ultimately influence the sustainability of the agriculture industry. Laboratory market research has contributed to the understanding of structural change issues in today's supply chain agriculture-market efficiency, buyer and seller earnings, and price bias compared to the competitive norm. This research also contributes to the development of methodologies (experimental economics) to investigate the impacts of structural change in agriculture. Annual losses attributed to Rhizoctonia Root and Crown Rot (RRCR) is estimated at two to three percent total sugar loss for 185,000 acres of sugar beet grown in the

irrigated High Plains region (CO, MT, NE, and WY). This disease is reported to affect approximately 30 – 50 percent of Wyoming's acreage, depending on the district. A one percent decrease in sugar content is lost revenue of approximately $90 per acre (2006 values). Field results for 2006 indicated that under severe Rhizoctonia disease pressure, one application of trifloxystrobin (Gem®, Bayer) at the time of inoculum introduction was ineffective.

- Many forage crops become toxic during drought conditions due to high concentrations of nitrate. Nitrate toxicity is often observed in cattle and sheep populations during periods of drought. Symptoms of nitrate toxicity vary widely, and include decreased performance, hormonal imbalances, abortion, and in many instances, death. Studies concur that individual animals vary in their tolerance to high nitrate. Identification of nitrate susceptible animals using genomics techniques will allow producers to employ alternative management and/or selection strategies to partially alleviate associated economic losses. Nitrate toxicity has long been problematic for livestock producers, with the reports of nitrate poisoning dating back to 1895. Previous research has focused on the mechanism, symptoms, and treatment of nitrate toxicity and the establishment of toxic levels of nitrates within ruminant species. Symptoms of nitrate toxicity are dependent upon the stage of poisoning and the individual animal. Acute signs of nitrate toxicity include cyanosis, respiratory distress, rapid respiration, weakness, coma, and possibly death. Salivation, teeth grinding, muscle tremor, convulsions, labored breathing, and diarrhea are among symptoms of subacute nitrate poisoning. Chronic signs include lethargy, listlessness, lack of coordination, and decreased feed intake, feed efficiency, growth rate, fertility, and milk yield. Effects of high nitrate have been reported in both males (impaired sperm quality) and females (abortion and abnormal fetuses). Toxic levels of nitrate, while variable, have been established using research and field trail data.
- Increasing production costs and market competition have contributed to the loss of profitability in producing dry edible beans. Dry bean production in the High Plains has begun to decrease while the Northern Plains states have increased their bean acreage. These changes coupled with increased production and export of inexpensive beans from Canada, China, and elsewhere have altered the landscape of the bean industry and economic viability of the crop in our region. If our industry is to prosper and increase production efficiency in the future, we must consider alternative production systems. Researchers in the Central High Plains are developing alternative production systems to increase production efficiency so that the bean producers in our region will again be competitive in the domestic and foreign markets. Production systems are focusing on reduced inputs, such as minimum tillage, reduced herbicide use, narrower row spacing and direct harvest. Research has shown the production systems that utilize narrow-rows, or a combination of narrow bed spacing and multiple rows/bed, in combination with direct harvest systems have been able to reduce the cost of production and increase yield compared to conventional systems. Studies in Colorado revealed that reducing the row width from 30 to 22 inches increased yield by 9 percent. They also reported that planting double rows on 22 or 30 inch beds also increased yield by 7 percent. These results indicate that techniques that distribute plant spacing more uniformly have a positive influence in yield potential. Why do producers in the Central High Plains plant on single rows on 30 inch beds? Currently producers' choice of row width for edible bean production is usually a compromise of issues including maximum yield potential, row spacing for other crops sharing the same tractor and implements, foliar disease potential, methods of irrigation, and harvest options. Researchers are looking at these issues and others

including upright bean plant architecture with high pod set and varieties that are drought tolerant or will produce well with limited irrigation. These programs included walk through variety trials that highlighted the upright architecture and high pod set of new bean lines. Other studies included new lines that emphasized drought tolerance or limited irrigation. Narrow-row/verses wide row planting studies gave producers an opportunity to visualize production systems up close. The most important outcome/impact through this work is a more efficient production quality dry edible bean that can be shipped to domestic and foreign markets at a competitive advantage.

c. **Source of Funding** – Hatch, Smith-Lever 3 b&c, State

d. **Scope of Impact** – State Specific
Multi-state Integrated Research & Extension (W-1177)
(CA, CO, IA, KS, NE, ND, OR, SD, TX, UT, WA, WY)
Multi-state Extension (MT, ND, SD, WY)

Key Theme – Animal Health

a. The Departments of Veterinary Sciences and Molecular Biology investigated a variety of animal health-related problems. Yersinia pestis, the causative agent of bubonic and pneumonic plague is endemic in the United States west of the Mississippi. Although the disease is ancient, many aspects of its disease mechanisms remain elusive. Both wild and domestic animal cases continue to be reported throughout numerous Western States.

The University of Wyoming is conducting experiments to identify and characterize novel virulence factors from two different bacterial pathogens, employing In Vivo Induced Antigen Technology (IVIAT). Using this gene discovery approach, we have initially examined immune sera from experimentally infected rabbits against E. coli expression libraries of Y.pestis genomic DNA. In parallel preliminary studies with our USAMRIID collaborators, this effort has already led to the identification of over 20 novel in vivo-expressed Y.pestis genes, with at least 8 loci potentially encoding novel virulence determinants facilitating plague infection and/or disease. Our lab has also begun identification of in vivo-expressed genes using adsorbed sera from Y.pestis-infected coyotes, a wild host species refractory to disease but not infection. Two genes of particular interest have been identified whose products do not appear to be immunogenic in the rabbit (a species sensitive to disease). Through IVIAT, we have also identified antigens which may be common to certain virulence processes in different diseases. Our preliminary experiments with plague have identified several of the loci up-regulated in vivo as “COGs” (clusters of orthologous groups [of proteins]), which possess highly conserved sequences across multiple bacterial species.

High altitude or brisket disease is a condition which sometimes occurs in cattle reared at elevations of 6,000 feet or more. Among cattle native to the high country, losses (mortality) may run about 0.5-5 percent; however, in lowland cattle brought to higher altitudes or in offspring from untested sires, losses can be as high as 30-40 percent. Brisket disease is a concern to producers throughout the Rocky Mountain region not only because of its direct economic consequences, but also because it drastically limits the use of cattle that could provide genetic-based herd improvement. Unfortunately, cattle show a high degree of

susceptibility to high altitude sickness compared to humans or common laboratory animals. In fact, among all species tested, domestic cattle show the most extreme negative response to high altitude exposure.

Transmissible spongiform encephalopathies are a heterogeneous group of diseases affecting humans and animals which manifest as progressive neurological disease. Chronic wasting disease (CWD) is one such disease affecting deer and elk in many areas of the United States. Cattle have been shown to be susceptible to CWD following direct intracerebral inoculation of infective CWD material. No studies of long-term susceptibility to CWD have been done in cattle following a natural route of transmission such as oral inoculation. Long term studies are requisite because of the long incubation periods typical of these diseases. Cattle and wildlife intermingle in many areas of the United States and there is the potential for transmission of CWD between domestic cattle and elk or deer. This issue is important to livestock producers, animal health diagnosticians and regulatory officials, and wildlife managers. Determination of cattle susceptibility will impact management decisions made at the wildlife/livestock disease interface.

b. **Impact** - The impacts of these animal health investigations are both immediate and long-term. The immediate impacts have been to reduce the morbidity and mortality of ongoing disease problems by providing 24 hour access for veterinarians and producers to information on disease diagnostics, animal disease, and other animal health issues through the Web site "Wyovet."

- Development of a simple blood test to diagnose brisket disease at a pre-clinical stage.
- Development of a single multiplexed nucleic acid test that would test for foot and mouth disease (FMD) and all FMD "look-alike" endemic diseases would greatly delay the rapid spread of FMD. Availability of such a test would also prompt enthusiastic participation in FMD surveillance by the producer and veterinary practitioner because a single test will not only rule out FMD but deliver a diagnosis allowing for treatment and/or prevention management strategies. The multiplex PCR would be a single test that could deliver a rapid diagnosis on a single sample collected from an animal with lesions compatible with FMD or any of the endemic "look-alike" diseases. A single test for multiple agents reduces sample handling and errors and saves labor and consumables/reagents and provides greater throughput with more information in less time. Eight DNA or RNA viruses can be screened for in one assay. The role of selected genes and their products in Brucella virulence have been assessed, employing traditional methods of gene/protein analyses. The potential of selected Brucella proteins for use as new/novel vaccine candidates are being evaluated in a laboratory animal model (mice).
- Adult (ruminant) ewes were treated with increasing doses of usnic acid in a modified Brownlee experiment. Clinical signs were seen only in ewes given more than 647 mg/kg and consisted of sudden death without premonitory signs. Ewes receiving 485 mg/kg or less remained completely normal for 10 days on treatment and did not have any post mortem lesions. Lesions in the high dose ewes consisted of massive muscular necrosis of the appendicular skeleton. Usnic acid does not appear to be responsible for lichen toxicity. This means that the actual toxin needs to be isolated and identified before there is any way to reliably predict the toxicity of X chlorochroa under any particular set of circumstances. Field work has demonstrated that the lichen does cause poisoning in domestic ruminants in the

"real world."

c. **Source of Funding** – Hatch, Animal Health, State

d. **Scope of Impact** – State Specific, but results have broad implications
Integrated Research and Extension

Key Theme – Animal Production Efficiency

a. Research projects impacting animal production are focused on ruminant nutrition and reproduction. Areas of emphasis in ruminant nutrition include optimal use of dietary protein and lipids to improve performance and quality of cattle and sheep. Research on forage-fed cows supplemented with vegetable oils has shown increased levels of vegetable oil fatty acids in the fat tissue of cows and calves. For example, conjugated linoleic and trans-vaccenic acids are greater in milk and fat tissue of cows, and fat tissue of the calves, when the cows are fed vegetable oils. Enhancing knowledge regarding the differential effects specific fatty acids exert on adipose tissue fatty acid metabolism may afford beef cattle producers the unique opportunity to use natural feedstuffs as nutrient partitioning agents.

In the High Plains and Intermountain West of the United States, much of the area is referred to as rangelands, which experience significant fluctuations in both the quality and quantity of forages throughout the year. Gestating ewes on rangeland with no supplementation often experience prolonged bouts of nutrition restriction of less than 50 percent of National Research Council requirements. In a recent three year study evaluating nutrient profiles of pastures in Montana, it was reported that the digestibility of forages declined markedly from May to October. To make matters worse, due to low protein content and high fiber content of poor forages, consumption may also decline. Thus, as the ewe is a fall breeding species, this poor nutritional environment often corresponds to the early gestational period. The fetal origins of adult diseases hypothesis proposes that alterations in fetal nutrition during critical periods of gestation can permanently alter fetal growth and development leading to persistent pathologic problems in postnatal life.

This study investigated if the management system under which a ewe was selected alters the impacts of early to mid-gestational under nutrition on fetal growth and offspring equality. Ewes subjected to a nomadic existence and limited nutrition throughout the year from Baggs, WY (Baggs ewes) maintained normal fetal weights and circulating glucose and essential amino acid concentrations when subjected to nutrient restriction (50 percent NRC requirements; NR) from day 28 to 78 of gestation. In contrast, ewes of similar breeding, size, body weight, and age from the University of Wyoming flock (UW ewes), selected to a sedentary lifestyle and above adequate nutrition, exhibited a 30 percent decrease in fetal weight, under the same NR. The growth restricted fetuses of UW ewes exhibited reduced circulating glucose and essential amino acid concentrations, bilateral cardiac ventricular hypertrophy, reduced kidney nephron numbers, and fewer secondary myofibers and smaller fasciculi in skeletal muscle than fetuses from control fed (100 percent NRC requirements; CF) UW ewes.

Livestock Marketing is a critical issue for most Wyoming ranching operations. A majority of

the yearly income is generated from the sale of weaned and backgrounded calves. However, most producers spend very little time marketing their livestock, and are typically "price takers." Started in 2002, the WyoBeef.com cattle listing service now advertises natural, organic, BQA certified, source and age certified, and PVP program cattle. Created through funding from the National Cattlemen's Beef Association BQA program and the Wyoming Business Council, the Web site promotes the superior quality and genetics of Wyoming cattle. Producers can list weaned calves, yearlings, replacement heifers, cows, and registered breeding stock. Cattle listings include in-depth information including herd health program, sires used, etc. Marketing information includes when and where cattle will be offered at auction, sales, or contact information.

b. **Impact -** Several impacts of animal production efficiencies are listed below. These impacts can be both short and long term and contribute to the sustainability of livestock production systems in Wyoming.

- The production system under which a female is selected may impact her future ability to produce healthy offspring under different nutritional and/or environmental conditions. This suggests that livestock producers should carefully evaluate the production system under which potential replacement females are selected before adding them to their flock or herd. These data suggest that sheep can be selected in a relatively short time (~ 30 years) to perform optimally under a particular production system, but this should not be extrapolated to other systems which employ markedly different environments and/or nutritional inputs.
- To be competitive, new methods in wool metrology must be accepted and utilized by the American wool producer. Three instruments that have provided leading edge technology in measurement of wool fiber diameter are the OFDA100, OFDA200, and the Laserscan. The OFDA100 and Laserscan are laboratory instruments that allow the measurement of wool fibers in less than two minutes. The average fiber diameter of wool is the most important physical characteristic of wool fibers and determines the initial value of the fiber as the diameter dictates what products the wool can be made into.
- Field peas are marketed as a dry, shelled product for either human consumption or livestock feed. The Carnival pea variety is classified by the USDA as a yellow grain pea and can be sold at current market price, whereas the Forager pea is classified under the U.S. sample grade miscellaneous category and may be subject to discount due to its darker seed coat. Darker seed coats may be discounted because they are presumed to be less nutritious. On average, yellow peas, such as the Carnival variety, have been more valuable than green peas, such as the Forager variety. Yellow peas typically sell for 2.5 percent more than green peas. This price differential is not substantiated if the peas are to be fed to finishing hogs or developing beef heifers at 16 percent of the total diet. However, the price differential should be 10 times greater if the peas are to be included at 33 percent of the diet of finishing lambs. Selling Forager peas for 25 percent less than Carnival peas would make cultivating Forager peas much less economically viable for farmers. At this discount, farmers would lose $23 million in potential income if all 326,986 field peas were converted to the Forager pea variety.
- Coyotes are the most significant predator of sheep, goats, and cattle in the United States, taking more than $40 million of livestock every year. Controlling coyote populations in order to limit predation has been a goal of stock growers and local, state, and federal agencies. Increasingly, public opinion indicates that non-lethal, humane methods for controlling coyote

predation are preferred. The agricultural industry, specifically the animal industry, will be the primary beneficiary of this research. Loss of livestock to coyote predation has serious economic impacts to animal agriculture. Research at the University of Wyoming has established the effectiveness of the antiprogestin compound, mifepristone (RU 486), as a humane, non-lethal, low-cost means of controlling coyote populations. An efficacious, single dose regimen for field application has been developed. This research is field-testing the species specificity of the CLOD on free ranging coyotes for the potential delivery of contraceptives/contragestives. Since most coyote predation is attributed to breeding pairs of coyotes, by eliminating the pups of these pairs, predation on domestic livestock can be reduced by as much as 91.6 percent. An added advantage of leaving breeding pairs alive, but not reproducing, is that they will defend territory against emigrating, transient coyotes or other breeding coyotes in search of new territory to colonize.

c. **Source of Funding** – Hatch, Smith-Lever, State, County, Private
d. **Scope of Impact** – State Specific
   Multi-state (AK, AZ, CA-D, CO, HI, ID, KS, ME, MI, MO, MT, NE, NV, NM, OH, WA, WY)
   Integrated Research and Extension
   Multi-state Extension (UT, WY)

Key Theme – Plant Germplasm

a. No renovation or restoration effort can be successful without addressing the threat of exotic invaders. In addition to examples such as the invasion of cheatgrass that has altered fire regimes and destroyed many native shrub lands, exotic weeds are a costly deterrent to many agricultural land uses. Because shrubs are a successfully competitive growth form (they often increase with herbivory) and are genetically variable in North America (many rapidly evolving shrub species occur in western U.S.) they offer a unique perspective in the study of invasion ecology. It is likely that western North American shrub species have unique characteristics that may make them especially competitive with weedy exotics. Yet field studies of the inherent variability in shrub populations have been primarily descriptive in the past. Additionally, research has seldom addressed the application of the flexibility of shrub gene pools to current management problems. This research can be valuable to managers and will inform theoretic ecology by providing a clearer view of evolution in action.

