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CSREES ANNUAL REPORT
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Wyoming's Accomplishment & Results

Introduction:

As a land-grant institution and Wyoming's only state university, the University of Wyoming (UW) has a responsibility to serve the state. The College of Agriculture reflects the land-grant philosophy and tripartite responsibility of instruction, research, and outreach.

Agriculture is changing. The resiliency of the industry is testimony to the fact that American agriculture continues to produce the most abundant, nutritious, and affordable food supply on the planet. Agriculture faces complex challenges and opportunities as we move forward in the 21st century. Both industry and land-grant institutions are challenged to compete in a global economy while responding to the changing needs of a diverse population. Ensuring agricultural sustainability, while addressing the environmental concerns of the public, continues to place new demands on the food and fiber industry. Issues involving agriculture, resource management, quality of life, and families and rural communities generates diverse research and educational directives. To the best of its ability, the College of Agriculture provides education and information to Wyoming citizens, so that they can continue to compete successfully in local, regional, and global markets. Opportunities are abundant for the College but constrained by resources. The College of Agriculture focuses on priority agriculture, environmental, and human resource needs of the state. Stakeholders have been vital in identification and prioritization of needs. The college has seven departments including agricultural and applied economics, animal science, family and consumer sciences, molecular biology, plant sciences, renewable resources, and veterinary sciences.

The College of Agriculture's mission is to serve the educational and information needs of students, Wyoming citizens and communities, and the global scientific community by pursuing and distributing unbiased, scientifically-based information on food and fiber systems, biological and human sciences, and natural resources. We will provide access to information from global sources, facilitate open and respectful dialogue, and encourage personal responsibility. 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.

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 the economy of most cities and towns. Livestock and livestock products generated approximately 84 percent of agriculture's cash receipts of \$955 million in 2000. The Wyoming livestock industry is forage-based with both private and public lands providing forage for livestock production. It is important to note that these same private and public lands provide forage for game and other animals that are important to another pillar of the state's economy, tourism and recreation.

Due to high elevation (average 6800') and climate over most of the state, Wyoming's agriculture faces unusual challenges. Improved animal and plant genetics, pest control, soil and water conservation, integrated resource systems, and domestic and international markets are needed to maintain sustainable and profitable agricultural systems. Stakeholder input suggests that all aspects of profitability and sustainability are important issues for research and extension including productivity, markets, and management of land, water, and wildlife resources. Drought continues to be a critical issue in the state impacting agriculture.

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 Wyoming's 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, and profitability. More than 3,300 producers attended various workshops regarding agricultural profitability that assisted them in making management decisions.

Inadequate nutrition during pregnancy can have serious postnatal and adult health consequences in livestock and in humans. The Center for the Study of Fetal Programming is conducting research to identify specific genes that are expressed in undernourished versus nourished ewes and cows. Identification of genes that are differentially expressed under nutritional stress might lead towards development of diagnostics and biotechnologies that are designed to improve maternal nutrition and, consequently, fetal health and longevity. The concept of Fetal Programming and a description of the multidisciplinary effort to study this important research area can be found at: <http://uwacadweb.uwyo.edu/healthyfetus/home.htm>

A major focus for the Department of Veterinary Sciences is the study of emerging infectious diseases that are of common concern to both domestic and wild animals. Currently, the risk of transmission of Chronic Wasting Disease (CWD) to other domestic species of food animals is of tremendous concern to producers, the livestock industry, and public health officials. The identification of animals affected with CWD is a problem that concerns the public at large, regulatory entities such as USDA, FDA, EPA, hunters and elk and deer ranchers. Ante mortem diagnostics can aid in the control of CWD by allowing the identification of animals before they show clinical signs and without the need for killing complete herds demonstrated to be affected by the presence of individual infected animals. Drs. Elizabeth Williams, Thomas Hansen, and Alberto van Olphen have entered collaboration and have submitted a \$500,000 grant to the

Department of Defense to study this problem and try to develop such diagnostic test. Ante mortem pre-clinical diagnosis of CWD would help a) decrease the risk of horizontal transmission by allowing the identification of individual infected animals that could then be removed from the herd, b) prevent the massive slaughter of non-infected animals in affected herds, and c) help wildlife management agencies implement more effective plans of control and /or eradication. Thus, the research has relevance to military and non-military health and well-being.

Genetic engineering of alfalfa to express spider silk is a research project with the overall goal of adding value to Wyoming's alfalfa crop. Spider silk is a novel protein that is characterized by several unusual molecular properties that endow it with extremely high tensile strength as well as tremendous elasticity. The synthetic gene for *Nephila clavipes* dragline silk fibroin has been inserted into alfalfa by *Agrobacterium*-mediated transformation. Following regeneration of shoots and roots, positive transformants were selected. Plants will be vegetatively propagated from these initial seedlings to obtain material for analysis of gene insertion and expression. Various procedures will be investigated to optimize purification protocols for extraction of silk protein from transgenic alfalfa. The vision is that transgenic alfalfa could be harvested multiple times per growing season, processed to hay bales or cubes as per normal farming operations, and transported to a central processing facility. Although the ultimate demand for spider silk for commercial applications cannot, at this time, be accurately estimated, it is anticipated that plant expressed silk could generate up to \$200 million/year. For example, biomedical uses include sutures, artificial ligaments and tendons and industrial uses include protective clothing, composite materials for building, and aerospace applications.

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

Key Theme – Adding Value to New and Old Agricultural Products

- a. The UW Wyoming Seed Certification Service provides certification and other support services that allow Wyoming seed producers and seed companies to market value-added products.

Hay producers are seeking marketing opportunities and alternatives based on both traditional and alternative modes of production. A primary opportunity for many hay growers includes production of high quality hay for specialty markets (dairy and horse). The Wyoming Hay Hotline is a web-based information system developed to provide marketing assistance to buyers and sellers of hay. Hay listings are posted on a Web site within a day or two of receipt from growers and listings are updated monthly during the marketing season.

- b. Impact – The Seed Certification Service provides a system by which national standards for certified seed production are met by Wyoming seed producers, which is also compatible with state and federal seed laws. Additional efforts include assisting seed producers in identifying profitable management practices and in locating stock seed. Seed crops in Wyoming were worth an estimated \$17 to \$19 million in 1999. Seed crops have a greater value than the same crop produced as food or feed, providing value-added benefits that are paid directly to

producers. Additional benefits to Wyoming occur as seed processing facilities, which provide jobs and bring money into the state with out-of-state seed sales.

Ninety-nine editions of the Wyoming Hay List have been published from September 1995 through December 2002. During a 28-month period from March 1998 to July 2000, the Web site averaged four visitors per day, but averages varied from 7.5 per day in August to 2.3 per day in May. Individuals from 26 countries and six continents visited the Web site during this period. From July 1, 2000 to June 30, 2001, Web site usage nearly doubled to 7.8 visits per day with a total of 2825 for the period. Daily visits averaged more than 18 per day during July 2002 when visits totaled 569 for the month.

Proso millet is an important alternative crop in Southeastern Wyoming. If market conditions are favorable it can be a very profitable crop. Being a spring planted crop, producers can use proso millet in the management of winter annual grassy weeds that impact winter wheat production. Early maturation is important to help avoid weather hazards during harvest. Earlier maturation with a shorter grain fill period is a feature of Horizon (9217). Currently, the earliest maturing released variety (Dawn) carries a substantial yield penalty. Other adapted varieties of comparable yield are lower in seed weight and grain volume weight. Horizon has the potential for early harvest with high yield while maintaining desirable seed weight and grain volume characteristics.

- c. Source of Funding – Smith-Lever, State
- d. Scope of Impact – State specific
Multi-State Integrated Research and Extension (WY, NE)

Key Theme – Agricultural Profitability

- a. The value of the agricultural sector output in Wyoming annually approaches or exceeds one billion dollars while cash income was \$954 million 2000. In 2000, 9,200 farms and ranches were operating in Wyoming with a total land area of 34.6 million acres. Cooperative Extension Educators conducted 123 workshops, multi-day seminars, or classes reaching over 3,300 individuals. A sample of the topics ranged from Ag Profitability, Beef Quality Assurance, Importance of Winter Forages, Young Beef Female, and Living on Small Acreages.