   Invasive species represent the most rapid, constant, and problematic disturbance of wildland ecosystems because of the extent and remote nature of these lands. In addition, the majority are public lands, which fall under a variety of often conflicting land uses. Resilience of native systems to invasion and their subsequent response are important to targeting areas most at risk. In identifying the response of native ecosystems to exotic invasive species, managers will be able to anticipate and proactively target at-risk systems. Many shrubland systems of the intermountain west are especially problematic if invaded because of their recent disturbance from energy development coupled with their importance in providing essential habitat for wildlife species. For example, the diminished extent and function of the sagebrush steppe ecosystems of western U.S. has direct impact on populations of obligatory species such as greater sage grouse which has been petitioned for listing under the endangered species act.

A series of projects have been developed to examine the response of ecosystems, native grasses, and shrubland ecosystems to exotic invasion. Genetic work on native species has documented native population divergence within populations isolated by invasive species. In addition, population demographics and reproductive success have been documented on the Snake River Plain of Idaho, across southern Idaho, northern Colorado and throughout Wyoming.

b. **Impact** - By identifying competitive native species, control of exotics will be more effective in preventing weed reinvasion following weed removal treatment. In this way the impacts of herbicides to non-target populations, the economic stressors and the continued spread of exotic species in Wyoming and the west can be addressed in a more sustainable manner.

- Genotypic variation of native grasses promises the development of native grasses that are especially competitive with invaders such as Russian knapweed and Canada thistle. Documentation of susceptibility of sagebrush steppe to rush skeletonweed following the cheatgrass wildfire cycle will enable managers to anticipate problematic areas for secondary invasion by perennial exotic weeds.

c. **Source of funding** – Hatch, State

d. **Scope of Impact** – State Specific
Integrated Research and Extension
Multi-state (AZ, CA-B CA-D, CO, HI, ID, MT, NM, OR, UT, WY)

Key Theme – Plant Production Efficiency

a. Researchers at the UW Agricultural Experiment Station conduct studies on all major crops, forages, and rangelands. Major research efforts in the plant efficiency area are: 1) biology and control of weeds, 2) plant disease recognition and control, 3) crop production practices, and 4) crop/legume production systems. Specific projects range from basic research to elucidate mechanisms of plant/pest interactions to long-term applied research on cropping systems. For example, the rapid adoption of Roundup Ready crops by farmers has made it important to have the capability to predict long term impacts this practice has on composition, density, and genetics of weed communities.

Considerable interest in oil seed production has occurred with the prospect of bio-diesel production. Sunflower is by far the most abundant of the oil seed crops. Production is now at an estimated 200,000 acres. In recent years, because of the edible oil, confectionary, and bird seed industries, market conditions in general have been good for sunflower seed. New varieties that possess oil qualities that make it attractive in the edible oil market are likely to contribute to continued strong market demand. Additionally, demand for soybean oil for bio-diesel has added strength to the edible sunflower oil market. As the price of soybean oil goes so goes the market for other vegetable oils. However, currently the extra processing cost associated with the conversion of raw sunflower oil to bio-diesel makes the oil unattractive for bio-diesel production. This could change as technologies evolve. Recent emphasis has been placed on identifying crops that can address the multiple markets of edible and bio-diesel production.

b. **Impact** – Several plant production efficiency impacts are listed below. Control and management of pests are an important component of these systems.

- After eight years there has been no evidence that any species has developed resistance to glyphosate. However, common lambsquarters and wild buckwheat have increased in treatments receiving only the low rate of glyphosate. Rotating glyphosate with conventional herbicides was no more effective in slowing this population increase than the use of the high glyphosate rate.
- Growing crops in narrow rows (less than 76 cm) reduced weed biomass and light interception by the crop was increased especially early in the season. Sugar beet and sunflower yields were increased dramatically when grown in narrow rows, while row spacing had no consistent impact on corn or drybean yields.
- Micro-rate applications in sugarbeets allow the amount of herbicides to be reduced. Micro-rate applications have allowed growers the ability to reduce their weed control by 20 to 35 dollars/Acre depending on number of applications. Since half and micro-rate applications are applied broadcast, the number of cultivations was also reduced by an average of one time per field. With both half and micro-rate systems, weeds are treated earlier, starting at sugarbeet cotyledon stage with a five to seven day interval between applications.
- Fluroxypr is an excellent broadleaf herbicide for controlling ALS-resistant kochia, while fenoxaprop or trakloxydim are very effective in controlling wild oat. Excellent weed control without barley injury was achieved with the combinations: flurozypyr + fenoxaprop or fluroxypyr + trakloxydim when applied at the three to five leaf stage of barley. By using these combinations barley growers will reduce the cost of application and increase their barley yield by 10 to 20 bushels/Acre.

c. **Source of Funding** – Hatch, State

d. **Scope of Impact** – State Specific
Integrated Research and Extension
Multi-state Integrated Research and Extension (NCC031)
(AZ, IA, IL, IN, KS, MI, MN, NE, ND, OH, SD, WI, WY)

Key Theme - Invasive Species

a. Weeds are a common problem for landowners both large and small throughout Wyoming and much of the West. While many people consider weeds to be an agricultural problem, the reality is that weeds also have serious impacts on rangelands, wildlands, roadsides, and suburban areas. The invasion of exotic species reduces habitat quality and forage availability for wildlife and livestock, strongly compete with native plants, inhibit recreational activities, increase wildfires, and use limited water resources. Extensive stands of Russian Knapweed were located in Wyoming, Idaho, and Colorado where native grasses remained after many years. Research is being conducted to assess the long-term potential of the few remnant plants to rebound following invasion of Russian knapweed. While certain weeds such as Canada thistle and field bindweed are well known throughout Wyoming and much of the Western United States, land managers often need training for proper identification of uncommon or new invaders. Training is crucial for early detection and rapid response to new invaders.

Early detection rapid education (EDRR) has become one of the focal points of invasive plant management efforts at the University of Wyoming. Years of experience have clearly taught us that an ounce of prevention for new plant invaders today can save millions of dollars in weed control costs in the future. While people throughout the state are very familiar with many of Wyoming's designated noxious weeds, there are several serious invaders throughout the West that are not yet present or are present but not yet problematic here in the state.

We have been conducting risk assessments to determine what noxious species from surrounding states may become serious pests in Wyoming in the future. We have used a threefold approach to this problem. The first step was to gather the checklist of non-native plants already present in the state and the official noxious weed lists of every Western State except Hawaii. The Wyoming invasive checklist was developed by researchers at the Rocky Mountain Herbarium from extensive plant searches throughout the state and the noxious weed lists developed by each state individually. We then cross-referenced the Wyoming checklist with the noxious weed lists. This allowed us to determine what invasive plants we have that are currently listed as noxious in other states.

Results from this first step were intriguing. Our approach discovered 63 species already found in Wyoming that are currently noxious in other states but not in Wyoming. We then ranked these by the number of times each species was listed as noxious in another state and the climatic and edaphic conditions where found. This allowed us to develop a "hot list" by which to prioritize educational efforts.

Our second step was to begin surveying the border counties of the states surrounding Wyoming. This allowed us to better understand what species may be "knocking at our door." Our efforts this summer tended to focus on the Northwestern border counties in Montana and Idaho. Plant surveys from these areas yielded several extensive infestations of problematic species such as spotted knapweed, plumeless thistle, and other species not yet on our noxious weed list.

In our third step, we then developed educational presentations on the top thirty ranked species from the risk assessment and the species found in border counties and have presented much of this information across the state at various extension and training meetings.

b. **Impact** - As Wyoming's exurban population continues to grow, noxious and invasive weeds will also continue to be problematic across landscapes fragmented by development. Noxious and invasive weed identification and control training with a strong emphasis on early detection and rapid response will save Wyoming millions of dollars in future weed control cost.

- These EDRR educational efforts are already paying off. In 2006, three species have been documented as new records in the state. These include Austrian fieldcress, Rush skeletonweed, and Perennial cornflower. All are now under eradication to prevent their continued spread. Additionally, many land managers are paying close attention to several species already present in the state that have been flying under the radar such as blueweed, small bugloss, scentless chamomile and sulfur cinquefoil. Also, follow-up survey efforts of

previous detection of yellow starthistle in 2005 have yielded no new plants in 2006. These efforts to educate land managers and protect Wyoming will continue to pay off for years to come.

- Collaborative research has sought to understand the mechanisms promoting successful biological and integrative control of Canada thistle and Dalmatian toadflax, two important weeds in the U.S. Service activities sought to educate stakeholders in biological and integrative control, and to implement control of salt cedar and Dalmatian toadflax through on-the-ground releases of insect biological control agents. These techniques are decreasing weed populations and the impact of chemicals on the environment.

c. **Source of funding** – State, Hatch

d. **Scope of Impact** - State Specific

Key Theme - Plant Health

a. The total value of all Wyoming crops is estimated at $250 million. Plant diseases caused by viruses, bacteria, fungi, and nematodes cause significant losses in Wyoming's crop yield and quality each year. Although actual plant disease losses for Wyoming are not available, annual U.S. losses to plant disease agents are estimated at $33 billion. In addition, indirect losses also are realized through avoidance (inability to grow high value crops due to potential disease risk), loss of certification status, and restricted markets due to quarantine issues. Economic losses attributed to plant diseases are significantly reduced by prevention, early detection diagnostics, and initiation of appropriate integrated pest management practices.

b. **Impact** – Approaches to disease suppression comprise the main thrust of research and extension efforts in this area.

- Cercospora leaf spot affects 80,000 to 100,000 acres of sugarbeet in the High Plains. If left unchecked, CLS can easily reduce sugar content by two percent, costing growers approximately $142 per acre. Costs of control are estimated at approximately $20 to $40 per acre (2006 values). The cost of fungicide in the SE Wyoming District is approximately $250,000 to $490,000, with great variability among years due to disease pressure. Field trials revealed greater than 90 percent disease suppression was possible with properly timed "new generation" fungicides deemed safer for the environment and operator. An organic fungicide (garlic juice) reduced Cercospora leaf spot, but failed to control early blight of potato.

c. **Source of Funding** - Smith Lever, Hatch, State

d. **Scope of Impact** - State Specific
Integrated Research and Extension

Key Theme - Home Lawn and Gardening - General Horticulture

a. During FY 2006, over 17,482 contacts were made regarding horticulture. Forty-five educational programs were presented through Cooperative Extension reaching 1,661 individuals in group settings. In addition, over half the counties in the state trained volunteer Master Gardeners through a state curriculum involving 64 hours of class time which enabled educators to extend outreach to urban residents with horticulture questions and problems.

Cooperative Extension Horticulture Issue Team provides leadership for "From the Ground Up," a 70 second TV spot aired twice weekly, 36 weeks a year on a station with potential to reach 9000 households. The media spots provide information on horticulture topics ranging from IPM practices to strategies to increase 'home grown' food production.

The Master Gardener program is growing in the state of Wyoming. It is now available in more than 50 percent of the state's counties. One of the core subjects within the Master Gardener curriculum is Entomology. Gardeners encounter insect pest problems on a daily basis. The first step to address such problems is the accurate and reliable identification of pests. In Wyoming, there are over 12,000 estimated insect species, and many of them can become garden pests. In order not to be "drowned" in this "sea of bugs," Master Gardeners need to receive efficient training in the basics of Entomology, and in particular, insect identification. It was delivered to seven different Wyoming counties and to a group of Extension Educators in the framework of the Train-the-Trainer approach to Master Gardener education. In total, 92 Master Gardeners and Educators received this training. The program has a variable duration of three to 12 hours. It includes presentations on the insect orders of horticultural importance and hands-on training on the use of insect identification keys. In addition, the students learn the basics of insect biology and ecology. This knowledge is instrumental in developing efficient, economical, and environmentally friendly methods of dealing with yard and garden pests.

b. **Impact** - Clients reported increased awareness and knowledge of horticultural skills as a result of educational efforts. Additionally, homeowners demonstrated better management of their properties. Media efforts including "From the Ground Up" increase awareness of CES as a resource for horticulture information and through follow-up calls increases decision making, horticulture skills, and knowledge.

- Twelve counties conducted Master Gardener training consisting of eight-10 sessions graduating nearly 150 new Master Gardeners. At a minimum, new Master Gardener graduates contribute 30 hours of volunteer time. In addition to new graduates of the program, Wyoming has over 200 active veteran Master Gardeners. New Master Gardener contributions, in addition to experienced Master Gardener volunteer time (8,714 hours), extend Extension's efforts with a value of over $119,817. Ninety-eight percent of Master Gardener participants showed an increase in knowledge from pre-test to post-test in the areas of water management, lawn care, and insect control.
- Feedback from participants indicated that the information presented was valuable and would help the attendees to address pest issues more effectively. In the short term, this education program allows the Master Gardeners to make informed decisions regarding insect pest problems. In the mid-term, the Master Gardeners will make the most efficient use of their limited resources for pest identification and control. The long-term impact is that more educated, knowledgeable Master Gardeners are of great value to Wyoming. The instructive aspect of this program is extremely valuable because gardening involves Wyoming citizens of all ages, professions, and educational levels. The demand for this class will increase and all of the participants found it valuable and stated they would recommend it to their colleagues. The UW Extension Entomologists make an impact on the counties and state by educating gardeners and homeowners to better deal with insect pest threats.

- The Wyoming nursery stock survey was conducted in July and August, as per USDA inspection priority guidelines. Sample collection exceeded that required to increase the probability of detecting latent infections.
- A total of 67 field samples were tested during the survey and additional check samples were processed. All samples were negative for the pathogen, and plant destruction/quarantine proved unnecessary. Counties surveyed were Campbell, Converse, Crook, Fremont, Johnson, Laramie, Lincoln, Natrona, Platte, Sublette, Sweetwater, Teton, Uinta, and Weston.

c. **Source of Funding** - Smith-Lever, State, County

d. **Scope of Impact** - State Specific

Goal 1 Summary:

The College of Agriculture conducts research and provides educational programs on agricultural systems and profitability throughout the state. A few of the college's on-going programs in the Goal 1 area are:

- Economics of farm/ranch systems with respect to profitability and risk
- Reproductive performance in domestic ruminants
- Improved legume species
- New and emerging animal diseases
- Extended cropping systems with emphasis on incorporating forages

In this program area, researchers have been active in 21 ongoing Hatch projects, and seven out of the 21 are multi-state projects. Ten of the 21 Hatch projects are integrated research and extension efforts. The approximate effort related to this program:

Agriculture Experiment Station FTEs	13.8
Cooperative Extension Service FTEs	26.35

Goal 1 Allocated Funds

CES	$2,465,695
AES Hatch, Multi-State & Animal Health	$1.0 million
AES State	$4.6 million

Goal 1: IMPACTS

Livestock Producers Implement Changes to Improve Profitability

Situation:

Agriculture is a foundation industry in Goshen, Laramie, and Platte counties producing $264 million in cash receipts in 2005. The sustainability and economic well-being of livestock producers is vital to the region. These producers face many challenges, including ever-increasing operating costs with relatively stable commodity values, changing technology, production

advances, passing on the business to future generations, coping with family issues within the business, and many others.

In January 2006, a sustainable ranching conference was held in Wheatland. Approximately 280 producers attended the six-hour program. Two well-recognized agriculture experts on the program attracted producers from across the United States. Kit Pharo, a seed stock producer and well-known newsletter publisher from eastern Colorado, offering strategies for making a profit in livestock, and Harlan Hughes, a professor emeritus from North Dakota State University and current writer for *Beef* magazine, were the main speakers. These "celebrities" were flanked by presentations from Dallas Mount and Mike Smith of the University of Wyoming Cooperative Extension Service. The conference went very well with many attendees commenting that the workshop was the best of its type they had attended.

Impacts:
Attendees were asked the day of the workshop to rank the overall value of the conference (1-very little; 5-a lot) and rate their knowledge of the topic before and after the presentations. The average ratings from 148 returned surveys were 4.51 for overall value with a 23-percent increase in knowledge. Attendees were also asked the day of the meeting what they will do as a result of the workshop and a surprising 68 percent of respondents listed actions they would take.

The July following the conference, a survey was mailed to 100 of the attendants to ask how they have used the information presented at the workshop. Thirty-five responses were received. Questions focused on how attendees learned about the workshop, why they chose to attend, and if they implemented changes as a result of something they learned at the workshop.

The majority learned about the workshop from direct mailing, and the topic of the presentations was the greatest draw with the time of the conference the second greatest. Of the 35 respondents, 67 percent have implemented a change in their operations, and 33 percent of those who have not are planning on implementing a change.

When respondents were asked to rate the statement, "This conference has made a positive impact on the profitability of my operation," (1-strongly disagree; 5-strongly agree) the average response was 3.4. The area educator received more positive comments from attendees about this meeting than any other he has been involved with or coordinated.

Comments from attendees:

- The workshop brought to light for producers that being production driven is not the only/best way for cattle producers to be. Profit driven, maybe with more emphasis on minimizing costs, is the more logical way to go about making the best of our businesses. I thoroughly enjoyed every speaker and their subject matter. Keep up the good work! Thanks for having me.
- This timely, well-attended workshop shows how stressed the producer is. Not only from drought but from inflated production expenses. We all want to be sustainable, but we don't know how. The July 12, 2006, *Platte County Record Times*, says real estate taxes are to increase 30 percent! How do we pencil that into an extreme drought? Time for ANOTHER sustainable ranching conference!

- This is the kind of workshop ranchers need to hear not pharmaceutical and feed companies; keep it up!
- Very well-promoted, great crowd. Good info. Not the same old stuff. Recognition that lots of types of inputs produce only marginal returns, if any.

Dallas Mount
University Extension Educator – Livestock Systems
Southeast Area/Platte, Goshen, Laramie counties
(307) 322-3667
e-mail: dmount@uwyo.edu

Uinta County Master Gardener Program Assists Urban Gardeners

Situation:
Successful gardening in Uinta County can be very challenging. A short growing season, alkaline and clay soils, and a dry, windy climate contribute to the difficulty. Understanding basic horticultural principles and regionally specific gardening information can significantly increase success. Additionally, through the Master Gardener program's volunteer hours of service, the community also benefits.

Weekly classes provided 40 hours of classroom instruction to Master Gardener class members. Information from all yard calls was shared and discussed as a group. A field trip helped participants see problems firsthand.

Impacts:
Written evaluations were collected at the conclusion of the program. Volunteer activities as a result of the program were also monitored. Written evaluation results from eight participants were (poor-1, fair-2, good-3, excellent-4, superior-5),

- Knowledge of gardening in Wyoming before program – 2.375
- Knowledge of gardening in Wyoming after program – 3.75
- Pre- and post-program knowledge was reported to have improved an average of 1.375
- 100 percent of participants reported an improvement in knowledge.

Volunteer members have contributed more than 200 hours of service to the community since the program's completion. Volunteer time valued at $13.75 per hour equates to a $2,750 contribution to the Uinta County horticulture program.

- Two quarterly classes have been taught by Master Gardener volunteers as a service to the community.
- Master Gardeners donated time to help two 4-H youth service projects in Evanston.
- Master Gardeners provided service and information to the Bear Park Weed Pull.
- Master Gardeners provided service to several homeowners through individual yard calls.

Bridger Feuz
University Extension Educator – Profitable and Sustainable Agricultural Systems
Desert West Area/Uinta and Sweetwater counties
(307) 783-0570
e-mail: brfeuz@uintacounty.com

Goal 2: Enhance a safe and secure food and fiber system

Overview
Researchers at the University of Wyoming (UW) seek to improve the quality of life through research and education that fosters a safe and secure food supply, promotes enjoyment of food that is nutritious and affordable, and supports Wyoming residents' health.

Given the public's varied avenues for access to food, reducing the risk of food-borne illness necessitates comprehensive educational intervention from the producer to the consumer – truly a 'farm to table to plate' approach. At all levels, the food safety activities implemented through UW build on principles of HACCP, (Hazard Analysis and Critical Control Points), the prevention-based food safety system that identifies and monitors food-borne hazards. Research and extension professionals at UW are also involved in projects focusing on issues of safe and secure food systems.

About 250 million tons of meat annually is consumed in the USA. On average, each person in the U.S. consumes about 85 kg of meat per year. Thus, the eating quality of meat affects the quality of life of most Americans. Research has focused on the improvement of the eating quality of meat and its production. It was found that the biological changes in the early stage postmortem muscle dramatically affected the quality of meat. Meat quality can be significantly improved by controlling postmortem changes. However, up to now, few studies were conducted to elucidate these changes. Research at UW is aimed at understanding mechanism controlling postmortem changes, which will allow development of strategies to effectively control these changes and, thus, improve the eating quality of meat.

Key Theme - Food Resource Management

a. The *Cent$ible Nutrition Program* (*CNP)*, CES's food and nutrition program for limited resource audiences that combines EFNEP and the Food Stamp Nutrition Education Program [FSNEP] helps families eat better for less. In FY 2006, CNP educators in all 21 counties and one reservation office enrolled 1,315 participants in a lesson series, and 11,106 persons participated in one-time lessons. Cent$ible Nutrition 1/2 hour television programs were aired twice a week for 45 weeks with a potential to reach 240,000 low-income contacts. Educators helped clients learn to plan meals, compare prices, use grocery lists, and provide food for the entire month.

b. **Impact** – Food resource management practices measured include planning meals, comparing prices, using grocery lists, providing food for the entire month, and monthly food costs.

- Ninety-two percent of graduates showed improvement in one or more food resource practices.
- Families saved an average of $53.00 per month on food purchases for an average savings of $636 per year. This represents $69,695 saved by the 1,315 Wyoming graduates who completed the exit survey.
- Sixty one percent of the 5,794 youth participants in Grazin' with Marty Moose and WIN Kids curriculum increased their ability to select low-cost, nutritious foods.

c. **Source of Funding** - Smith-Lever 3-D (EFNEP), USDA Food & Nutrition Service with local and state matching (FSNEP)

d. **Scope of Impact**: State Specific

Key Theme – Food Safety

a. Microbial contamination of food is a serious health problem. Each year in the U.S., foodborne diseases cause approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths. With approximately 60 percent of food borne illness outbreaks nationwide attributable to food-service establishments, food-service personnel are key to reducing the risk of foodborne illness. The Wyoming Food Safety Coalition (WFSC) is a multi-institutional, multi-disciplinary partnership that has become the primary source of food-safety education throughout the state. The heart of WFSC is a core of locally trained teams, most of which include a county-based UW CES FCS educator and a health inspector from the Wyoming Department of Agriculture or a local city/county health department or both.

   USDA grants helped establish WFSC and workshop registration fees now fund WFSC, along with supplemental grants (for example, from the Food and Drug Administration). Coalition team members trained 1,967 food handlers in the following workshops: Basic-277; Intermediate-355; Advanced-179; and ServSafe-316; and Day Care - 840. In-house trainings reached 399 individuals. Consumer programs and displays reached 640 and 356 individuals, respectively.

   The CNP had 1,315 participants enrolled in the program and reached 11,106 clients through one-time presentations. CNP educators helped clients learn how to thaw and store foods properly, prevent cross contamination, and to wash hands frequently and thoroughly.

   The recognition of Escherichia coli 0157:H7 as a distinct serotype of pathogenic E. coli occurred in 1983 following two outbreaks of a distinctive gastrointestinal illness characterized by severe abdominal pain, watery diarrhea, bloody diarrhea, and little or no fever. This illness, designated hemorrhagic colitis, was associated with the consumption of undercooked hamburgers at a fast food restaurant chain. These initial observations led to the recognition of a novel and increasingly important enteric pathogen causing intestinal and renal disease. Since 1983, a great deal of research has been accomplished, and has led to many different methods for rapid detection and control of E. coli 3157:H7 in the beef processing environment. The collective sum of these interventions has been a downward trend in the number of contaminated food samples and foodborne outbreaks due to E. coli 0157:H7 during the past four years. The decrease in the production of contaminated meat may be due in part, to the fact that the United States Department of Agriculture (USDA) and Food Safety Inspection Services (FSIS) announced a series of new measures designed to reduce the incidence of E. coli 0157:H7 contamination of raw ground beef.

b. **Impact** – Thanks to the WFSC, including leadership from UW CES, hundreds of food workers statewide are handling food more safely.

   Medium Term

   Based on data from a 2001 evaluation project conducted by UW CES for WFSC, this year's 1,135 participants in WFSC Going for the Gold (intermediate and advanced) and ServSafe workshops are estimated to have made the following changes:

   - 480 (97 percent) made at least one change related to cleanliness, for example, washed their hands more often.

- 396 (80 percent) made at least one change related to cooling food, for example, put food into shallow containers or cut meat into smaller pieces before putting it in the refrigerator.
- 386 (78 percent) made at least one change related to food preparation, for example, prevented cross-contamination by keeping raw meats, cooked foods, and fresh produce separate.
- 371 (75 percent) made at least one change related to other miscellaneous areas, for example, monitored critical control points more closely.
- 347 (70 percent) made at least one change related to cooking food, for example, used a stove or microwave – not a steam table – to reheat food.

Long Term

- Improved food handling behaviors, such as those estimated to have been made by workshop participants, increase the likelihood that food served in Wyoming is safe, and therefore, decreases the risk of foodborne illness.

Cent$ible Nutrition Program

- Sixty-four percent showed improvement in one or more food safety practices surveys.
- Fifty-eight percent of youth involved in the school enrichment program improved practices in food preparation and safety.
- In addition to the requirements mandated by FSIS, it seems that another logical area to control the spread of E. coli 0157:H7 would be in the live animal, prior to slaughter. The objective of this work is the development of a rapid method to detect E. coli 0157:H7 in cattle. The detection system consists of two components, including a reporter bacteriophage genetically modified to carry a β964;-galactosidase gene, and a luminescent substrate for the β964;-galactosidase. Both the bacteriophage and the substrate will be included in a single A snap-valve device. When the sample to be tested is added to the device, the reporter bacteriophage will infect any viable E. coli 0157:H7 present within the sample, and force the bacteria to make large amounts of β964;-galactosidase. Following the infection process (approximately one hour), the cap of the test device (containing the substrate) will be snapped, releasing the substrate into the main compartment of the device, where it will interact with the β964;-galactosidase. The entire device will then be place into a hand-held luminometer, which will record the photons generated from the interaction of the substrate with the β964;-galactosidase. Alternatively, if a colorimetric substrate is used, there will be no need for the instrumentation, and the test will be read visually.
- The nature of this detection method is such that it will be effective at sensitively detecting E. coli 0157:H7, and also distinguish between viable and non-viable cells, since bacteriophages can only grow within living bacteria. Also, the assay will be rapid and easy to perform. This test method will allow identification of animals that are infected with E. coli 0157:H7 prior to slaughter, allowing for corrective measures to be taken, leading to the production of safer beef.
- In addition to the control of E. coli 0157:H7 at the slaughter/processing plant, it seems that another logical area to control the spread of E. coli 0157:H7 would be in the live animal, prior to slaughter. On the farm, effective E. coli 0157:H7 requires reducing the frequency and intensity of fecal shedding of this pathogen by cattle, in addition to targeting environmental sources of the organism. To that end, many research groups

have focused on the control of E. coli 0057:H7 in cattle through the use of E. coli 0157 specific vaccines, and probiotic bacteria.