Economic profitability is vital to the sustainability of agriculture since no practice or agricultural operation is sustainable unless it is first profitable. A system that examines all of the resources of the farm and ranch (land, labor, and capital) should provide for a more stable, long lasting, sustainable agriculture in the face of increasing change and numerous demands on agriculture's management. Several programs were developed and presented to educate individuals in the agricultural sector on ways to make agriculture profitable as well as sustainable.

Producers, regulatory agencies, and policy makers are concerned about the impacts of recent changes in the structure of U. S. agriculture. Laboratory markets have been designed to

investigate the effects of changes in trading institutions and methods of delivery. The research contributes to understanding price discovery under alternative trading institutions and delivery methods.

Agriculture is important to the economy of the state and the welfare of our rural communities. Farms and ranches in Wyoming generated cash receipts of \$851.7 million in 1999. The 1996 FAIR act along with recent trade agreements such as NAFTA and GATT have created a market environment for agricultural producers that will be more volatile and risky in the future. The gradual loss of government program payments and reductions in trade barriers all means producers will have to improve their marketing and risk management skills to be successful in the future.

Forages are the most important resource in support of beef cattle production in Wyoming. Feed costs during the winter represent approximately 60% of total production costs of cow-calf operations. Costs can be significantly reduced if forages with adequate nutritive content can be used to extend the normal grazing season and if costs associated with harvesting, hauling, storing, and feeding hay can be reduced. The ultimate goal would be to graze year-round on forage that would meet 90% or more of animal needs without sacrificing production.

b. Impacts – Cooperative Extension efforts resulted in the following impacts:

- Seventeen individuals, participating in a two day Quicken workshop, adopted at least one technique presented during the class.
- Program evaluations from four state-wide Young Beef Female Workshops indicated participants' increased use of integrated production practices such as retained ownership of cows and calves, altering calving season, utilizing irrigated and improved pastures, and focusing on the young beef female from the time she is weaned until she is bred with her second calf.
- As a result of programs presented on alternative forages and their management practices, there was a 25 percent increase over any year in the past 17 years in the number of producers growing supplemental forages and a 10 percent increase in the number trying the concept of grazing windrows for the first time.
- Three hundred producers participated in the CES sponsored Agriculture Profitability Conference held in conjunction with Wyoming Stock Growers, Wool Growers, and Soil and Conservation Districts Mega-Conference. Evaluations indicated that participants increased their knowledge about the various subjects offered and over 40 percent indicated they planned to change management practices and incorporate the acquired knowledge into daily practices.
- Program evaluations indicated that participants increased their knowledge, learned how to maintain and how to keep their cost down, and learned new trends in agriculture and to evaluate their marketing alternatives and choices.
- Six operations completed the Beef Quality Assurance test and committed to implementing the procedures of this program to provide a more wholesome product for consumers.

- Fourteen counties held programs on forage production and analysis. Eighty-five percent of producers participating reported learning that without testing, perceptions through visual inspections only, were inaccurate and typically cost \$45 to \$105 per cow on winter feed costs calculated at today's hay prices.
- Producers participating in drought management workshops reported management practices they planned to change as a result of programs. A sample of the responses include: "Lower number of cows we are running", "Conduct a more critical evaluation of current herd quality and goals", "Long term management goals such as developing dependable fixed water supplies and improve available forage for grazing".
- 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. A multi-state project resulted in an award-winning handbook for producers and educators entitled "Managing for Today's Cattle Market and Beyond." This work was also the basis for two grants awarded to the University of Wyoming and Colorado State University for multi-state projects relating to risk management education for producers. Results of a Risk Management Education Needs Assessment Survey from a random sample of 800 producers (400 in Wyoming/400 in Colorado) conducted in March 1999, as a cooperative effort by UW Cooperative Extension and CSU State Cooperative Extension were summarized in a paper entitled "A Two-State Comparison of Farmers' and Ranchers' Risk Management Education Needs." That paper was chosen for publication in the Journal of the American Society of Farm Managers and Rural Appraisers.
- Before and after questions in Rancher's Marketing Workshop "Trends in the Beef Industry" and "Marketing Alternatives", indicated a 65% increase in ranchers' understanding of how industry trends affect them, 56% increase in desire among participants to develop a marketing plan that took into account changes in the beef industry and information they had learned regarding marketing alternatives, and 40% increase in understanding price risk management strategies they could use.
- To reduce feed costs, grazing trials on windrowed hay were conducted on meadows of several cooperating producers. On one ranch, cows grazing windrows and cows fed hay from the same meadow gained the same and, after three months, had the same body condition. Neither group of pregnant cows was fed supplements during the November to mid-February period. The cost of baling, transporting, storing, and feeding hay was avoided with the grazing group.
- On another ranch a budget was developed for windrowed hay grazing and for feeding stored hay. On the 600-cow herd, an estimated \$0.19/day was saved with winter grazing. Since hay quality was thought to be lower than that of stacked hay, the producers provided protein supplement to the windrow-grazed animals, amounting to \$0.21/day. Changes in forage quality were identified at the ranch as one of the biggest questions regarding hay left in the windrow. Subsequent sampling from the time of windrowing through the fall-winter grazing period (end of January) showed that quality of forage left in the windrows and that of stored hay was similar. Previous estimated savings for 620 cows at \$0.19/day over 60 days of the winter was \$7,068. Not feeding the protein supplement would result in a savings of \$14, 400 for winter grazing their 620 cows (\$24/cow/winter).

- c. Source of Funding – Hatch, Smith-Lever 3 b&c, State
- d. Scope of Impact – State Specific
Multi-state Integrated Research & Extension (W-177)
(AZ, CA, CO, IA, ID, KS, NE, NM, NV, OK, SD, TX, UT, VA, WA, WY)

Key Theme – Animal Health

- a. The Department of Veterinary Sciences researchers investigated a variety of animal health-related problems. For example, Bovine Viral Diarrhea Virus (BVDV) is the cause of large economic loss to the cattle industry exceeding 400 million dollars per year in the U.S. A diagnostic to help in identifying BVDV infected cows and a diagnostic designed to distinguish between persistently and acutely infected calves is needed in eradicating the disease. Chronic Wasting Disease affects deer and elk and raises questions about the impact of the disease on wildlife, susceptibility of domestic animals, and food safety. The identification of animals affected with CWD is a problem that concerns the public at large, regulatory entities such as USDA, FDA, EPA, hunters, and elk and deer ranchers. Ante mortem diagnostic can significantly impact the control of dissemination of CWD by allowing the identification of animals before they show clinical signs and without the need for killing complete herds demonstrated to be affected by the presence of individual infected animals. West Nile virus (WNV) was first detected in the United States in 1999, in New York City and surrounding areas. By the summer of 2002, WNV had spread as far west as the Rocky Mountains (New Mexico, Colorado, Wyoming, and Montana) and Pacific coast states (California and Washington). The rapid spread of WNV in 2002 took most experts by surprise, and this emerging disease poses an increased threat to the health of humans and animals in the United States.
- 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.”
- Bovine viral diarrhea virus (BVDV) is the most significant infectious cause of bovine reproductive failure. Detection and elimination of persistently infected (PI) calves is of paramount importance to producers, and at present there are several diagnostic tests used to detect these animals, The two most common ear notch tests currently used are immunohistochemistry and an antigen capture ELISA test – both detect the presence of viral antigen in the ear (skin) sample of infected calves, and both can be adapted for use with large sample sizes (hundreds of calves can be tested at a time). A comparison of the BVDV ear notch immunohistochemistry (IHC) test, the BVDV ear notch antigen capture ALISA test, and the gold standard test – virus isolation from blood – was made using a population of persistently infected calves from two beef cattle herds. Both the IHC test and the ELISA test performed well, with sensitivities of greater than 98% and specificities of 100%. Both tests proved to be easy to adapt to large sample sizes, and both tests are preferred to blood tests by producers. This research confirmed that ear notch (immunohistochemistry or antigen capture

ELISA) testing is an economical and sensitive method to screen calves for infection with BVDV. Unfortunately, both the IHC and ELISA tests appear to detect most or all acutely (i.e., not persistently) infected calves, thus confirmatory testing at a 30 day interval may be necessary to differentiate acutely infected calves from true persistently infected calves. Researchers continue their efforts in diagnosing BVDV positive cattle and distinguishing between persistently and acutely infected cattle to help control this disease.

- Drs. Elizabeth Williams, Thomas Hansen and Alberto van Olphen are conducting a collaborative study to develop a diagnostic test for CWD. Ante mortem pre-clinical diagnosis of CWD would help a) decrease the risk of horizontal transmission by allowing the identification of individual infected animals that could then be removed from the herd, b) prevent the massive slaughter of non-infected animals in affected herds, and c) help wildlife management agencies implement more effective plans of control and/or eradication. Currently, genes that are induced by CWD are unknown. The identification of genes induced by CWDP_rP infection might also contribute to better understand the pathogenesis of CWD and other TSEs, to design strategic measures of control and prevention, and to serve as the basis for the exploration and potential development of treatment.
- Surveillance for West Nile virus (WNV) in Wyoming was initiated in June of 2002, under a collaborative agreement between the University of Wyoming (Wyoming State Veterinary Laboratory) and the Wyoming Department of Health. The first case of WNV in Wyoming was diagnosed in August 2002, in a horse from Goshen County. The spread of the disease throughout 15 counties in the state was monitored. Human, avian, and mammalian cases were tracked and information about the spread of the disease was disseminated to the public via various media and information meetings. Guidance on ways to protect humans and animals from West Nile virus was presented to the public via print, radio, and television media, and via brochures produced by collaborating agencies. Research projects investigating the roles of various mosquito vectors, the roles of reservoir species including birds, and the impacts on domestic and wild animal populations are in review stages.

c. Source of Funding – Hatch, State

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

Key Theme – Animal Production Efficiency

- a. Research programs designed to improve animal production are being conducted by researchers in animal science. Areas of emphasis in ruminant nutrition include optimal use of dietary protein and lipids to improve performance and quality of cattle and sheep. Specifically, provision of supplemental lipids with unique fatty acids to lactating beef cattle may be used to differentially regulate production traits. Dietary supplementation with vegetable oils alters fatty acid composition of lipids absorbed in the small intestine of ruminants. Specific fatty acids available for metabolism may subsequently affect adipose and mammary tissue lipid metabolism, and depending on the fatty acid, increase or decrease fatty acid synthesis. Enhancing our 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. Effects of early

gestational nutrient restriction on offspring growth, development, and carcass characteristics of sheep and beef cattle is being studied by the Center for the Study of Fetal Programming. Good evidence exists that undernutrition during the first half of gestation is detrimental to fetal-placental growth and development in several mammalian species including sheep. In humans, and rodents, offspring from undernourished dams exhibits an increased incidence of obesity, diabetes, hypertension, and cardiovascular disease as adults. More importantly, no studies have been conducted in livestock species, directly linking early maternal undernutrition to the endocrine status, production efficiency, body composition, and carcass characteristics of their offspring. This is particularly important for sheep and beef cows in the High Plains and Intermountain West, which graze low-quality range forage during the first half of gestation, and thus may experience periods of undernutrition. Reproductive studies emphasize the identification and development of methods to regulate fertility in domestic animals, particularly cattle and sheep.

Educational efforts have been directed towards assisting a localized dairy industry in western Wyoming. Nutritional management is being used to help address issue such as air and water quality and waste management which further complicate economic sustainability. This effort is in cooperation with Utah State University.

- b. Impact – Research is being conducted to determine if type of lipid supplementation during early lactation will influence metabolic signals that mediate production responses of beef cows. Experiments are underway to evaluate nutrient partitioning and lipid metabolism in thin and well-conditioned beef cows fed high-oleate or high-linoleate lipid supplements for the first 60 days of lactation. Determinations will also be made on the suckling calf's plasma and adipose tissue for fatty acid composition when the calf's dam consumes supplemental lipids with high-oleate or high-linoleate content. Results of the project will help beef cattle managers identify lipid supplements that are suitable for thin and well-conditioned beef cows. Implementation of the proposed nutritional strategies may result in partitioning of nutrients to support economically important beef cattle production traits. As stated earlier, no research in any livestock species has been conducted to evaluate the impacts of maternal nutrient deprivation during gestation on the subsequent growth and performance of their progeny. There is a real potential for range sheep and beef cows in the High Plains and Intermountain West to experience prolonged periods of undernutrition during the first half of gestation. Because early gestation is a crucial period for placental and fetal growth and differentiation, maternal nutrient deprivation during this critical period has a real potential to inhibit subsequent growth rate and carcass composition of their lambs and calves. The successful completion of the proposed project will allow the development of new approaches to optimize fetal development and subsequent productivity and marketability of sheep and beef cattle. Researchers have identified a uterine protein called ISG17 that is expressed in uterine cross-sections from pregnant cows. This protein is hypothesized to function in preparing the uterine wall for adhesion and implantation of the embryo. It is anticipated that the study of uterine proteins that are induced by early pregnancy will lead to biotechnologies that will reduce the incidence of early embryo mortality in cows and humans.
- c. Source of Funding – Hatch, Smith-Lever, State, County Private

d. Scope of Impact – State Specific

Multi-state Research (W-112)-(AZ, CA, CO, HI, ID, KS, MI, MO, MT, NM, NV, OH, OR, TX, WA, WY)
Integrated Research and Extension
Multi-state Extension (UT)

Key Theme – Biotechnology

- a. In the Department of Molecular Biology, projects are underway that are 1) investigating the genetic engineering of alfalfa to express spider silk as a strategy to add value to Wyoming's alfalfa crop, 2) characterizing novel protease enzymes from spiders that could lead to new biotechnological and biomedical application and 3) studying new systems for recombinant glycoprotein production.
- b. Impact – To date, sequence and detailed characterization of a spider silk-degrading protease had not been reported. To address this gap in knowledge of fiber-degrading enzymes, a new research project was initiated to identify enzymes that degrade protease-resistant solid silk. These studies will provide the first detailed biochemical and genetic information on peptidases involved in silk degradation. Characterization of a silkase with novel enzymatic features will advance our understanding of enzymes that degrade protease-resistant solid fibers assembled from silk proteins, extracellular matrix proteins, or aggregated beta-sheet proteins, such as fibril-forming beta-amyloid proteins associated with certain neurodegenerative disorders. Furthermore, because of the predicted enzymatic capabilities of these spider metallopeptidases, the results from this research could lead to new biotechnological or biomedical applications. Researchers are conducting studies to determine if plants can be used as biofactories for silk production. The synthetic gene for *Nephila clavipes* dragline silk fibroin has been inserted into alfalfa by *Agrobacterium*-mediated transformation. Following regeneration of shoots and roots, positive transformants were selected. Plants will be vegetatively propagated from these initial seedlings to obtain material for analysis of gene insertion and expression. In the future this transgenic alfalfa could be harvested multiple times per growing season, processed to hay bales or cubes as per normal farming operations, and transported to a central processing facility. Although the ultimate demand for spider silk for commercial application cannot, at this time, be accurately estimated, it is anticipated that plant expressed silk could generate up to \$200 million/year. For example, biomedical uses include sutures, artificial ligaments and tendons, and industrial uses include protective clothing, composite materials for building, and aerospace applications. Researchers have created novel transgenic insect cell lines that encode and express genes encoding various enzymes involved in mammalian glycoprotein biosyntheses. These cell lines are able to support production of “humanized” recombinant glycoproteins upon baculovirus infection. A novel baculovirus vector has also been created that can induce expression of mammalian functions necessary for humanized glycoprotein production in established insect cell lines. These new tools are the basis of a new U.S. Patent, which was issued 10/8/02. These tools support the production of more authentic recombinant glycoproteins that can be used to improve human and animal health through applications as vaccines, diagnostic reagents, and therapeutic agents.