- Bacteriophage (phage) therapy represents another method that can be used to control shedding of E. coli 0157:H7 in cattle. Phage therapy is the application of phages (bacterial viruses) to bacterial infections in living animals with the goal of reducing the bacterial load. Phages can be delivered topically, orally, directly into body tissues, or systemically. The natural ability of phages to kill infected bacteria is exploited to reduce the amounts of bacteria present in the animal.
- The objective of this study is to use a model system to demonstrate the effectiveness of phage therapy to reduce or eliminate E. coli 0157:H7 in the bovine gastrointestinal tract.

c. **Source of Funding** – State, Hatch, Smith-Lever 3(d) EFNEP and USDA Food & Nutrition Service with local and state match (FSNEP), state agencies

d. **Scope of Impact** – State Specific

Goal 2 Summary:
The College of Agriculture provides educational programs across the state. Two of the ongoing programs are *Going for the Gold - Food Safety Training* and *Cent$ible Nutrition Food Safety Curriculum.* Research efforts focused on developing more effective means of protecting foods stored at low temperatures as well as improving nutritional value of beef and lamb, and improved dietetic techniques. Researchers in this area participated in one Hatch project.

Agriculture Experiment Station FTEs	0.9
Cooperative Extension FTEs	5.72

Goal 2 Allocated Funds

CES	$535,247
AES State funds	$ .25 million

Goal 3: Enhance a healthy, well-nourished population

Overview
According to the Centers for Disease Control and Prevention and other health organizations, too many Americans are not eating well; are not active enough; don't enjoy physical activity; and have a poor body image. The national anti-obesity atmosphere is pushing many people to focus exclusively on trying to lose weight rather than achieving a healthy, enjoyable lifestyle.

To improve the health of Wyoming residents, research and extension programs focus on eating and exercise habits based on recommendations for optimal health. The College of Agriculture conducts research and provides educational programs to adults and youth throughout the state that enables them to make health-promoting choices.

Key Theme - Human Health
a. Steps to A New You is a 2-faceted healthy lifestyles program that combines a series of

food/physical activity/body image classes (A New You) with a pedometer-based physical activity program (WIN Steps).

- Four series of classes were held in 2006, with 50 participants. This implementation reflects the meshing of research (including control of key variables) with the realities of Extension outreach.
- CES implemented Dining with Diabetes, a collaborative program conducted by Nutrition and Food Safety Educators and diabetes educators. The five-session program combines education on diabetes self-care with recipe demonstrations, food tasting, nutrition information, and low-impact physical activity. Over 700 participants have completed the program in five areas.
- Type 2 diabetes is the most common metabolic disease in the world. In the United States alone, the associated health care cost exceeds $130 billion per year. Obesity is developing into a serious problem worldwide which is closely associated with type 2 diabetes. Fetal nutrient deficiency in human pregnancy occurs due to a variety of situations, such as maternal malnutrition, reduced placental efficiency, adolescence pregnancy, closely spaced pregnancy, pregnancy with multiple fetuses and hyperemesis gravidarum, which has long-term consequences for offspring health, including high incidences of obesity and type 2 diabetes. Up to now, it remains unclear what causes this negative association. Since skeletal muscle is the main site for the utilization of glucose and fatty acids in the body and insulin resistance in skeletal muscle is the key step in the incidence of type 2 diabetes, we hypothesize that impaired fetal skeletal muscle growth due to nutrient deficiency plays an important role. Our goal is to understand how the development of fetal skeletal muscle affects the properties of skeletal muscle of adulthood, and to develop effective strategies to mitigate or avoid incidence of diabetes and obesity caused by impaired skeletal muscle development due to fetal nutrient deficiency. We have established a sheep model in which fetal nutrient deficiency was induced by applying maternal global nutrient restriction (NR) during early to middle gestation. This NR limits the amount of nutrients available for fetal growth. We showed that this NR affects fetal skeletal muscle development. Muscle fiber composition and muscle fiber diameter were altered and a reduction in mitochondrial density/function of skeletal muscle was observed in NR offspring. Further, insulin resistance was detected in NR offspring. Due to the essential role of skeletal muscle in insulin resistance and the importance of mitochondria in fatty acid oxidation, the reduction in mitochondrial density/function in skeletal muscle may explain the observed insulin resistance and obesity in NR offspring.

In an effort to boost the immune system, many nutritional products are being developed or promoted. The term that has been developed to describe these types of products is "neutraceuticals" where they have been demonstrated to have some biological benefit. One such product that appears to possess this capability is a compound known as beta-glucan, derived from yeast and mushrooms and some plants. Studies published over the past two decades, primarily in Japan, have demonstrated that glucans vary in their properties and that specific ones do indeed have this immune promoting potential. However, it is unknown if these benefits are uniform for all glucans or if they possess the same biological potency. Regardless, in our aging population, an immune booster has the potential to allaying disease development and could improve overall health. Cells were cultured and mice were fed with varying forms of glucans at differing doses to ascertain those that would promote health and to determine the biopotency.

Glucans were found to differ in their possible biological effectiveness with the soluble glucans being the most effective at immune enhancement. This knowledge can have effects that may vary. New products could be developed from the glucans, new farming systems to farm the yeasts and mushrooms could be developed, and diet and health can be promoted through either optimizing the nutrients in the diet or the consumption of developed supplements.

It is the intent of UW researchers to develop a butter/margarine that would be healthier than those currently on the market. It has been demonstrated that consumption of steric acid is neither atherogenic (contributing to heart disease or elevated blood cholesterol) nor does it compromise the immune system. Other dietary saturated fats have an effect by compromising one or both of these areas. When other margarine/butter substitutes have been developed, they still utilize fats, e.g. palm kernel oils or coconut oils, that contain short-chain saturated fats that will still compromise health. Margarines are typically created by hydrogenating polyunsaturated fats to make them more hydrogenated. However, in this process, trans-fatty acids are developed. These trans fats are inducers and/or promoters of heart disease and cancer as well as reducing immune system function. By replacing the oils and fats typically used to make butter or margarine or healthier substitutes with one based on a Shea nut blended with oil from the rape seed, we will develop a fat substitute that has healthier saturated fats with a blend of these already shown to be healthy polyunsaturated and monounsaturated fats.

The current global obesity epidemic, together with its associated chronic diseases, represents a major drain on healthcare resources. Estimates suggest that 18 to 35 percent of pregnant women in the U.S. are clinically obese. Western highly palatable diets combined with maternal obesity are a special concern because of adverse effects on both maternal health and fetal development that can result in harmful and persistent effects in offspring. Type 2 diabetes and obesity are closely linked metabolic complications, both of which are increasing at alarming rates, especially in teenagers and even children. The increasing prevalence of overweight and obese women of childbearing age is a growing public health concern in the U.S., and may pre-dispose offspring to obesity and diabetes. Mechanisms linking maternal over-nutrition and obesity to offspring obesity and diabetes, however, remain poorly defined.

b. **Impact -** CES's *Dining with Diabetes* program was implemented in five counties with over 721 participants. At the conclusion of each class, participants received copies of the recipes of the foods demonstrated and tasted. One of the most frequent impacts from the *Dining with Diabetes in Wyoming* program reported was participants making the recipes at home from the foods demonstrated during the class. A sample of comments from class participants included:
   - The program helped me select the appropriate portion size for different foods by visualizing how they look on my plate.
   - This program gave me easy to understand explanations of very complicated ideas.
   - After attending the program, I discovered that eating correctly for diabetes isn't all that bad.
   - I discovered that even though you have diabetes, you can still eat and enjoy food. The food was tasty.

- A sheep model of maternal obesity has been developed that will allow us to study its specific effects on fetal growth and development and subsequent offspring health. We have conducted preliminary studies on ewes fed 150 percent (fat ewes) or 100 percent (controls) of NRC recommendations for three months before, to 75 days after mating when they were necropsied (gestation length = 150 days). Fat ewes increase their body weight by ~30 percent from diet initiation until mating and their weight increased an additional 20 percent from mating to day 75 gestation. Control ewes just maintained body weight from diet initiation to mating and between mating and day 75 of gestation, their weight increased only ~7 percent due to the growth of gravid uterine tissues. Fetal weight was ~30 percent greater when they were gestated by fat ewes than when they were gestated by control ewes (347 ± 12 vs. 286 ± 10g). While the majority of fetal organ weights were increased in proportion to the increase in fetal weight in fat ewes, the pancreas was increased in weight well above the increase in fetal body weight. Further, concentrations of insulin and glucose were also elevated ($P<0.05$) in the blood of fetuses gestated by fat ewes on day 75 of gestation, suggesting gestational insulin resistance in these animals. The observation that pancreatic development and function had been advanced in the fetuses of fat ewes may be of considerable importance to later pancreatic function, and may lead to Type 2 diabetes and obesity.
- There is little scientific evidence from which to base recommendation for fat intake in endurance-trained individuals. While very low-fat diets (less than 15 percent of total energy) are generally not recommended for athletes, these diets are often followed with the belief that they may enhance performance and/or benefit health. In reality, such low-fat diets may compromise intramyocellular lipid stores, impair endurance performance and unfavorably alter lipid profiles, even in endurance-trained individuals. Research results suggest that very low-fat diets do not affect endurance running performance but may have adverse affects on triglyceride and HDL concentrations and the ratio of total to HDL cholesterol even in healthy endurance-trained individuals. Overall the results support the position that fat intake should not be heavily restricted in the diet of endurance athletes, and the moderate-fat diets which emphasize monounsaturated fat may be prudent for optimal cardiovascular health.
- One neutraceutical currently being developed is Shea nut, with its primary saturated fat being steric acid, will not have the deleterious effect on health. Further, consumption of diets high in the monounsaturated fats and containing the critical balance of the n-6 and n-3 polyunsaturated fats further promote optimal health and do not promote heart disease and reduced immunity. By blending Shea nut butter with Canola or Rape seed oil, it should become possible to develop a blended product (a substitute for margarine or butter) that is healthier than both and healthier than other substitutes that are now on the market such as Smart Balance and Smart Start. At this time a prototype has been developed with color, textural analysis and sensory evaluations completed as part of determining the blend ratios that will make the best Shea nut butter.

c. **Source of Funding** – Smith-Lever, State, Hatch

d. **Scope of Impact** – State Specific

Key Theme - Human Nutrition

a. The *Cent$ible Nutrition Program (CNP)* goal is to help limited resource families to improve nutritional well-being. Nutrition educators documented life changing behaviors with pre- and post-surveys, success stories and testimonials related to nutrition practices. Approximately 1,315 individuals enrolled in lessons and 11,106 individuals participated in one-time lessons as well as 5,794 youth in youth programs. Additionally, CNP is reaching underserved audiences state-wide through the use of public television. CNP 30-minute TV programs were aired two times per week for 45 weeks resulting in 240,000 low-income contacts.

Extension educators conducted 144 educational programs, classes, workshops, or health fair presentations reaching over 3,613 adults and 443 youth. Topics ranged from "Desktop Grazing", and "Preventing Diabetes" to "Basic Nutrition."

b. **Impact** - Cent$ible Nutrition – Nutrition practices measured include planning menus, reading labels, making healthy food choices, preparing foods without adding salt, and serving children breakfast.

- Sixty-five percent of participants reported improvement in reading labels.
- Fifty-one percent reported improvement in selecting healthy foods.
- Fifty-three percent reported improvement in planning meals.
- Fifty-three and fifty percent respectively reported serving more than one kind of fruit or vegetable each day.
- Results of 5,794 youth participants enrolled in Grazin' the Food Guide Pyramid with Marty Moose and WIN Kids curriculum:
  - Eight-seven percent now eat a variety of foods
  - Seventy-four percent increased knowledge of human nutrition
  - Sixty-six percent increased their ability to choose low-cost, nutritious foods
  - Fifty-eight percent improved practices in food preparation and food safety
- Participants in nutrition education programs conducted by CES educators reported making one or more changes consistent with the Dietary Guidelines. Short term outcomes showed 100 percent of participants indicated they had gained knowledge and a greater awareness of the subject matter.
- Steps to a New You helps participants make many significant changes in their behaviors and attitudes related to food, physical activity, and body image. These changes are consistent with improved health and with helping participants achieve a healthy weight.
  The following were statistically significant changes among the 160 study volunteers:

  <u>Food and eating</u>
  Increased Intakes:
  Eating more….fruits, vegetables, and whole grains
  Drinking less….soda pop
  Ordering fewer…..super-sized portions
  Less often…eating while doing other activity

  <u>Physical activity</u>:
  Increased Frequency:
  - Purposefully adding activity to daily routines
  - Engaging in planned physical activity, that is, moderate- to high-intensity activities and/or strength training

c. **Source of Funding** -Hatch, state, Smith-Lever 3(d) (EFNEP), USDA Food & Nutrition Service with local and state matching (FSNEP).

d. **Scope of Impact** - State Specific
Multi-state extension (MT, ID, WY)
Integrated Research and Extension

Goal 3 Summary:
The College of Agriculture conducts research and provides educational programs to adults and youth throughout the state, enabling them to make health-promoting choices. University of Wyoming research in the area of human health has focused on intracellular bacteria pathogens and studies on human nutrition and health. Researchers in this area participate in two Hatch projects and a multi-state project.

Agriculture Experiment Station FTEs	0.9
Cooperative Extension Service FTEs	29.32

Goal 3 Allocated Funds

CES	$2,743,613
AES Hatch/Multi State	$ 0.2 million
AES State funds	$ 0.4 million

Goal 3 - IMPACTS

Cent$ible Nutrition Program makes a difference across Wyoming

Situation:
Wyoming has more than 25,423 food stamp recipients living in 10,590 households, which is only 46 percent of the households eligible to receive food stamps. Due to Wyoming's large geographic size and low population, food security is a challenge for those with limited resources making nutrition education, including food resource management, very important.

The University of Wyoming's CES's Cent$ible Nutrition Program, which is the umbrella title for the Expanded Food and Nutrition Extension Program and Food Stamp Nutrition Education Program, had the following outputs over the past year:

- 1,315 adults participated in a series of lessons, averaging 8.1 lessons per person (10,651 teaching contacts).
- 11,106 adults participated in one-time lessons with 80 percent reporting intended behavior change.

Impacts:
1,315 adult participants reported the following outcomes through the pre- and post-assessments.

- 85 percent showed improvement in one or more food-resource management practices.
- Families reported saving an average of $53 per month.