- c. Source of Funding – Hatch, State
- d. Scope of Impact – State Specific, but has far reaching impacts

Key Theme – Plant Germplasm

- a. Brown Root Rot (BRR) of alfalfa, caused by the soil-borne fungus (*Phoma sclerotoides*), causes a rot of the taproot of alfalfa resulting in winterkill and loss of plant stands. Severe stand loss in established alfalfa stands in several alfalfa growing areas of Wyoming have now been attributed to this disease. Similar unexplained losses in other Rocky Mountain States may also be due to BRR. Although the Canadian variety Peace has reported field resistance to BRR, it is susceptible to other diseases present in the U.S. Also, since U.S. alfalfa varieties have not been selected for resistance to BRR they cannot be recommended for BRR control. Field surveys in Wyoming have shown that this disease is wide spread throughout the state. However, its distribution in other Rocky Mountain States is unknown. Researchers are developing a screening technique for selecting and evaluating for BRR resistance. Using this screening method, breeding lines are being developed and evaluated for an eventual BRR resistant variety.
- b. Impact – In Wyoming, 54.6 percent of the alfalfa acreage surveyed is infected with BRR. It is estimated that 338,500 acres may be infested in Wyoming alone. Alfalfa yield losses in a BRR infested field, where no other diseases were found, was .5 tons/acre. Using a price of \$70/ton and the estimated acres infested with BRR in Wyoming results in an annual loss of over \$11 million. Having a BRR resistant variety bred for the U. S. has large potential benefits for alfalfa growers.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – State Specific
Multi-state (W-006) (AK, AS, AZ, CA, CO, GU, HI, ID, Micronesia, MT, NM, NV, Northern Marianas Islands, OR, UT, WA, WY)
Integrated Research and Extension

Key Theme – Plant Production Efficiency

- a. Researchers at UW Agricultural Experiment Stations 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 recognitions and control, 3) crop production practices, and 4) crop/legume production systems. Specific projects range from basic research to elucidate mechanisms of plants 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. A project was initiated in the spring of 1998 to address high and low rate continuous glyphosate use in a continuous corn or a sugar beet, corn, wheat rotation. Diseases cause millions of dollars in losses to U.S. sugar beet growers. One disease particularly damaging in the Western U.S. is Fusarium Yellows. This fungus not only attacks

the adult plant, causing a disease of the water-conducting vascular tissue, but also attacks and kills seedlings and young plants. Chemical seed treatments and soil fumigation have been the traditional means of attempting to control this disease. Recently, several varieties with resistance to Fusarium Yellowing have been developed. Both are currently grown on a limited basis in Wyoming. Also, several bacterial and fungal organisms have been registered for application on seed for biological control of several soil-borne diseases including Fusarium spp.

- b. Impact – Initial results from the project initiated in the spring of 1998 to address high and low rate continuous glyphosate use in a continuous corn or a sugar beet, corn, wheat rotation indicate that repeated use of Roundup Ready technology involves shifts in weed species to those that have sufficient tolerance to occasionally survive treatment, i.e. common lambsquarters, wild buckwheat and Russian thistle. In addition these shifts have occurred much more rapidly at the pint compared to the quart rate of glyphosate. This data further indicates that development of a resistant weed population to this technology will take much longer than five years to develop. On-farm research conducted in Wyoming has shown an increase in sugar beet yield can be realized with the combination of biological seed treatment and Fusarium Yellowing-resistant sugar beet varieties. Sugar beet yields were increased from 13.6 T/A up to 22.4 T/A with the Fusarium Yellowing-resistant variety WS91 plus biological seed treatment. With an estimated 1,700 acres infested with this disease, a potential savings of over one million dollars annually could be realized from these new control practices for this one disease in one sugar beet growing area of Wyoming. Current research is addressing the evaluation of other sugar beet varieties and breeding lines for reaction to Fusarium Yellowing in the Big Horn Basin.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – State Specific
Integrated Research and Extension
Multi-state Integrated Research and Extension (NC-226)
(IL, IN, KY, MD, MI, MO, NE, NY, OH, OK, PA, SD, VA, WI, WY)

Key Theme – Invasive Species

- a. Western rangeland managers have difficulty monitoring expansive and inaccessible areas for weed invasions. Tools to enhance identification of problematic weed invasions and to monitor their spread are critical to public land management in the west. In Wyoming and the arid west, revegetation with perennial grasses following control of perennial weeds can be difficult. Revegetation can be particularly difficult where native species are desired but often not available. Using weedy invasions may provide a new approach to selecting native plant stock that is competitive with weeds to improve revegetation efforts.
- b. Impact – Researcher have developed a Weed Invasion Susceptibility Prediction (WISP) model. Working with BLM during 2001, five weedy invaders in the Jack Morrow Hills area were mapped and incorporated into GIS with other data to develop WISP. The WISP model is currently being used by BLM and other weed managers in Wyoming. The ability to predict

the susceptibility of rangeland to potential weed invasion and their spread has allowed managers to target weed control efforts. Research has been initiated using weedy invasions to select for competitive ability in native plant species. Remnant native plant individuals have been found in long-term weed infestations in Wyoming and Idaho. Native species were documented and seeds collected for studies to assess the competitive ability of these native plants. Seed propagules were grown in competitive greenhouse studies. Results have been reported to the international meeting of the European Science Foundation in Halle, Germany, in fall 2002. The project is critical to managers and revegetation work to control invasive exotics. The ability to revegetate invaded lands using native species selected for competition with weeds would greatly enhance weed control efforts.

- c. Source of Funding - State
- d. Scope of Impact – State Specific

Key Theme – Plant Health

- a. The Extension Plant Pathology Lab (EPPL) is the University of Wyoming’s source of plant pathology information. The EPPL provides information to Wyoming and regional producers on crop production and disease management. It also provides information to homeowners and deals with all plant species. The EPPL also provides a facility for submitting samples for disease diagnosis and receiving disease management recommendations. Educational programs include extension presentations, applied research, and demonstration plots. Economic loss attributed to plant diseases is significantly reduced by prevention, early detection, and initiation of appropriate management practices.
- b. Impact – Outside funding generated for regional plant disease research and plant pathology extension effort was \$73,500. The Extension Plant Pathology Lab processed 271 plant disease samples during 2001. Responses included guidelines on management of the specific disease identified for that particular plant sample. Educational programs were delivered throughout the state, region, and U.S. These included training for the pesticide applicator program plus local, regional, and national workshops to develop and report improved practices for disease management.

Annual losses attributed to *Rhizoctonia* root and crown rot (RRCR) are estimated at two-three percent total sugar loss for 185,000 acres of sugar beet grown in the irrigated High Plains region (CO, MT, NE, WY). This disease is reported to affect approximately 30 to 50 percent of Wyoming’s acreage, depending on district. A one percent decrease in sugar content is lost revenue of approximately \$78 per acre (1999 values). Field trials at Torrington during 2002 demonstrated that properly timed applications of “environmentally safe” strobilurin chemistry reduced *Rhizoctonia* disease loss by at least 80 percent under moderate to severe disease situations. A less expensive option, Topsin also was tested and was found to be approximately 50 percent effective as more expensive strobilurin chemistries. Growers now have several chemistries from which to choose. Results from timing and rate studies are being utilized by the EPA to develop labels for this new fungicide chemistry class.

- c. Source of Funding – Smith-Lever, Hatch, State
- d. Scope of Impact – State Specific
 - Integrated Research and Extension
 - Multi-state Integrated Research and Extension (W-186)
 - (AR, CA, HI, ID, MI, NC, NE, NM, OR, WA, WY)

Key Theme – Home Lawn and Gardening – General Horticulture

- a. Wyoming has only five counties with year round horticulturist on staff. Other offices utilize part-time summer help and volunteer Master Gardeners who work with agricultural educators to meet clientele needs in horticulture. In a recent study of the types of information Wyoming residents have used from extension, over half (53 percent) of respondents have requested information on home gardening and lawn care. It is estimated the average household in Wyoming spends \$800 per year on landscaping and gardening. Water conservation, community beautification, yard waste, and pesticide reduction are all issues affecting Wyoming residents in their horticultural efforts.
- b. Impact – During FY 2002, over 22,686 contacts were made regarding horticulture. Twenty-four educational programs were presented and community gardens were started through Cooperative Extension Service (CES) efforts in five counties to demonstrate what will grow in Wyoming’s climate and altitude. Clients reported increased awareness and knowledge of horticultural skills as a result of educational efforts. Additionally, homeowners demonstrated better management of their properties.

Ten counties conducted Master Gardener training consisting of eight-ten sessions graduating 118 new Master Gardeners. At a minimum, new Master Gardener graduates contribute 30 hours of volunteer time. New Master Gardener contributions in addition to experienced Master Gardeners volunteer time adds over \$63,500 to Extension efforts. 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.

Four demonstration areas were planted with 26,000 plants. Four hundred individuals participated in seven XeroScape classes. Evaluations reported 98 percent of respondents adapting XeroScape practices in their landscapes.

Two CES horticulture fact sheets were revised and rewritten: *Gardening: Vegetable in Wyoming and Landscaping: Turf in Wyoming.*

- 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 areas are:

- Economics of farm/ranch systems with respect to profitability and risk
- Nutrition and reproductive performance in domestic ruminants
- Brown Root Rot resistant alfalfa cultivars
- New and emerging animal diseases
- Extended cropping systems with emphasis on incorporating forages

In this program area, researchers have been active in 15 ongoing Hatch projects, and five out of the 15 are multi-state projects. Well over 50 percent of the projects are integrated research and extension efforts. The approximate effort related to this program for the AES is 16.3 FTEs with expenditures of \$.84 million Hatch and \$2.25 million State.