- 92 percent showed improvement in one or more nutrition practices.
- 53 percent reported thinking about healthy food choices more often when deciding what to feed their families.
- 65 percent reported using the "Nutrition Facts" labels more often to make food choices.
- 40 percent reported they or their children more often eat something in the morning within two hours of waking.
- 53 percent reported serving more than one kind of fruit to their families each day more often.
- 50 percent reported serving more than one kind of vegetable to their families each day more often.
- 46 percent reported when eating bread, they eat whole-grain bread more often.
- 39 percent reported getting a "super-sized" portion less often. (A "super-sized" portion of food or beverage is one that is much bigger but costs only a little more money.).
- 64 percent showed improvement in one or more food safety practices.
- 36 percent reported being physically active for at least 30 minutes per day, on four or more days per week, more often.

Mary Kay Wardlaw
Director, Cent$ible Nutrition Program
Department of Family and Consumer Sciences
(307) 766-5181
e-mail: wardlaw@uwyo.edu

A Taste of Success

Situation:
Children today face many health challenges – behaviorally and physically. The Kids First summer program in Sheridan County is incorporating nutrition education and food preparation activities for 72 participants ages 4-15. The program is a partnership between Northern Wyoming Mental Health Center Inc. and the University of Wyoming Cooperative Extension Service.

The concern regarding American children's weight and nutritional well-being provides rationale to incorporate nutrition education and cooking with kids into any behavioral health program. Many studies show a direct link between nutrition intake and academic performance. For these reasons, one of the most important tools that can be offered to children and adolescents is how to make healthy food choices, what qualities are best, and how to prepare simple, tasty foods.

Kids First incorporated five weekly one-hour lessons for ages 4-10. Youths ages 11-15 utilized mini-lessons from "WIN Kids" curriculum, although the bulk of the five weekly 1 ½-hour sessions were spent in the kitchen preparing for the once-a-week family meal that served 50-75 youths and adults. Nutrition lessons focused on identifying the different food groups, grains, fruits and vegetables, calcium-rich foods, and foods high in protein. Each class included a healthy snack related to the food group of the week. Lessons with older youths emphasized portion sizes, how much sugar is in soda pop, and what snacks are considered "sometimes" or "always" foods.

Groceries and materials, including aprons for each child, were provided by Northern Wyoming Mental Health. Meadowlark Elementary School housed the program. All age groups were team-taught by the Big Horn Mountain Area (Sheridan and Johnson counties) educator for nutrition and food safety and the Sheridan County Cent$ible Nutrition Program educator.

Impacts:
The outcomes of the Kids First partnership were evident in nutrition knowledge gained and the multi-dimensional learning opportunities pertaining to healthy food choices, cooking skills, social skills, staying on task, turn taking, following directions, and enhancing self-esteem. Youths helping to prepare a meal were more apt to encourage family members to attend the family meal. Children ages 4-10 were given the opportunity to make a healthy snack as part of their weekly nutrition lesson. At the conclusion of the summer, pre- and post-test data indicated improved understanding of the food groups, especially calcium-rich foods, proper hand-washing methods, and improved food safety practices.

When the older group members were asked what they learned through the summer, their comments focused on cooking skills and "how to manage my eating." All participants clearly enjoyed the hands-on cooking. At the conclusion of the program, the small cookbook *Kids First Cooks! 2006 Family Night Recipes* was compiled and distributed to the youths.

One of the greatest impacts of this program is the readily identifiable sense of pride and pleasure Kids First participants demonstrated. When children know they can cook something good and share it with their family and friends, it's a taste of success. "The addition of nutritional health and food preparation as therapeutic activities has been well received by staff, parents, and, most importantly, the youths. Of all the activities added to the curriculum over the past few years, the nutritional component has been, by far, the most exciting and embraced one," reported the Kids First coordinator.

Carolyn Benepe
University Extension Educator – Nutrition and Food Safety
Big Horn Mountain Area/Buffalo, Sheridan counties
(307) 674-2980
e-mail: cbenepe@uwyo.edu

Goal 4: Enhance greater harmony between agriculture and the environment

Overview
Management of natural resources and associated environmental issues permeate nearly every aspect of life in the state. Public demand and expectations often conflict when determining appropriate management strategies for Wyoming's wide-open spaces, wildlife, and public lands. The need for science-based information and expertise in evaluating public policy and facilitating conflict resolution is ever increasing in Wyoming.

Wyoming's ecosystems, whether agro, range, or forest, have both plant and insect pests. The

effective use and value of range, forest, and cropland resources depend on the appropriate management of noxious weeds, insect pests, and diseases. Research and extension education programs in integrated pest management, bio-control, and other environmentally friendly pest control techniques are important to the state's ecosystems.

A large share of the state's income is generated from extraction of mineral and fossil fuels. Coal, trona, and natural gas are examples of large extractive industries in the state. Research and education programs on improving rangeland and reclaiming disturbed sites benefit individuals, communities, and the state by enhancing the productivity and stability of reclaimed lands.

The integrity of Wyoming's natural resource base and the state's diverse ecosystems is a central focus of the UW's extension and research programs. Natural resource related research and extension programs are designed to foster an understanding of the functioning of Wyoming ecosystems as related to the people and economic viability of the state.

Key Theme - Pesticide Application

a. Federal and state laws require that individuals using restricted use pesticides become certified applicators. Private applicators must be recertified every five years, and commercial applicators must earn recertification every three years. The University of Wyoming Cooperative Extension Service provides training for both initial certification and recertification of private and commercial applicators. UW CES cooperates with the Wyoming Department of Agriculture in the certification program. Training sessions for private applicators are on a county by county basis and are held as needed with each county holding one to two training sessions per year. County based educators provide training for private applicators. Training for private pesticide applicators consists of a two to four hour session concentrating on the safe and proper use of pesticides, environmental issues and calibration. Commercial applicator training takes place at the state level. Training for new commercial applicators consists of 24 hours of basic classroom instruction in safe and proper use of pesticides, environmental issues, weed science, entomology, plant pathology, small animal control and calibration. An initial certification school, consisting of 24 hours of training and a 12 hour recertification school were each held in 2006. Federal, state, and university personnel provide the training for commercial applicators. In 2006, approximately 402 private applicators received training to become certified and 475 received training to become recertified. In 2006, 754 commercial applicators received training to become certified and 1,325 received training to become recertified. Approximately 5,000 applicators in the state have a private applicators license and 3,000 have a commercial applicators license. Twenty-four Pesticide Education Program Fact Sheets (MP-93.1 through MP93.14) and other training materials that deal with various pesticide topics are available for both the private and commercial pesticide applicator training programs. These materials are available on line at: http://uwadmnweb.uwyo.edu/UWCES/UWPMC.asp

b. **Impact** - The response to applicator training schools continues to be very good. Of the various ways to become certified, many people elect to attend training schools, which indicate they are receiving training in the safe and proper use of pesticides. Based on surveys, approximately 877 private pesticide applicators and 2,079 commercial pesticide applicators adopted practices such as reading and understanding the pesticide label, wearing and using

the proper safety clothing and equipment, applying pesticides only when needed, and using integrated pest management strategies. Due to the private and commercial pesticide applicator training programs, pesticide complaints to the Wyoming Department of Agriculture are minimal. Those that are reported are usually due to pesticide misuse.

c. **Source of Funding** – Smith-Lever, State

d. **Scope of Impact** – State Specific

Key Theme - Natural Resource Management

a. Watersheds in arid and semi-arid regions within the United States are increasingly at risk of impairment due to both competition for available water supplies and water quality degradation. The western region of the country is the fastest growing region in the country. Traditional land uses, such as livestock grazing and irrigated agriculture, have historically had significant impacts on watersheds, but today as rural areas are being rapidly developed, environmental and management issues that were once considered to be "Eastern" problems need to be considered.

   The U.S. Environmental Protection Agency has established criteria to evaluate pollutant contribution from land-use impacts and other non-point sources. Under section 303(d) of the Clean Water Act, water quality management decisions are to be watershed based. The state of Wyoming has recognized the most successful watershed and water quality programs are initiated and implemented locally. The vision for the Wyoming Water Quality Division's Non-point Source Program states that it "intends to work through voluntary and incentive methods to preserve and restore the quality of Wyoming's surface water and groundwater resources so they continue to be available for designated uses" (Wyoming Non-point Source Management Plan, Update March 2000).

   The University of Wyoming Cooperative Extension Service (UW CES) has been working closely with Wyoming Association of Conservation Districts (WACD) and the Natural Resources Conservation Service (NRCS) to rebuild the water quality monitoring training program and to develop a certification program. The new training program, which is now being run by UW CES, has been streamlined into three modules and updated and enhanced. Funding and support are being provided by the WACD. NRCS and Wyoming Department of Environmental Quality (WYDEQ) are also working with them.

   A two and a half day course specifically addressing the science of water quality has been added to the curricula; a significant expansion of the previous two hour class. In addition, a training of trainers program has been initiated. A difficulty with the previous training program was finding available and qualified instructors. As part of the current training program, University of Wyoming personnel are being trained to be future course instructors. The objective is to develop and maintain a reserve of fully qualified instructors to teach the three different modules of the training program as necessary. The trainees participate in the courses as they are taught and are updated in changes in water quality regulations and monitoring techniques.

One of the major environmental controversies of our time is in regard to the rapidly rising concentration of CO_2 in the earth's atmosphere and whether or not this is causing global climate change. Regardless of its impact on the earth's climate, there is a growing movement in the United States and the rest of the world to lower the concentration of CO_2 in the atmosphere. In the United States, the most widely accepted strategy for reducing levels of CO_2 in the atmosphere is to sequester (or remove) C from the atmosphere and store it in soil as SOC (the major component of SOM) where it has beneficial effects on soil properties and land sustainability. There appears to be a particularly large potential to increase C storage as SOM in disturbed and reclaimed soils including reclaimed soils on surface coal mine lands in Wyoming. In fact, our previous studies of SOM dynamics and C cycling in reclaimed mine land soils in our state indicate that these soils are accumulating C at a rapid rate.

CES educators and specialists conducted 68 educational workshops, classes or tours reaching over 2,984 individuals on topics ranging from Range Monitoring, and Drought Management and Grazing to Small Acreage Management. The Sustainable Management of Rangeland Resources (SMRR) Initiative Team created over 120 sixty-second natural resource educational spots over two years which air twice weekly on statewide commercial television reaching a potential 9,000 households.

b. **Impact** – Eighteen WACD and WYDEQ personnel had successfully completed Module I of the new training program. Module I consisted of two background courses over a five day period taught by University of Wyoming faculty: Watershed 101 and Water Quality 101. The two and a half day course on Water Quality has now been fully integrated into the training program complete with a training manual and homework problems. The relationship between soil microbial biomass and SOC (as a constituent of SOM) in reclaimed soils compared to nearby undisturbed soils.

A framework for integrating landscape ecology and stream channel sites has been adopted. Appropriate sites for model development and testing have been identified in Wyoming that are closely linked to emerging issues of concern (fecal coliform, actively degrading streams, and coalbed methane production). Field techniques for assessing stream channel stability have been developed using a high resolution portable LIDAR system, and computer-based algorithms constructed that interpret field data.

- Participants in CES educational programs reported increased awareness of natural resource issues affecting their agricultural operations, environmental issues, regulatory issues, and the need for an integrated approach to problem solving.
- Over 304 producers, natural resource agency staff, and representatives from interest groups participating in the Wyoming Rangeland Management School reported they had gained knowledge. Thirty-five percent of evaluation respondents indicated they would improve range monitoring practices.
- Small acreage workshop evaluations showed that over 80 percent of participants increased their interest and awareness. One hundred percent reported they increased knowledge and 100 percent indicated they intended to change their practices as a result of information presented.

c. **Source of Funding** – Smith-Lever, Hatch, State

d. **Scope of Impact** – State Specific
Multi-State Research (AL, CA-B, CA-D, CO, CT, GA, IA, KY, LA, MA, MD, ME, MI, ND, NH, NY, ND, OH, OR, PA, RI, TX, UT, WA, WV, WY)
Integrated Research and Extension

Key Theme – Integrated Pest Management

a. Potential larval habitats of the mosquito Culex tarsalis (Coquillett), implicated as a primary vector of West Nile Virus in Wyoming, were identified using integrated remote sensing and geographic information systems analyses. The study area is in the Powder River Basin of north-central Wyoming, an area that has been undergoing a significant increase in coalbed methane gas extractions since the late 1990s. Large volumes of water are discharged, impounded and released during the extraction of methane gas, creating aquatic habitats that have the potential to support immature mosquito development. The West Nile Virus (Flaviviridae: Flavivirus) is a member of the Japanese encephalitis serocomplex. West Nile Virus affects the central nervous system and causes a serious threat to public health. Since West Nile Virus arrived in New York City in 1999, it has spread across the North America continent, and by the end of 2004, the total human deaths reached 374 cases nationwide. The state of Wyoming was hit heavily in 2003 with 375 human cases including nine deaths. In addition to posing a clear threat to human health the West Nile Virus poses a threat to native wildlife species. For example, the West Nile Virus is hypothesized to be responsible for the sharp decline of greater sage-grouse (Centrocercus urophasianus) in this region as the survival rate of this species has been reduced by 25 percent in recent years.
CES implemented a competitive grant program for applied research in IPM. One sample of a project under way is: Control of annual bromes (*Bromus tectorum* L., and *B. japonicus* Thunb.) and longspine sandbur (*Cenchrus longispinus* (Hack.) Fern.) with Plateau (Imazapic) herbicide and perennial cool-season forage grasses. Imazapic (Plateau) herbicide is promoted as a safe and effective herbicide for the control of cheatgrass on rangeland by the manufacturer. However, the manufacturer has limited the sale of this herbicide to government land management agencies. Thus use of this herbicide by private rangeland owners is limited. Results of this study may encourage the manufacturer to reconsider this decision, especially when Plateau is used to suppress cheatgrass to aid in the establishment of perennial forage grasses on degraded range and pasture lands. This practice may also be applicable for revegetation of pipelines, especially on private lands where the landowner is interested in the establishment of perennial forage grasses.

b. **Impact** – Several impacts from the competitive grant program for applied IPM are listed below.

- Mosquito control is a critical component of the arbovirus control programs, and one of the most effective ways to control a mosquito population is to reduce its larval (breeding) habitats. Previous studies have shown benefits of using remote sensing in the identification of mosquito breeding habitats. However, these studies have not targeted West Nile Virus or the intermountain west and plains areas in Wyoming where West Nile Virus risk is high. From an operational point of view, previous efforts used map resolution that was too coarse to implement local control strategies and not specific to larval habitat. With the increasing status

of this emerging arbovirus, a more accurate and finer grain mapping system is necessary to aid the West Nile Virus prevention program. The classification procedure developed by this study can be used to efficiently create a spatially explicit distribution of C. tarsalis larval habitats at the large scale. Although ponds smaller than one acre will be overlooked in this assessment, the product is valuable for the regional prediction of the vector population. Given that permanent water stands are usually larger than two acres, results from this study are suitable for long term monitoring purposes. UW researchers are currently pursuing the use of higher spatial resolution images, to improve the resolution of spatial assessment and to better quantify the impact of coalbed methane discharge water on mosquito larval habitat for ponds smaller than the detectable limit with Landsat. Since Culex spp. mosquitoes are primary vectors of West Nile Virus, the methods and activities in this study may provide a tool to identify Culex species habitats in other regions of North America. The image classification can be easily repeated and adopted. With the wide availability of Landsat™ data, this classification procedure can be applied more broadly in the future.

- Plateau herbicide will reduce cheatgrass infestation and late summer application appears to be more effective compared to early spring application. Although two oz of Plateau per acre reduces cheatgrass infestation it appears that four oz is best and six oz may be more than needed. Minimizing the amount of herbicide used to suppress cheatgrass seed production and establishment saves in herbicide costs and may reduce the negative affect Plateau might have on germination of seeded grasses, especially those planted at the time of herbicide application. Suppressing cheatgrass appears to improve establishment of seeded grasses bringing a unit of land back into production faster. This is the second year that we have seeded grass data to analyze. Plots that had grass last year improved in stand and seeded grasses became established in additional plots this year. Additional work under non-drought conditions needs to occur to determine just how effective the use of Plateau herbicide is in suppressing cheatgrass and establishing perennial forage grasses.

c. **Source of Funding** – State, Smith-Lever (3d)

d. **Scope of Impact** – State Specific
Integrated Research and Extension

Key Theme – Sustainable Agriculture

a. Preservation of and continued improvement of the health and stability of all of our natural resources forms the basis for our survival and the survival of generations to come. Our natural resources provide the basic production potential for all food, water, recreation, energy (in the form of wood, coal, gas, oil, etc.) fiber, etc. that we as humans must have to sustain our survival and that of our future generations. In that regard we could say that future generations are actually our most important renewable resource and all other goes to sustain them.

Research is currently evaluating grazing systems designed to maintain and optimize performance from a range resource by matching individual animal productivity (by stage and level of production) to the actual resource rather than attempting to modify the resource to match the animal and its respective nutrient needs. Educational programs and workshops to better acquaint young people with methods and systems to improve livestock productivity

while working within the bounds of the available resource is critical for resource maintenance. Information provided to school age youth about production agriculture and how it affects their daily lives is critical if the general public is to fully understand the importance of domestic production agriculture. Taking this message to the elementary schools and providing "field trips" to the farm-type environments are vital if this educational process is to proceed. Providing producers, resource managers and others with the most current scientific information on natural resource management while demonstrating how animals can be used in the maintenance and improvement of the grazed resource is critical. Biting vectors such as mosquitoes have been shown to be major carriers of catastrophic diseases that affect human populations where these mosquitoes propagate. Better understanding how these afflictions such as West Nile develop and move through the environment is the only way that we will ever be able to interrupt the life cycle and provide protection and relief to the affected human populations.

b. **Impact** - Research on and matching the animal, based on its production status and subsequent need, to the available grazed resource has been useful in identifying alternative management strategies to currently accepted and used practices which help improve animal productivity and thus increase sustainability of the family farm/ranch unit. Not only do these activities provide increased potential for net return to management they also provide a positive impact on the improvement and subsequent preservation of the natural grazed resource.

- The best opportunity for providing timely information on natural resource management to the general public as well as producers and other land users in a relatively short time, is at public expositions. Presentation of scientific information and how to use this information for natural resource management at schools and workshops attended by producers, resource managers, conservationists and others interested in natural resource management provide participants a common basis of scientific material upon which they can make management decisions, based on the best and latest information available, as compared to making the same decisions on speculation or personal bias which has frequently been the approach in the past. As a result of the resource management schools, clientele are requesting more information through more schools which provide more in-depth curriculum about the science of the biological systems present in the natural resource. The result of this need for further education will be the development of newly based schools designed to move the level of scientific knowledge to the next level. This will result in more consistent and concise decisions made by managers of both public and private native range resources. Better understanding of the biology of how catastrophic vector borne diseases move through the environment will better equip public health providers with the information and knowledge necessary to interrupt/disrupt the spread and perpetuation of diseases such as West Nile.

c. **Source of Funding** – Hatch, State

d. **Scope of Impact** – State Specific
Integrated Research and Extension

Key Theme – Water Quality

a. A significant challenge the West faces is to satisfy local, state, and national energy needs, while ensuring adequate quantity and quality water supplies and minimizing negative environmental impact associated with management of co-produced water, often of substantially impaired quality. In four of the Northern Plains and Mountain States (Wyoming, Montana, Colorado, and Utah), there are major water resource management, quality, and quantity issues associated with water co-produced during the extraction of coal bed methane. This water is typically modestly saline and highly sodic. Surface discharge and/or in-channel disposal of this produced water is presently the predominant water management approach for this type of water. However, the short and long term impacts of surface disposal of CBM water to the soil, vegetation, and water resources across the region are potentially negative in scope.

   Arsenic (As) enters water supplies from natural deposits of the earth's crust and/or anthropogenic activities (e.g., agriculture production, mineral mining, coal burning power plants). Recent studies suggest that high concentrations of arsenic in drinking water are found in many countries throughout the world including western U.S. The predominant forms of arsenic in water include arsenate (As V) and arsenite (As III). The U.S. National Research Council recently recommended lowering the human drinking water limit of 50 µg/L for arsenic based on extensive literature review. Subsequently, the U.S. Environmental Protection Agency (EPA) proposed a new limit of 10 µg/L for arsenic for human drinking water effective January 26, 2006. Current arsenic removal technologies suggest that the removal of both arsenic species require pH adjustments, pre-oxidation of As(III) to As(V), and/or are affected by competing ions in water such as sulfates, phosphate, and silica. Recent studies in our Water Quality Lab at the University of Wyoming have shown that CuO (cupric oxide) particles can effectively remove arsenic from natural waters across a wide range of water chemistries. The CuO works based on an adsorption process which traps arsenic onto its surface. This adsorption process relies on pH, but unlike many other techniques, it has a relatively high zero point of charge (ZPC) pH of 9.5, which allows for natural waters, both surface and groundwater, to be below the pH of the ZPC and thus brings a strong positive charge to the material. The uniqueness of CuO lies in the fact that during numerous tests conducted under myriad of conditions, results suggest that water pH, competing ions (phosphates, silicates, and sulfates), and arsenic oxidation states have no effect in removing arsenic from natural waters. Batch studies completed so far with CuO provide an understanding of how water pH, oxidation state of arsenic, and concentrations of phosphate, silica, and sulfate impact the removal of arsenic from water. However, batch experiments are difficult for field applications.

b. **Impact** – Integrated research has focused on improving water quality and riparian area management.

- Arsenic poisoning due to the consumption of water is of grave concern throughout the world and is in need of dire attention from the scientific community to establish a viable technique to alleviate the health risks that accompany arsenic exposure. Long-term exposure to arsenic contaminated drinking water, in excess of 50 µg/L, causes increased risk of skin, lung, bladder, and kidney cancer including skin-related problems such as hyperkeratosis and pigment mutations. Arsenic consumption also promotes cardiovascular and nervous system malfunctions, eventually resulting in death. There are numerous techniques that are effective

and capable; however each has its drawbacks and hindrances that affect its arsenic removal capacity. Results of this study suggest that we may have a viable arsenic removal method that works under a wide range of water conditions. The Traditional problems of arsenic removal (e.g. pH adjustments, oxidation state of arsenic, and competing common anions) do not seem to interfere with the effectiveness of CuO particles. The continuous flow arsenic treatment model developed from our research group is critically important for developing a practical and effective point-of-use arsenic removal process for drinking water systems. Subsequently, this will significantly improve the health of many people worldwide by improving drinking water quality.

- The development of a comprehensive integrated research, education, and extension project has resulted in providing numerous land owners within the Northern Plains and Mountains Region the tools to institute science-based natural resources monitoring programs to better manage produced and impaired waters from energy development. The impacts of this integrated project have and continue to reach local, regional, and national levels – with the state of Montana, Northern Cheyenne Tribe, and US EPA adopting promulgated surface water quality standards specific to salinity and sodicity, and the state of Wyoming currently going through the process. Furthermore, these standards are intended to be protective of existing beneficial water resource uses. In addition, these integrated research, education, and extension efforts have resulted in policy changes regarding water quality standards in Montana and Wyoming. Ultimately, the most significant indicator of success resulting from the Produced and Impaired Water Management Project is the adoption of these water quality materials, research-based publications, participation in public hearings on the issue, outreach education of the public and regulatory agency personnel, and influence of policy makers.

c. **Source of Funding** – Hatch, State, Multi-State

d. **Scope of Impact** – State Specific
Integrated Research and Extension

Goal 4 Summary:
The integrity of Wyoming's natural resource base and diverse ecosystem is the focus of the College's extension and research programs. A few of the college's on-going efforts in the Goal 4 area are:
1. Integrated Pest Management
2. Natural Resource Management
3. Rangeland and Riparian Management
4. Water Quality
5. Carbon Sequestration
6. Wildlife Management

Researchers in this area participated in nine Hatch projects and three of the nine are multi-state projects and five are integrated research and extension.

Agriculture Experiment Station FTEs 4.1
Cooperative Extension Service FTEs 12.33

Goal 4 Allocated Funds

CES	$1,153,777
AES Hatch & Multi-State	$ 0.3 million
AES State Funds	$ 1.8 million

Goal 4 – IMPACTS

The Small Acreage Conservation Education and Outreach Project

Situation:

Wyoming and other western states are undergoing a rapid shift in land use. Thousands of acres are being subdivided into small-acreage parcels. As this occurs, the number of small-acreage landowners grows. Owners of small-acreage parcels can be new to the land and may not have the knowledge, skills, or experience to adequately manage properties. This can lead to soil erosion, water quality contamination and water wastage, decreased and fragmented wildlife habitat, invasive noxious weed infestations, poor wild and domestic animal health, air quality issues, grassland and riparian degradation, and other natural resource problems.

To meet the educational needs of these landowners, a collaborative, multi-pronged approach to land management education is needed. Recognizing this, the University of Wyoming Cooperative Extension Service (UW CES), Wyoming Association of Conservation Districts, Wyoming Private Grazing Lands Team, Historic Trails Resource Conservation and Development Council (RC&D), Natural Resources Conservation Service (NRCS), Wyoming State Forestry Division, Audubon Wyoming, Wyoming Department of Environment Quality, and the U.S. Environmental Protection Agency joined to form the Small Acreage Issue Team. The team's mission is *"To create a culture of stewardship among small-acreage land managers by promoting sustainable practices that enhance the ecological, economic, and social aspects of the land and its people."*

Seven CES educators are working on the team with approximately 10 more individuals representing the other groups and agencies supporting the project. Efforts include producing *Barnyards & Backyards: Rural Living in Wyoming,* a quarterly magazine with articles by natural resource experts on a variety of topics of interest to rural homeowners. Each issue features landowners who practice good land management. The articles discuss challenges the landowners face in Wyoming and the strategies they use to overcome them.

Landowner visits were conducted by UW CES interns and volunteers with the nationwide Student Conservation Association in two pilot areas of the state during summer 2006. These visits inform landowners of the many land management resources available and allow them to discuss any particular needs they have. The visits help project team members better understand landowners' educational needs.

Informational workshops provided an opportunity for landowners to talk about problems they have encountered and to attend expert-led sessions to learn about different land management topics.

Impacts:
Fifty-eight landowners received a visit to their property by a representative of the team. Results of a survey distributed as a follow-up to the visits illustrate the effectiveness of this approach. One hundred percent of respondents were satisfied with the visit and believed the visit was helpful. Eighty-five percent of respondents plan to implement a conservation practice as a result of the visit. When asked what types of practices they would implement, comments included:

- Reseed my dead lawn in September according to soil test results.
- Pasture rest from overgrazing and possible area reseeding.
- I will contact the conservation district for help on planting a windbreak.
- I will not pull my Canada thistle since it will just resprout and spread – I'll use a herbicide.

A total of 270 took part in the workshops offered during this pilot year, and 204 evaluations were completed. Participants were asked to rank their knowledge of land management issues before and after the workshops. On average, landowner knowledge increased 30 percent after attending a workshop. On a scale of 1-poor to 5-excellent, participants gave the workshops an average score of 4.62. When asked if they would use the information to change how they manage their property on a scale of 1-not at all to 5-definitely, participants gave an average rating of 4.57. When asked how they would use the information presented, comments included:

- Heal my property – bring it back to natural state
- Re-landscape with water conservation in mind
- Rotationally graze my horses and enhance weed control
- Improve grazing land use with electric fencing
- Plan layout of property
- Be able to calibrate herbicide application to get rid of weeds and grow native grass

Cole Ehmke
Financial Management and Ag Diversification Specialist
Department of Agricultural and Applied Economics
(307) 766-3782
e-mail: cehmke@uwyo.edu

University of Wyoming CES Small Acreage Team members:
Tom Heald, Dallas Mount, Eric Peterson, Scott Hininger, Hudson Hill, Ron Cunningham

Goal 5: Enhance economic opportunity and quality of life for Americans

Overview
Cooperative Extension is working to enhance Wyoming communities and the well being of households through relevant integrated educational and resource management programs. CES focuses on increasing the capacity of communities, enterprises and families to create communities in Wyoming that offer a sustainable future in which to live**,** learn and work.

The federal government manages a significant amount of the land area in the Western United States. In Wyoming the Forest Service, Bureau of Land Management, National Park Service,

Bureau of Reclamation, and Fish and Wildlife Service control 29.8 million acres or about one-half of the surface area in the state. Due to its large land holdings, management decisions by federal land management agencies can have significant impacts on the economies and lifestyles of communities in Wyoming. Researchers are working with Wyoming communities, assisting them with identifying impacts of change, developing community network resources, and identifying growth opportunities for existing businesses. Multi-state projects interface retailers, small manufacturers, and home-based businesses; helping these businesses identify economic development and growth opportunities in their rural locations.