Cooperative Extension Service FTEs	20.94
Goal 1 Allocated Funds	\$1,473,350.00

Goal 1: IMPACTS

ISSUE – UW CES provides management assistance for drought-stricken livestock producers

During the 2002 growing season, southeast Wyoming experienced one of the most severe droughts in history. The Wheatland Irrigation District was only able to supply less than 10 percent of the normal irrigation water it usually gives to the farmers and ranchers who depend upon this water for their livelihood. Stockwater often ran dry, little hay was produced, and rangeland that is normally grazed spring to fall saw little if any productivity during this year of drought.

What has been done

The local University of Wyoming Cooperative Extension Service (UW CES) provided much-needed management assistance and technical expertise to drought-stricken producers in southeast Wyoming. Many producers contacted the extension office seeking assistance in formulating cattle feed rations using alternative feeds or in deciding which crops to plant for an emergency forage source. Working both in the office and at producers’ kitchen tables, UW CES provided the assistance needed to help make the tough management decisions that come with a drought.

Two meetings were conducted to present information to producers on management during a drought. A four-hour “Drought Management Strategies” workshop hosted by CES included four presentations covering a variety of applicable topics ranging from monitoring runoff conditions and precipitation to Farm Service Agency assistance programs. A range field day was provided at Thunderhead Ranches in eastern Albany County. The day-long event included three presentations by CES staff members and an afternoon session on range plant identification.

The information offered in these workshops was summarized in the press release, “Planning for a Winter Feed Shortage”, prepared by the local educator. This information appeared in statewide newspapers and was also discussed during several radio interviews with statewide coverage. This publicity resulted in several agriculture producers from across the state contacting the office in Platte County to gain assistance in drought-management decisions.

Impacts Achieved

Individual consultation with producers is often the most valuable and effective method of providing technical assistance to try to achieve a positive impact. The most common request of producers was for assistance in formulating beef cattle feed rations using alternative feeds. Educators in Platte County were able to save many producers thousands of dollars by encouraging the use of less expensive feeds and more efficient use of feeds already on hand.

Both the “Drought Management Strategies” workshop and the Range Field Day showed successful results. A total of 47 producers registered for the workshop and 36 attendees completed evaluations ranking it overall as a 2.4 (with 1 meaning very helpful). Of those who completed the evaluation, 15 listed operational changes that they planned to make as a result of the meeting. Producers wrote:

- “I will monitor conditions in late winter and early spring to make decisions in a timely manner”.
- “lower number of cows we are running”
- “long-term management goals such as developing dependable, fixed water supply and improving available forage for grazing”
- “look at changing to a cow-calf-yearling operation”
- “conduct a more critical evaluation of current herd quality and goals”

Thirty-five producers attended the Range Field Day and indicated that the material presented would be useful in the management decisions.

To cattle producers, drought is among the worst possible natural disasters that can occur. This year’s drought forced liquidation of the cattle herds of several area ranches. UW CES played a valuable role in assisting producers to evaluate options to manage despite the drought.

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ISSUE - Utilizing management-intensive grazing systems to increase productivity of irrigated pastures

Providing feed through harvested forages accounts for the majority of the expense of a livestock operation. The expense increases during times of the kind of severe drought Wyoming has been

experiencing for three growing seasons. If not properly cared for, the overall health and vigor of irrigated and non-irrigated pastures can be adversely affected for several years even if the drought ends.

Livestock producers in the West are generally able to utilize public rangelands for grazing during the growing season. These lands are controlled by the Bureau of Land Management (BLM) and must adhere to their guidelines in order to sustain grazing rights. One of the issues often debated between the BLM and producers is the optimum timing for grazing rangeland forages. Most range conservationists would ideally like to avoid grazing during the approximately 45-day growing season.

What has been done

In 2001, the University of Wyoming Cooperative Extension Service (UW CES) in Big Horn County initiated a program that attempted to meet these predicaments. The program focused mainly on the proper care and management of irrigated pastures.

Impact

A group of 26 participants learned the skills of:

- understanding plant growth and physiology to determine optimum harvest times
- using soil samples to determine the current health status of pastures and to make educated plans to sustain high levels of production
- selecting forage varieties that are adapted to Wyoming
- adopting methods for extending the grazing season
- stocking rates of pastures
- conducting paddock rotation

Several producers investigated the option of grazing crop aftermaths such as corn stubble and sugar beet tops. Producers who had one of these sources available could delay feeding hay for as long as eight weeks. Another option was to plant a fall crop such as turnips into a barley stubble field in August. During a good year, a crop such as turnips can produce as much as five tons of dry matter per acre.

Another method for reducing costs and extending the grazing season was to harvest one cutting of hay and then either leave it and let animals harvest it or cut it, leave it in windrow, and turn animals onto it a section at a time.

Some of the producers began utilizing cheaper, more flexible fencing materials to control the grazing pattern of their livestock. Quickly harvesting forages and then rotating animals off to allow for an adequate rest period increases the vigor of a grass sward and the amount of dry matter produced per acre.

When properly managed, irrigated pastures can be utilized for a longer period of time in the spring, and producers can delay turnout onto public grounds during the critical 45-day growing period without losing production.

One participant in the program opened dialogue with a BLM office regarding increasing range stocking rates if he is able to delay turnout during the critical period.

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ISSUE: Campbell County producers get immediate results

Three years of drought have greatly affected forage quality and availability in Campbell County. Producers have struggled to put together an adequate forage supply for their livestock. An increasing number of acres of cereal grains are being harvested for hay or grazing forage. Since many of the cereal grains grown across the county are not tall enough to make hay, they are being considered by many producers as a source of feed for livestock to graze. First, producers have to make sure the grains are safe.

Nitrate poisoning is a common problem in livestock that has been documented for many years. Nitrate is a normal plant nutrient that is generally converted to plant protein. While nitrate content of forages is generally safe, stress conditions, including drought, can cause an increase in the nitrate level accumulated in forage. Though many livestock producers are desperate for a source of feed for their cattle or sheep, they cannot afford the losses associated with feeding toxic forage.

What has been done

To help producers, the Campbell County Cooperative Extension Service (CES) conducts nitrate checks on field forages using Montana State University's Nitrate QuikTest. While the test does not give a quantitative result for nitrate content, it can still be used as a guideline for determining the safety of grazing or harvesting forages. CES validated the Nitrate QuikTest by using it in the field, sending a sample of the same forage to a commercial feed testing lab, and then comparing the results of the two tests.

Impact

The total acreage of cereal grains tested in Campbell County included 476 acres of wheat, 455 acres of barley, 1,246 acres of oats, 235 acres of triticale, and 175 acres of millet. A total of 300 tons of purchased wheat hay was also tested. The acres were on 17 ranches and farms across Campbell County. Some of the fields were tested more than once to determine if nitrate content went down with maturity. Oats and barley proved to be the most susceptible to high nitrate levels, while wheat and triticale were the least susceptible. Results from the Nitrite QuikTest and commercial feeding test lab showed high levels of nitrate in all samples.

Ten of 15 surveys mailed to those who used the service were returned. One hundred percent of those responding said they would use the service again. All respondents said they used the results of the test to make farm and ranch management decisions. These management decisions affected

an estimated 4,000 head of cattle and 500 head of sheep on more than 2,500 acres in Campbell County. Comments included:

- “It is nice to see our extension office grow with the needs and times for the future of all in agriculture”.
- “The safety of our livestock depends on identifying problems before they arise”.
- “This test was very important to me since regular lab tests take 10-14 days plus a 160-mile drive, and I need to know sooner than that”.
- “I have already sent in a sample (to a lab), and the results came back and confirmed the finding of the field results”.
- “If we had not had this test available, we would surely have lost cows here”.
- “This test helped put my mind at rest knowing what, when, where, and how I would utilize my fields”.
- “This testing service is of great benefit to ag producers”.

To combat nitrate poisoning, producers plowed up their fields rather than using their crops for feed, combined forage registering levels with low-nitrate forage to dilute the level of nitrate, and combined and harvested grain rather than using it for feed. These management decisions saved Campbell County ranchers an estimated \$35,000 by preventing the potential loss of livestock to nitrate poisoning.

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ISSUE: New sheep disease threatens industry

Sheep industry and veterinary professionals in Wyoming are extremely concerned that some sheep in the state could possibly be carriers of deadly scrapie, a disease in sheep similar to mad cow disease in cattle.

Until recently there was no practical way to identify sheep that were infected and those that might be carriers. However, newly developed clinical testing methods have helped the industry identify and isolate animals that tested positive in what is called the third eyelid test, developed at Washington State University and U. S. Department of Agriculture (USDA) labs. Prior to this newly developed test, the only one available was a lab test of the brain tissue of dead animals.

Lack of herd-identification tracking systems also created serious problems for federal animal and health inspectors even if they found scrapie in brain tissues since they could not go back and test animals in a flock in which diseased animals were found.

What has been done

To combat this situation, veterinarians at the federal Animal-Plant Health and Inspection Service (APHIS) worked with the Wyoming State Veterinary Lab to develop a Wyoming scrapie program.

The University of Wyoming Cooperative Extension Service (UW CES) was asked to help implement the new program by educating producers about the disease and by advising youths taking sheep to county fairs.

During the past year, six workshops were set up to train CES educators, 4-H program associates, and local producers. CES was also asked to help in identifying producer and youth flocks so that the veterinarians could more easily pinpoint infected herds.

Impact

Using the third eyelid test on Wyoming sheep, eight flocks were identified as having sheep that were particularly susceptible to scrapie. Producers of these flocks had sheep that might be carriers of scrapie removed for further testing. Sheep with scrapie have to be destroyed to prevent the spread of the disease.

In addition, a large number of flocks in Wyoming are now tagged, identifying each sheep and the flock it came from. Sheep shown at county fairs are similarly tagged. This tagging will allow for the tracking of future generations of sheep that may be carriers of the disease.

Veterinarian John Duncan of APHIS wrote in a memo that CES helped take a giant step forward in identifying and removing diseased sheep from the Wyoming sheep industry and in implementing the proper tagging of sheep shown by youth at county and state fairs.

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ISSUE: Genetic engineering of alfalfa to express spider silk: a strategy to add value to Wyoming's alfalfa

The major goal of this project is to genetically engineer alfalfa (*Medicago sativa* L.) to express spider silk.

What has been done

The synthetic gene for *Nephila clavipes* dragline silk fibroin has been inserted into alfalfa by Agrobacterium-mediated transformation. Following regeneration of shoots and roots, positive transformants were selected. Plants will be vegetatively propagated from these initial seedlings to obtain material for analysis of gene insertion and expression. Various procedures will be investigated to optimize purification protocols for extraction of silk protein from transgenic

alfalfa. Expression of spider silk will be quantitated from dry and fresh tissues. The relative feed value of the bulk material before and after silk isolation will be determined. Select transgenic plants will then be backcrossed to Wyoming-adapted cultivars.

Impact

We envision that transgenic alfalfa could be harvested multiple times per growing season, processed to hay bales or cubes as per normal farming operations and transported to a central processing facility. Following processing the remaining material could be utilized as animal feed. Beyond the revenue generated by silk production, economic development also would be fostered by establishing the processing facility. Although the ultimate demand for spider silk for commercial applications, cannot at this time, be accurately estimated, it is anticipated that plant expressed silk could generate up to \$200 million/year.

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ISSUE: Reducing over-wintering costs of Wyoming's cow herd

Winter feed costs represent, on average, 60 percent of total production cost of cow-calf operations. Irrigated meadows are typically harvested and stored as hay for winter feeding. The feeding period for some locations in Wyoming can be as long as seven months. Costs can be significantly reduced if forages with adequate nutritive content can be used to extend the normal grazing season and if costs associated with harvesting, hauling, storing, and feeding hay can be reduced.

What has been done

Trials were conducted on meadows of several cooperating producers. On one ranch, cows grazing windrows and cows fed hay from the same meadow gained the same and, after three months, had the same body condition. Neither group of pregnant cows were fed supplement during the November to mid-February period. The cost of baling, transporting, storing, and feeding hay was avoided with the grazing group. On another ranch, where a larger group of cows were grazed (>600) a budget was developed for windrowed hay grazing and for feeding stored hay.

Impact

On the 600-cow herd, an estimated \$0.19/day was saved with winter grazing. Since hay quality was thought to be lower than that of stacked hay, the producers provided protein supplement to the windrow-grazed animals, amounting to \$0.21/day, however subsequent sampling through the fall-winter grazing period (ending of January) showed that quality of forage left in the windrows and that of stored hay was similar.

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ISSUE: Effects of early gestational nutrient restriction on offspring growth, development, and carcass characteristics of sheep and beef cattle

At present, little is known about the underlying mechanisms whereby alteration in conceptus nutrient deprivation result in permanent changes in structure, physiology, and metabolism of the neonate, a condition referred to as “fetal programming.” In humans and rodents, offspring from undernourished dams exhibit an increased incidence of obesity, diabetes, hypertension, and cardiovascular disease as adults. Epidemiologically, low weight or thinness at birth is associated with increased risk of cardiovascular and metabolic disorders in later life. Detailed studies are needed to elucidate specific alterations in the developmental process, as well as follow these neonates into adulthood. In particular, there is a need to understand the specific changes in organ and tissue structure and function that are induced by inadequate prenatal nutrition. More importantly, no studies have been conducted in livestock species, directly linking early maternal undernutrition to the endocrine status, production efficiency, body composition, and carcass characteristics of their offspring. This is particularly important for sheep and beef cows in the High Plains and Intermountain West, which graze low-quality range forage during the first half of gestation, and thus may experience periods of undernutrition.

What has been done

To establish the feasibility of depriving cows of ~50 percent NRC requirement from day 30 to day 120 of gestation (~1/3 of gestation), we conducted pilot study in the pregnant ewe from day 28 to day 80 (~1/3 gestation). This interval of early gestation in the ewe is roughly equivalent to the time line of conceptus (placental and fetal) growth and development, which occurs from day 30 to day 120 gestation in the cow. Briefly, mature multiparous Rambouillet cross ewes were bred, and on day 20 of gestation, weights were obtained so that individual diets could be based on metabolic weight. The diet consisted of a pelleted beet pulp (79.68 percent total digestible nutrients [TDN], 93.48 percent dry matter [DM], and 9.99 percent crude protein). Final diet amounts were calculated on a dry matter basis for the total TDN needed to meet the energy requirements of a non-lactating ewe during the first 15 weeks of gestation (TDN =3.07 percent of metabolic bodyweight; 84). On day 21 gestation, ewes were placed in individual pens and fed these maintenance diets until day 28 when ewes were again weighed. Ewes were then divided evenly into a control (fed to 100 percent TDN, NRC requirements) and restricted (50 percent TDN) group. Each week thereafter, ewes were bled via jugular venipuncture and reweighed so that individual diets could be readjusted for weight loss or gain. On day 80 of gestation, ewes were sacrificed and the gravid uterus recovered. By day 80 of gestation, ewes in the restricted group had 7.4 percent reduction in body weight and ewes in the control group had a 7.5 percent increase in body weight. All conceptuses were viable, and the weight of fetuses in the restricted group was 32 percent less than in the control group (221 vs 326g; P<0.01). While the number of placentomes, total cotyledonary and caruncular weights, and total placentome area (cm²) were

numerically reduced in the restricted group compared to the control group, there was no statistical difference between the two groups. Further, fetuses in the restricted group exhibited cardiac hypertrophy, with increases ($P < 0.05$) in both right and left ventricular weights per unit fetal body weight when compared to fetuses from the control-fed group, highly suggestive of fetal hypertension. This hypothesized increase in fetal blood pressure may have resulted from an increased cotyledonary vascular resistance, as a reduced umbilical blood flow and increased umbilical artery pulsatility index have been consistently reported for sheep pregnancies with IUGR fetuses, and provide evidence of a true functional placental insufficiency in this model. Further, a reduction in glucose transport from mother to fetus is suggested by the reduced ($P < 0.05$) glucose concentrations in fetal blood in that group (13.35 ± 0.61 mg/dl vs 16.93 ± 0.91 mg/dl, respectively).