Key Theme - Family Resource Management

a. Cooperative Extension Community Development Education Educators in six extension areas conducted 17 financial management classes reaching 1,615 individuals. Topics included credit, savings, money talk, financial security in later life, and basic budgeting. Of the 1,615 total participants, 1,235 attended single topic workshops and 380 completed in-depth financial management courses that entailed three to twelve sessions.

b. **Impact** - Impact documented through evaluations on financial management programs included:

- 74 percent of participants indicated they had learned at least one new method for decreasing their expenses.
- 29 percent established an emergency reserve fund.
- 47 percent calculated amount needed for retirement.
- 83 percent better understand the costs of credit and dangers of making only the minimum payment.
- 100 percent reported they learned new information in the classes.
- 56 percent have set a long term financial goal and have a written plan for managing debt.
- 82 percent reported they were making changes in their money management practices.
- 40 percent increased their savings, ranging form $10/month to $10,000 total savings as a result of the Money Talk series.

c. **Source of Funding** - Smith-Lever

d. **Scope of Impact** - State Specific

Key Theme - Community Development

a. The future of Wyoming communities depends, in great part, upon the sustainability of its economy, people, and environment. Fifty-four educational workshops, classes, and seminars reached over 1,623 individuals. Topics included facilitation skills, mediation training, conflict management, teambuilding, and leadership development. Leadership is an important foundation for effective community development. Studies and surveys repeatedly document the need for leaders in rural communities. There are a few leadership programs in the state and very few exclusively locally based. The leadership program developed seeks to get communities involved in producing their own cadre of local leaders. This program differs from traditional programs in three ways: first, the programs are locally run with UW acting as a partner. The university helps guide the process of development, but community participants own the program. UW provides technical expertise when local expertise cannot

be found. Second, the curriculum is defined not by outside experts but a local steering committee. Finally, university personnel assist in assessment. Leadership Institutes that meet monthly for six to nine sessions and run six hours in length have been initiated in seven counties in Wyoming with over 102 participants. In addition in 2006, one area educator presented EVOLVE at the Western Regional Mid-Managers meeting reaching 82 individuals. Extension educators are also providing third party facilitation to community groups reaching 287 individuals in 12 facilitated sessions.

b. **Impact** - Impacts from the workshops conducted include: new skills were acquired and participants had a better understanding of using criteria for determining resolution. One hundred percent of participants felt they would use at least one skill learned in their workplace or desired to use them in community meetings. Specific outcomes include:

- Results from mediation training included conflicts resolved. Workplace mediation program evaluations indicated participants learned tips for calming unhappy customers and improved skills in conflict management.
- Leadership Institute participants reported the following short term outcomes: on a scale of 1-5 (1=no improvement to 5=greatly improved), skills improved in communication – 3.8, problem solving – 3.6, decision making – 3.7, building relations – 4.2, and leadership abilities – 4.3. Medium term outcomes measured six months following the eight month program included: 1) PCLI graduates are emerging as leaders in the community; 2) participants reported becoming active on city and county boards; 3) individuals reported goals set during the program were achieved; 4) graduates are demonstrating leadership skills in community organizations. Long-term impacts measured from follow-up surveys with 2003 graduates include: 100 percent of graduates are implementing teambuilding tools and 90 percent of participants are using communication and managing change tools. One hundred percent of respondents are involved in the community at either the same level or more after the course.
- Facilitation training participants reported in a three month follow-up that the most significant things learned were: group stages are normal, facilitation tools, moving groups forward, valuing all points of view and being flexible, group dynamics, listening styles, and how to build consensus.
- As a result of 2005 EVOLVE training, the leadership program has been implemented in Idaho.

c. **Source of Funding** - Hatch, Smith-Lever, State, County, Private

d. **Scope of Impact** - State Specific
Integrated Research and Extension

Key Theme - Youth Development/4-H

a. Positive youth development is a process of growing up and developing one's capacities in positive ways. (Walker & Dunham, 1994). 4-H becomes part of the total contextual environment for positive youth development. Life skills were defined as communications, problem solving, planning ability, decision making abilities, striving for excellence, leadership, and interpersonal relationship building. Wyoming had 7,209 youth and 3,307

volunteer leaders enrolled in the traditional 4-H youth program. Over 367 workshops, camps and clinics were held in counties throughout the state reaching over 10,229 youth. Over 9,310 youth participated in 4-H school enrichment programs during the year.

b. **Impact** - Both formal and informal evaluations were used to determine success of program efforts in 4-H and youth. Participants reported skills had been enhanced after participating in 4-H judging programs including horse, livestock, meats, vegetable, and wool. Increased skills reported by youth included decision making, verbal communication, and team work. Ninety-five percent of youth indicated they had learned something new through clinics and workshops attended.

- County, state, and regional camps helped members to increase skills, knowledge, increase self confidence, and develop interpersonal skills. One hundred percent of members could identify one thing they had learned and how they can use the information in their project work. Traditional member's demonstrated new skills learned through hands-on camp activities which were documented through written evaluations, observation, and leadership of youth sharing skills with others.
- Junior Leader age members (13–19) who received training have conducted clinics and field days for club project members, and taken over adult leadership responsibilities. Members have become more involved in community service projects and demonstrated that they had learned the meaning of team work and cooperation. A major impact of the program is the skill demonstrated in organization, team work, communication, public speaking, time management, and critical thinking. Youth reported increasing their ability to accept responsibility as well as being more thorough in project completion.
- Project workshops and clinics held throughout the state resulted in members learning new skills, gaining knowledge, increasing communication skills, enhancing decision making, and the importance of following through on a project. Impacts were documented through pre- and post-test, written evaluations, follow-up contacts with participants, and informal observation.

c. **Source of Funds** - Smith-Lever 3 b & c, State, County

d. **Scope of Impact** - State Specific

Key Theme - 4-H Leadership Development

a. State 4-H Youth Specialists, Extension Educators, and 4-H Program Associates presented training to the 3,307 volunteer leaders in Wyoming. Methods of training included subject matter project training, risk management through two-hour workshops and home study courses, district, state, and regional meetings, and printed materials. Total attendance at leader training sessions was over two thousand for leaders attending project workshops. Counties utilized training to recruit new and diverse volunteers to fill 4-H committee assignments and increase participation of new leaders. Volunteer recognition on state and county levels was completed through certificates, plaques, leader appreciation in newsletters, and 'leader of the month' program.

b. **Impact** - Over half of all volunteer leaders enrolled in Wyoming received formal training. Counties documented increased volunteer participation where training was conducted. One hundred percent of leaders completing the screening certification indicated they gained new knowledge and 89 percent reported they better understand the structure of 4-H.

Volunteers participating in project workshops and training reported increased knowledge and skills in subject matter areas and a better understanding and confidence in teaching skills to youth. Leaders trained in the disciplines of horse and shooting sports increased volunteer efforts in counties by up to 75 percent.

c. **Source of Funding** - Smith-Lever, State, County

d. **Scope of Impact** - State Specific

Key Theme – Impact of Change on Rural Communities

a. Wyoming is a state of contrasts, imprinting its own unique footprint on important issues. Issues such as shifting demographics in a low population setting, abundant natural resources (both mineral and scenic), and high level of government ownership of the land area create a challenging environment for research and extension specialists. With about 49 percent of the state owned by the federal government, management decisions by federal land management agencies can have significant impacts on the economies and lifestyles of communities. In Wyoming, two areas represent the bulk of the controversy over public lands issues, mineral development and endangered species.

b. **Impact -** Providing solid economic information helps reduce the emotionalism associated with discussions regarding the management of Federal land. It also improves the decision making process by providing decision makers with more reliable and credible information on which to base their decisions. Finally, these types of analyses allow communities in Wyoming to participate in the planning process by quantifying the issues that are of particular concern to them. The net result is improved decision making with regards to the management of Federal lands.

- An Off-Road Vehicle Study was completed for the Wyoming State Trails Program (a unit of the State of Wyoming Department of State Parks and Cultural Resources). The study used a survey of 1,900 ORV users in Wyoming (resident and non-resident) to estimate numbers, location and frequency of use, and economic impact of ORVs. This was a first of its kind study for Wyoming that will help the state better understand, plan for, and manage ORV use.
- Members of the group contributed time and analysis expertise to a feasibility study for a potential bio-diesel, canola oil crushing facility in Riverton, Wyoming.
- An economic impact analysis was completed for the BLM's Moxa Arch EIS in southwestern Wyoming. This information will be used in developing the management plan for the Moxa Arch natural gas field.
- Members of the group have begun working on an economic analysis for the Shoshone National Forest. This information will be used in the development of a revised management plan for the Forest. This project is being funded by the Governor's State Planning Office.
- An economic analysis of the impacts of the Bighorn National Recreation Area on Big Horn county was developed at the request of local officials in Big Horn County. The analysis has been used by Big Horn County in negotiations with the Bureau of Reclamation and the State of Montana regarding the management of Yellowtail Dam.

c. **Source of Funding** – Hatch, State

d. **Scope of Impact** – State Specific (W1192) (AK, CO, ID, NM, NV, OR, UT, WY)
Integrated Research and Extension

Civil Rights – Diversity

Key Theme – Multi-cultural and Diversity Issues

a. The Extension Civil Rights coordinating committee conducted five county civil rights training reviews during the past year. During reviews comprehensive training is provided to assure that all Extension employees are committed to serving all clientele and targeting underserved audiences when identified or needed.

When developing plans of work, individuals include diversity within each plan. UW extension and research professionals were committed to reaching the total population of Wyoming including the under-served and under-represented Native American and Hispanic population. Such activities include staffing bi-lingual coordinators for the Cent$ible Nutrition Program (CNP), and preparing nutrition materials in Spanish and Braille. In 2006 CNP expanded collaborative efforts with the Eastern Shoshone and Northern Arapaho tribes that enabled CNP to increase funding for nutrition education on the Wind River Indian Reservation.

b. **Impact** - All 27 Cooperative Extension county offices have gone through a comprehensive training and assessment review on Civil Rights and Diversity. All county CES staff had written civil rights into their individual or county plans of work. Civil Rights are a component of annual performance appraisals. CES annually recognizes one staff member for diversity efforts.

c. **Source of Funding** - Smith-Lever

d. **Scope of Impact** - State Specific

Goal 5 Summary:

Wyoming residents identified economies of Wyoming communities, personal finances, and youth development as high priorities. University of Wyoming researchers are working with Wyoming communities, assisting them with identifying impacts of change, developing community network resources, and developing leadership capacity for community leaders. Researchers in this program area participated in one Hatch project, which is integrated research and extension.

Agriculture Experiment Station FTEs	1.6
Cooperative Extension Service FTEs	40.67

Goal 5 Allocated Funds

CES	$3,805,686
AES Hatch & Multi-State	$ 0.1 million
AES State funds	$ 0.25 million

Goal 5 – IMPACTS
Dealing with Angry People

Situation:
More than 200 people completed facilitation training during the past several years in the Big Horn Basin area. On evaluations, more than half of the participants stated they wanted more information on dealing with angry people. Facilitation training offers general information but doesn't deal specifically with customers or clients who are angry or very upset.

Robert Bacal, a Canadian researcher, has studied public sector businesses and government in the United States for many years. More recently, he has seen increased aggression, increased verbal abuse, and more frustrated and less tolerant customers. This has been confirmed by participants attending a new University of Wyoming Cooperative Extension Service (UW CES) training called "The Angry and Upset" as observed at their worksites.

The area extension educator in the Big Horn Basin developed a three-hour workshop that incorporated interaction and practice of skills taught. The program partners were Northwest College, Powell Valley Community Education, UW CES -Washakie County, Big Brothers Big Sisters, and the Women's Business Rendezvous planning committee, who co-sponsored the workshops.

Eight 3-hour workshops were held in Worland, Cody, and Powell. The workshops included three sections: what angry people want/need, a four-step process for dealing with angry, upset people, and cooperative communication tools. Also, an hour version was developed for the statewide Extension Professional Improvement Conference, the Fair Managers Conference, and the Cody Rotary Club reaching an additional 125 people.

Impacts:
The three-hour program was immediately evaluated after completing the training by 151 participants. A follow-up survey was mailed three months later to determine practices applied.

The immediate evaluation revealed that the overall workshop was rated 4.7 (1-poor to 5-excellent). Ninety-four percent of the participants correctly named the four parts of the process – act, add, reframe and problem-solve – and 98 percent named at least one cooperative communication tool they knew they would use. Most people said the most useful information was on reframing – the four-step process and controlling their own responses.

A three month follow-up evaluation was mailed to participants. The return rate was 37 percent of attendees.

- Awareness of personal reactions and "hooks" increased for all participants. When confronted by angry people, participants rated the awareness of their own reactions at 4.3 (1-less aware to 5-more aware) as a result of the training.
- Knowledge was retained after the training. Ninety-four percent correctly identified the three things angry people want and need – to be helped, to have their emotions and the problem correctly identified, and to be given choices during problem solving.
- Behaviors were adopted.

- 72 percent have used the process since the training.
- 89 percent said the process flowed well.
- 95 percent said it helped them slow down (a good thing). When dealing with angry people, the first step is to act rather than react. Reactions are usually emotional and ineffective. Slow down, acknowledge the angry person's feelings and do some fact-finding with them.
- 95 percent said it helped them act rather than react.
- 94 percent said the relationship was preserved.
- 88 percent said the problem was solved.

- 100 percent of respondents adopted at least one of the cooperative communication practices.
- Testimonials:
  - *"I made several business cards with a brief explanation of the four steps. I have them near my phone and in my purse."*
  - *"The speaker was an excellent communicator and knew her subject."*
  - *"The interactive participation worked very well for me."*
  - *"I'm glad you mailed this follow-up because it helped me remember some things I need to do. It is difficult to change old habits."*
  - *"It was very helpful information and, although I don't catch myself every time from reacting, I find I catch myself more and more easily. As with anything, practice makes perfect, and I plan on practicing these tools for the rest of my life."*

Rhonda Shipp
University Extension Educator – Community Development
Big Horn Basin Area/Big Horn, Hot Springs, Park, and Washakie counties
(307) 527-8560
e-mail: rshipp@parkcounty.us

Finding You!
Situation:
A major obstacle to developing an approach to character education in recent history has been the assumption there could be no essential agreement on the values believed to compose good character.

In 1992, the Los Angeles, California-based Joseph and Edna Josephson Institute of Ethics hosted a three-day conclave in Aspen, Colorado, of 30 of the nation's top experts in character education and representatives of youth organizations to create a framework for character education. The result was The Aspen Declaration on Character Education, which outlines a common vocabulary of six core values defining character: responsibility, respect, trustworthy, fairness, caring, and citizenship. The actions led to Character Counts!, an approach to character education.

As a collaborative effort between Uinta County 4-H and the city of Evanston's youth group, Youth Opportunities Unlimited, an effort was undertaken to not only secure funding but implement strategies for character education in the community.

In spring 2005, 4-H worked jointly with Evanston High School counselors to develop a program called Finding You. Twelve high school freshmen were selected based on high-risk behaviors to be part of the program. These youths were either failing or close to failing more than two classes, socially challenged, or not involved in extracurricular activities.
The goal was to not only introduce these students to the six pillars of character in an effort to change these behaviors but, more importantly, provide them the motivation to change their behaviors, which included improving their grades, attending school, and following rules.