Impact

There is a real potential for range sheep and beef cows in the High Plains and Intermountain West to experience prolonged period of undernutrition during the first half of gestation. Because early gestation is a crucial period for placental and fetal growth and differentiation, maternal nutrient deprivation during this critical period has a real potential to inhibit subsequent growth rate and carcass composition of their lambs and calves. To date, no research in any livestock species has been conducted to evaluate the impact of maternal nutrient deprivation during gestation on the subsequent growth and performance of their progeny. Undernutrition during early gestation in the sheep and cow may affect growth rate and carcass quality of their offspring, which will have direct relevance to the Western U.S. sheep and beef industry. Decreased growth rate and sub-optimal carcasses cost feedlot producers millions of dollars annually. While the concept of “fetal programming” is widely considered by the medical community to have a major impact on the health and longevity in the human population, no research has been conducted into its impact on the health, productivity, and longevity of livestock species. Future technologies and approaches based on basic information provided from the proposed research will be developed to optimize fetal development and subsequent longevity, productivity, and marketability of beef cattle. Further, we will obtain specific information linking maternal undernutrition to specific differences in gene transcription and translation at the cotyledonary-caruncular interface, the lung, and in cardiac muscle, which will lead to a better understanding of alterations in maternal-fetal nutrient flux and cardiovascular function respectively. The successful completion of the proposed project will allow the development of new approaches to optimize fetal development and subsequent productivity and marketability of sheep and beef cattle.

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

Overview:

Researchers 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. Agricultural producers, food processors, food-service personnel, and home food preparers are critical points of control for food-borne illness. Research addressing food quality and safety issues directed at these processing, handling and preparation sites is key to enhancing the food supply. Research supported educational programs that expose the expanding base of food-safety knowledge and emergence of new pathogens and more virulent strains of existing ones is necessary at all levels to reduce food-borne illness and increase food quality. Research and extension professional are involved in projects focusing on issues of safe and secure food systems.

Key Theme – Food Resource Management

- a. In 2002, *Cent\$ible Nutrition Program* [CNP] educators in all 23 counties and one reservation office, worked with 1,655 households enrolled in a lesson series, and 17,275 persons participated in one-time lessons. Educators helped clients learn to plan meals, compare prices, use grocery lists, and provide food for the entire month. CNP is CES's food and nutrition program for limited resource audiences that combines EFNEP and the Food Stamp Nutrition Education Program [FSNEP].
- b. Impact – Households averaged a savings of \$38.07 per month on groceries, which over a one year period of time equals \$75,607 savings for enrolled families. Fifty-one percent of graduates of the program improved on planning meals. Forty-five percent increased use of a grocery list; 47 percent now compare prices; and 45 percent provide food for a month, stretching resources to purchase food. A Big Horn County participant reported how the program had helped "I have learned how to make a menu and cut down portions. This has allowed us to not have too many leftovers, therefore less waste, and saves money on our grocery bill by \$100 each month".
- 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 Quality

- a. The American public has become increasingly concerned with food quality. Consumers demand food that is readily available, affordable, and wholesome. By implementing future nutritional inputs into beef cattle production, both the consumer and the livestock producer should benefit from selective fatty acid supplementation. Selective fatty acid supplementation has been initiated by feeding sheep and cattle diets in which supplements containing either high oleic acid or high linoleic acid safflower oils were provided to the animals. In sheep, muscle lipids contained fatty acids that reflected the diet, as well as those fatty acids produced within the rumen by the microbes that inhabit this part of the gastrointestinal tract of sheep and cattle. In beef cows, selective lipid supplementation has shown promise in enhancing reproductive efficiency of cows, and may result in milk fatty acids that could have positive benefits to the calf.
- b. Impact – The potential impact of these specialized fatty acids in the health of human consumers is not certain, and the impact of these fatty acids on growth and immune function of growing beef calves has not been investigated. The goal of this research endeavor is to reveal the potential that lipid supplementation may have for both the cow and the meat-producing offspring of the cow. Meat containing higher proportions of polyunsaturated fatty acids would be in line with current biomedical recommendations for a healthy lipid containing diet for consumers. Also, certain fatty acid produced as intermediates of digestion in the gastrointestinal tract of ruminants have shown remarkable health benefits in rodent models for the study of cancer, immunology, atherosclerosis, and more.
- c. Source of Funding – State
- d. Scope of Impact – State Specific, but results would have broad implications.

Key Theme – Food Safety

- a. Microbial contamination of food is a serious health problem. 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 food borne illness. Given that roughly one-third of food-borne illness outbreaks can be traced to home settings, the general public also plays a critical role in reducing the risk of food-borne illness. Extension Educators, as part of the Wyoming Food Safety Coalition, trained 1,064 food handlers through food safety workshops. In-house training in food service businesses reached 889 individuals. Consumer programs reached 394 people and food safety displays were viewed by 600 individuals. The *Cent\$ible Nutrition Program* (CNP) had 1,655 families enrolled in the program and presented 960 one-time presentations to over 14,817 clients. CNP educators helped clients learn how to thaw and store foods properly and to wash hands frequently and thoroughly.
- b. Impact – Results from a state-wide survey conducted by UW CES for the Wyoming Food Safety Coalition indicate that of the 1,064 participants in *ServSafe*®, Basic, Intermediate and Advanced *Going for the Gold* workshops, an estimated:

- 919 (97 percent) made at least one change related to cleanliness, for example, 625 (66 percent) wash their hands more thoroughly.
- 739 (78 percent) made at least one change related to food preparation, for example, 502 (53 percent) keep raw meats, cooked foods, and fresh produce separated.
- 663 (70 percent) made at least one change related to cooking food, for example, 417 (44 percent) use a stove or microwave – not a steam table – to reheat food.
- 758 (80 percent) made at least one change related to cooling food, for example, 511 (54 percent) put food into shallow containers or cutting meat into smaller pieces before putting it in the refrigerator.
- 710 (75 percent) made at least one change related to other miscellaneous areas, for example, 313 (33 percent) monitor critical control points more closely.

Cent\$ible Nutrition Program

- 61 percent of homemakers showed improvement in one or more of the food safety practices including thawing foods properly and storing foods properly.
- 19 percent of homemakers showed improvement in both of the food safety practices.
- On entry surveys, 56 percent of participants demonstrated acceptable food safety practices in contrast to 82 percent on exit surveys.

c. Source of Funding – 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. The research effort in this area involves approximately .5FTEs with an expenditure of \$.09 million Hatch and \$.17million State.

Cooperative Extension FTEs	4.95
Goal 2 Allocated Funds	\$384,730.00

Goal 2: IMPACTS

ISSUE – Food safety makes a difference

People often do not think about food safety until a food-related illness affects them or a family member. Almost everyone has probably experienced a food-borne illness at some time. Restaurant food could be the cause, but actually many cases of food-borne illnesses occur when food is prepared at home. If food is handled and prepared safely, most problems can be avoided. All food may contain some natural bacteria, and improper handling can give the bacteria a

chance to grow. Also, food can be contaminated with bacteria from other sources that can make people ill. Contaminated or unclean food can be very dangerous, especially to children and the elderly. The fact that an estimated one out of three people do not wash their hands after using the restroom adds to the danger. While the food supply in the United States is one of the safest in the world, the Centers for Disease Control estimate that 76 million people get sick, more than 300,000 are hospitalized, and 5,000 Americans die each year from food-borne illnesses. Preventing food-borne illnesses and deaths remains a major public health challenge.

What has been done

The goals of food safety education offered by the University of Wyoming Cooperative Extension Service (UW CES) are:

- to reinforce food safety education and training among restaurant and food-service workers
- to educate the public to handle and prepare food properly at home whether they are cooking from scratch or serving take-out meals and restaurant leftovers
- to help the public understand the importance of washing hands regularly

The *Going for the Gold* intermediate food safety training class and the *ServSafe*® program were presented in cooperation with consumer health specialists for Crook and Weston counties to Weston, Crook, and Campbell County food-service personnel. In addition to team teaching with Consumer Health Specialists and the Wyoming Department of Agriculture at these sessions, the Family and Consumer Sciences (FCS) educator also co-taught *Grazin' the Food Guide Pyramid with Marty Moose* and a hand-washing lesson with Health Specialist Doug Krogman to 34 second grade youths at Gertrude Burns Elementary School. Training was also conducted for 4-H clubs working in concession stands during county fairs. The training included discussions of proper holding temperatures, food safety, and sanitation. In addition, 147 *Cent\$ible Nutrition Program* participants completed a food safety curriculum lesson.