At the conclusion of the eight sessions, if the students had a C (75-percent) average and acceptable behavior in all their classes and acceptable school attendance, they had the opportunity to become "teen teachers" in an elementary school.

The Finding You program consisted of eight, one-hour sessions over 2 1/2 months of the spring semester. The first session was an overview of the program in which the students set their own ground rules, established a standard for becoming teen teachers, and decided if they wanted to continue with the program. Each of the following six sessions focused on one of the six pillars. Through interactive, hands-on approaches, students outlined how the pillars related to their lives and the choices they make. For the last session, they developed their own lesson plans and had the students divide into groups, one for each of the six pillars.

At the conclusion of the eight weeks, six of the 12 were able to meet the standards set by the group to become teen teachers. Using plastic and lattice frames, the youths built a maze in the gym at North Elementary School. Over two days, 365 North Elementary students wound their way through the six-pillar maze. In the maze, the teen teachers dressed in their character-colored shirts, and led a short interactive exercise to teach students about their respective pillars.

Impacts:
The six students who met the standards were able to become teen teachers and increased their grades to 75 percent. They kept school attendance acceptable, and teachers rated their behavior as acceptable. Two of the students stated on their final evaluations, "This group motivated me to improve my grades."

The entire group completed a pre- and post-questionnaire, in which they rated themselves on each of the six pillars. Pre- and post-tests showed similar results for four of the pillars, trustworthy, respect, caring, and citizenship. On two other pillars – fairness and responsibility – they rated themselves a point lower on the average. These results show the group gained a better understanding of what each pillar means, how they should incorporate them into their lives, and how their decisions, actions, and reactions affect others. These results showed knowledge increased and a better understanding of oneself.

Youths stated:
"I learned about the pillars, and I had not heard of them before."
"This support group helped me find a little more out about myself."
"The support group helped me understand how we should help others and ourselves."
"This support group helped me get my grades up."
"The support group could be improved by meeting more often."

"It was hard to get my grades up in order to become a teen teacher."

Phase two of the program will include the teen teachers returning once a month to teach students at North Elementary School about character education – as long as they maintain the same standard set by the support group. In the fall of 2006, North Elementary School incorporated the Character Counts! framework into its school days. For example, weekly assemblies are held where classes perform skits for their peers based around the character pillars. They have celebrated Character Counts! week by wearing pillar colors each day.

Dawn Sanchez
University Extension Educator – 4-H/Youth
Uinta County
(307) 783-0570
e-mail: dasanchez@uintacounty.com

B. Stakeholder Input

Stakeholder input comes to the College of Agriculture Cooperative Extension Service and Agricultural Experiment Station through a variety of methods. A joint research and extension needs assessment process was completed as outlined in the Plan of Work written for Wyoming 1999-2004. A stratified sample was used to determine program and research needs in the state. In addition to the mail survey, a phone survey was conducted with a random sample of Wyoming residents. Both surveys also addressed preferred delivery methods by Wyoming citizens. Stakeholder input gathered through all methods is shared with CES initiative teams comprised of field educators, extension specialists, UW department heads, and administrators. Information is used in development of CES programs and applied research. This needs assessment guided development of the 2007 – 2011 plan of work.

Stakeholder input has been a vital component to strategic planning for both CES and AES. Both CES and AES have utilized stakeholders through the advisory process and in the case of CES, sought input prior to implementation of the strategic plan. Two AES sites have gone through a planning process similar to strategic planning. As a result of that process, a new combined southeast R&E center which was under construction in 2005, opened in 2006 to replace two existing stations. In addition, in 2006 the Laramie Research and Extension Center was established, which combined the animal science farms, the plant sciences greenhouses at UW and the McGuire Ranch into an integrated crops and livestock research and extension center which allows UW to conduct inter-disciplinary research near the UW campus.

CES advisory committees have formed in the nine Extension areas. These area advisory committees meet at least once annually to provide input on issues and program direction for CES. Advisory committee members are nominated by extension staff by subject matter interest. Selection to serve on advisory committees is based on gender, geographic representation, race, national origin, and underserved audiences. Another example of state-level stakeholder input is the advisory committee of county commissioners formed by the Wyoming County Commissioners Association. This advisory committee meets with the director of UW CES during the association's quarterly meetings.

All counties have had targeted advisory meetings to gain stakeholder input on reaching limited resource audiences in the Cent$ible nutrition program (EFNEP and FSNP). County 4-H staff has established 4-H Expansion and Review committees to specifically address outreach efforts toward underserved youth audiences. Training has been provided for staff to encourage diversity in representation on advisory committees. County personnel also utilize collaborative partners to learn needs within communities of the state. In the past year CES has partnered with the Natural Resource Conservation Service (NRCS) with representatives meeting quarterly to assess joint needs and work cooperatively in development and delivery of programs. Each of the three Research & Extension Centers has an advisory committee that meets annually. These advisory committees provide information on existing research and outreach programs and input regarding priority needs for research and outreach. The College of Agriculture maintains a separate statewide advisory committee. The committee meets annually to exchange information on the college's programs and to seek input of future concerns and issues. Three departments, Animal Science, Family and Consumer Sciences, and Veterinary Sciences, have separate advisory committees that provide input on programs in those departments.

One example of the critical role stakeholders have contributed in FY06, through advisory committee input for AES and CES three new positions were funded through the state legislature which included a crops extension educator for the Big Horn Basin area and two new positions at SAREC – a Research Director and Livestock Systems specialist.

C. Program Review Process

The merit review process for extension programs covers all programs conducted by UW CES. A team leadership model is utilized to review program plans and direction for CES programs as outlined in the 2004 UW CES Strategic Implementation Plan. Program initiative teams develop and review programs on an annual basis. Teams are comprised of internal CES educators, specialists and faculty in addition to collaborative partners who provide an external check on programmatic decisions by CES. Just a few examples of external stakeholders participating in program planning and assessment include: NRCS, forest service, and Audubon Society on Small Acreage issues; Department of Agriculture Consumer Health Specialists and Environmental Health Sanitarians – on food safety programs; and WIN Wyoming (Wellness IN Wyoming) is a multi-disciplinary, multi-agency network of over 130 educators and health-care professionals representing over 60 public and private entities in 19 states, the District of Columbia, Australia, the United Kingdom, and Iceland who discuss priorities in nutrition. Teams make decisions to maintain, modify, or create new programs to meet the needs identified through external and internal stakeholder input.

Projects supported with formula funds (Hatch, Multi-State, McIntire-Stennis, Animal Health) must be approved projects. The project proposal is transmitted to the department head and the head appoints a minimum of two internal scientific reviewers who are knowledgeable in the field to review the proposal. After a proposal is revised based on the above review, it is transmitted to the Experiment Station Director. The director's office assigns three internal scientific reviewers who are knowledgeable in the field to review the proposal. The AES is exploring implementation of external review all funded projects beginning in FY07.

The Wyoming Agricultural Experiment Station administers an internal competitive grants

program using a portion of its federal dollars. Proposals are reviewed by a ten member university-wide committee. Each proposal is also sent to external reviewers. The committee submits recommendations for project funding to the AES director.

D. Evaluation of the Success of Multi and Joint Activities

As outlined in the Stakeholder input section, the UW CES and two of the R&E Centers went through a strategic planning process. AES has closed two stations and has completed construction of one near Lingle that will accomplish the necessary research for the region. The CES strategic plan has identified five initiative areas which provide greater focus for extension personnel. Those initiatives redefined by stakeholders are Profitable and Sustainable Agriculture, 4-H/Youth Development, Nutrition and Food Safety, Rangeland Resources, and Community Development Education.

The programs identified in the College of Agriculture's 5-Year Plan of Work address the critical issues of strategic importance for the state and region. These issues were identified through extensive input from research and teaching faculty, CES personnel, and college stakeholders during the college's strategic planning process. The five program goals listed in the 5-Year Plan of Work are consistent with those at the national level. Over 50 percent of the research projects identified in this report reflect an integrated effort between research and extension. Researchers at UW's College of Agriculture are involved in approximately 13 multi-state projects. These projects cover all but one of the identified program goals (goal 2). The college's researchers have also been successful with research involving multi-institutions. There is also on-going multi-institution research programming through the R&E Centers. In addition, researchers have been successful in integrating research programs with various federal and state agencies and organizations. These linkages, as well as campus wide multi-disciplinary research programs, are encouraged through the AES university-wide competitive grants program. Specific CES and AES projects which are multistate or integrated are identified on the final page (60) of this report. Details are integrated into the goals in section A.

There are a limited number of on-going multi-state/multi-institution research projects involving University of Wyoming researchers that address the needs of under-served and under-represented populations, including WIN the Rockies. However, researchers need to continue to seek ways to better address the needs of these population groups in their future efforts.

The programs described the expected outcomes and impacts. Each of the educators and specialists wrote impact statements, some of which are used for the impact reporting to CSREES and others for county commissioners, state and national legislators, university administration, and clientele.

The College's 5-Year Plan of Work describes the expected outcomes and impact for each of the five goals. Information concerning the outcomes and impacts is presented in an evaluative manner so that expectations have been made clear. Within each goal outcomes concerning work with external agencies including multi-state and multi-institutions are also addressed and encouraged.

By focusing on specific outputs and outcomes as identified within the plan, there was more

consistency in reporting program effectiveness. Through the college's strategic planning efforts there appears to be a more concerted effort to streamline research programs to address one of the identified goals. Research and extension personnel are seeking ways through the Plan of Work to work more closely together in order to address the needs of the state and region. As these efforts continue, the college can anticipate an improved effectiveness in its research and extension programs.

E. Multi-state Extension Activities

Cross-discipline activities, multi-state, and joint research have been common in the past, so these requirements are not new to Wyoming. Joint research can be audited through the projects that were at one time called regional projects. In the supplemental report to the Plan of Work 1999 - 2004, Wyoming suggested that 25 percent of its Hatch funds would be devoted to the integrated activities; but Extension listed zero (0 percent) of its Smith-Lever funds on integrated activities. The contradiction comes from the fact that Hatch funds can be audited, whereas the Smith-Lever funds could not be audited. Because of that concern, Wyoming added an auditable tracking of the Smith-Lever funds that are both multi-state and integrated with Hatch through an on-line reporting system utilized by all CES employees. In addition, CES specialists report multi-state and integrated activities through the UW College of Agriculture faculty update, which are submitted annually.

F. Integrated Research and Extension Activities

The strategic plan for the College of Agriculture calls for collaboration in all three functions, instruction, research, and outreach. To encourage multi-disciplinary and collaborative research efforts, the Wyoming Agricultural Experiment Station established a competitive grants program that emphasizes research across disciplines and colleges.

Multi-disciplinary and integrated research efforts are quite common in the College of Agriculture. Over half of the research projects are integrated and the majority of those are multi-disciplinary. This is particularly true of the research efforts dealing with Goal 1 on competitiveness and profitability of agriculture.

Research efforts in areas under Goal 3 have been enhanced through projects on human nutrition and health. This has been most apparent with the increase in projects in the Department of Family and Consumer Sciences.

Initiative teams formed as a result of the CES strategic plan have members representing CES educators, state specialists and faculty members, and UW College of Agriculture department heads. The intent of the initiative teams is to build communication and develop a more integrated program for research and extension.

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Actual Expenditures of Federal Funding for Multistate Extension and Integrated Activities
(Attach Brief Summaries)
Fiscal Year: 2006

Select One: ☐ **Interim** ☒ **Final**
Institution: University of Wyoming
State: Wyoming

	Integrated Activities (Hatch)	Multistate Extension Activities (Smith-Lever)	Integrated Activities (Smith-Lever)
Established Target %	%	25 %	25 %
This FY Allocation (from 1088)		$ 1,332,077.00	$ 1,332,077.00
This FY Target Amount		$ 333,019.00	$ 333,019.00
Title of Planned Program Activity			
Goal 1: Enhance Agricultural Systems that are highly Competitive in the Global Economy		$ 130,224.00	$ 165,350.00
Goal 2: A Safe & Secure Food & Fiber System	$		
Goal 3: A Healthy Well Nourished Population		$ 21,000.00	$ 7,000.00
Goal 4: Greater Harmony Between Agriculture and the Environment		$ 115,471.00	$ 100,921.00
Goal 5: Enhnaced Economic Opportunites & Quality of Life for Americans		$ 68,324.00	$ 61,000.00
Total	$ -	$ 335,019.00	$ 334,271.00
Carryover	$ -	$ -	$ -

Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays reported here accurately reflect allowable expenditures.

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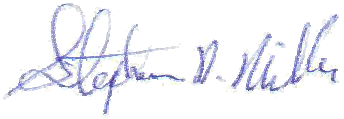
Select One: ☐ **Interim** ☒ **Final**
Institution: University of Wyoming
State: Wyoming

	Integrated Activities (Hatch)	Multistate Extension Activities (Smith-Lever)	Integrated Activities (Smith-Lever)



Smith/Lever Multistate and Integrated Programs

Description of programs can be found in the narrative portion of POW accomplishment report.

Multistate	Integrated
Goal 1 –	
▪ Certified Seed Production	▪ Certified Seed Production
▪ Profitability of Growing Dry Beans	▪Profitability of Growing Dry Beans
▪ Risk Management for Ag Families	▪Reduced Agent and Area Treatments
▪ Small Acreage Management	▪Animal Production Efficiency
▪ Animal Production Efficiency	▪ Invasive Species
	▪ Plant Health
Goal 3 –	
▪ Steps to a New You	▪ Steps to a New You
Goal 4 –	
▪ Natural Resource Management	▪ Natural Resource Management
	▪ Integrated Pest Management
Goal 5 -	
▪ Community Development	▪ Community Development

Integrated/Hatch Programs

Goal 1 –
- ▪ Reproductive Performance in Domestic Ruminants
- ▪ Plant Disease Epidemiology & Management in Agronomic Crops
- ▪ Ecological Relations & Management of Selected Rangeland Plants
- ▪ Production of Horticultural Crops in a Semi-arid, High Altitude Climate
- ▪ Enhancing the Competitiveness of U.S. Red Meats
- ▪ Genetic Variability in the Cyst & Root-Knot Nematodes (from W-186)
- ▪ Plant Genetic Research Conservation & Utilization

Goal 3 –
- ▪ N-3 Polyunsaturated Fatty Acids & Human Health & Disease

Goal 4 –
- ▪ Riparian Vegetation Filter Impacts on Non-point-source Pollutants from Range & Cropland
- ▪ Mechanisms & Impacts of Integrated Pest Management Strategies for Sustainable Canada Thistle Control in Riparian Corridors

Goal 5 –
- ▪ Rural Communities & Public Lands in the West: Impacts & Alternatives
- ▪ Benefits & Costs of Natural Resources Policies Affecting Public & Private Lands