Impact

ServSafe® evaluation results:

All 17 participants passed a certification exam offered by the National Restaurant Association Foundation. In a written evaluation, 100 percent rated the training “better than average” or “excellent”. When asked about the most helpful part of the training, participants’ responses included:

- making me more aware of hand washing, cross contamination, and the importance of proper temperatures
- learning about micro-organisms and food-borne illness
- learning why time and temperature control is so very important

Following the *ServSafe*® training, 88 percent of those responding indicated that they planned to make changes at their workplace within three months such as:

- washing hands more
- encouraging employees to apply what they learned about dress
- taking temperatures and calibrating thermometers

Eighteen participants completed *Going for the Gold* intermediate training. A total of 88 percent rated the training “better than average” or “excellent” and indicated that the most helpful part of the training was:

- explanations of each important item – temperatures, cooling, and heating
- information on bacteria and growth
- training in cleaning and sanitizing

A total of 92 percent of the participants said they planned to make changes at their workplace including:

- encouraging more hand washing and also checking the temperature of products more often
- sending people home when they are sick
- sanitizing every day

From youth programs conducted:

- All of the second graders who participated in the hand-washing program indicated an attitude change.
- Ninety percent of the 11 participants in the 4-H food booth training indicated that they had gained knowledge and skills. All of them reported that they planned to make changes in behavior.

Cent\$ible Nutrition Program evaluation results:

- Twenty-two percent said they followed the recommended practices more often, of not allowing meat and dairy foods to sit out for more than two hours. Furthermore, 16 percent said they always followed the recommended practice.
- Fifty-two percent said they followed the recommended practice more often of not thawing foods at room temperature. Furthermore, 21 percent said they always followed the recommend practice.

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Goal 3: Enhance a healthy, well-nourished population

Overview:

Many Americans have eating and exercise habits that are not in keeping with recommendations for optimal health. A recent survey indicated that Wyoming residents tend to be too sedentary and eat too few fruits and vegetables.

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. Wellness in Wyoming (WIN Wyoming) is one new approach to promote people feeling good about who they are and motivating them to maintain healthy behaviors.

Annually, over 300 Million people are infected with Plasmodium, a small parasite that causes malaria worldwide including parts of the U.S. Approximately 1.5 Million people die from malaria every year. Due to global environmental changes, an increase in insecticide resistant mosquitoes which transmit malaria, and a rise in drug-resistant Plasmodium strains, the malaria threat is growing. This development calls for an urgent need of new drug and vaccine targets. Cardiovascular disease is the single largest cause of mortality in the United States. Yet treatments remain relatively crude and the biochemical processes that underlie this family of diseases remain poorly understood. Researchers are studying the changes in gene expression that follow the induction of myocardial infarction in mice. Another project is designed to study the properties of a novel actin binding protein in *Drosophila* which is associated with parallel actin bundle formation during the development of bristles. These actin based structures are important in many specialized cell functions ranging from hearing to intestinal absorption.

Key Theme – Human Health

- a. Researchers in the Department of Molecular Biology are using a novel computational approach to identify new potential drug targets in the genome of *Plasmodium falciparum*. Their method identified 9 new putative targets that are currently characterized in our laboratory using powerful genetic and biochemical methods. Researchers are studying the changes in gene expression that follow the induction of myocardial infarction in mice. The objective is to develop a comprehensive, biochemical model that describes the response of heart tissue to ischemia and to the mechanical stresses that accompany infarction. Ultimately, we wish to dissect the biochemical events that control left ventricle enlargement and loss of pumping efficiency following a heart attack. We employ the technology of high-density DNA microarrays to simultaneously measure expression of all genes in the mouse heart after induction of a myocardial infarction. In another project researcher are studying the roles of the forked proteins in assembly of parallel actin fiber bundles. Forked proteins are involved in forming the very large, 100-400 μ m long and 1 μ m diameter, fiber bundles present in developing *Drosophila* bristles. These fiber bundles appear in the electron microscope to have virtually identical structure to actin fiber bundles in intestinal and kidney microvilli and in the stereocilia of the ear, which are 1-7 μ m long and .1-.2 μ m in diameter. Studying fiber

bundle formation in *Drosophila* has the advantages that the actin fiber bundles in bristles are very large, and that mutants are available which are defective in fiber bundle formation. The results of these experiments will help in understanding how similar actin bundles are regulated in intestinal microvilli, kidney proximal tubules, and ear stereocilia. This may result in treatments for some forms of deafness, kidney failure, and intestinal absorption diseases.

CES efforts are based primarily on *WIN Wyoming [Wellness in Wyoming]*, a state-wide collaboration of more than 90 educators and health-care professionals representing over 75 public and private entities within and beyond Wyoming at the community, state, and university levels. Members educate people to respect body-size diversity and to enjoy the benefits of active living, pleasurable and healthful eating, and positive self-image.

- b. Impact – Current anti-malaria drugs are either expensive, have severe side effects, or are no longer effective in some areas, in which malaria is endemic. The new targets identified in our bioinformatics approach have a high potential to be effective in development of new anti-malarial drugs and vaccines. Regulation of the assembly of actin into tightly packed bundles is critical in many cellular processes. Research on cellular responses to stressors of cardiovascular health is aimed at developing improved tools for diagnosis and treatment of heart attacks. Researchers have identified a protein called forked that is essential for bundle formation. Understanding how these proteins function may allow the development of drugs or gene therapy to restore damaged actin bundles in the kidney or the ear.

Educational efforts from *WIN Wyoming* resulted in the following impacts: “Size It Up!” presentation, which reflects WIN Wyoming’s mission and principles, has been delivered to over 5,000 youth and adults. Program participants report increased awareness and behavior change in self acceptance as a result of the program. An annual one-day meeting of coalition members was evaluated on a Likert scale of 1 – 4, with 4 = highest and 1 = lowest. Members rated the meeting 3.6 for professional growth, 3.9 for professional motivation, 3.9 for useful information, and 3.7 for exchange of ideas. “A New You” curriculum was pilot tested by six UW CES educators in seven classes in four counties. Ninety-two percent of participants reported adopting new practices including: quit dieting, focus on healthy eating, found ways to be more active. Benefits reported from the program were: acceptance of body size and shape, changed attitudes toward eating, and increased activity levels.

- c. Source of Funding – Hatch, State
- d. Scope of Impact – State Specific

Key Theme – Human Nutrition

- a. The *Cent\$ible Nutrition Program* 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 1,655 households enrolled in lessons and 17, 275 individuals participated in one-time lessons as well as 1,642 second, fourth, and sixth grade youth at 12 elementary schools completed 4-5 lesson series.

Extension educators conducted 70 educational programs, classes, workshops, or health fair presentations reaching over 3,475 individuals. Topics ranged from “Eat 5-a-Day” and “Osteoporosis” to “Eating for a Healthy Heart”. One educator presented TEAM Nutrition programs at various schools and in the community reaching 1, 250 youth.

Research is being conducted to determine the effect of diet on ovulation. In feeding rats oils enriched in the shorter omega 3 fatty acids, linolenic acid, or olive oil, ovulation was enhanced to the same extent exhibited with fish oil ingestion when compared to a vegetable oil base. Results from ovulation studies and consumption of fish oil, in particular, the long-chain omega 3 fatty acids, imply that by altering the oils in our diets to include olive oil or those with higher levels of omega 3 fatty acids such as canola oil derived from rape seed, an improvement in reproductive success will be seen. In another dietary study, researchers are investigating the effect of different dietary fats on insulin sensitivity and the development of diabetes. It is not widely recognized that the type of fat we consume influences the rate at which we lose peripheral sensitivity to insulin and thus become diabetic.

- b. Impact – *Cent\$ible Nutrition* participants showed a 22 percent increase in nutrition practices as a result of lessons. Dietary improvements include nutrient intake of protein, iron, calcium, vitamin A, vitamin C, and vitamin B₆. Mean nutrient adequacy ratio for all nutrients increased from .76 at entry to .82 at exit (1.0 equals 100 percent). Intake of fats, oils and sweets decreased. A success story from Platte County noted *when the WIC nurse asked K to fill out a 24-hour food recall, the nurse was amazed to see how balanced K’s diet was. The nurse commented on what a good job the young woman was doing with her diet. K related to her that she had “gone through those classes that Karen teaches” three years ago. She learned how important diet is to her health, and now to the health of her unborn child.*

Participants in nutrition education programs conducted by CES educators reported making one or more changes consistent with the Dietary Guidelines. One hundred percent of the participants indicated they had gained knowledge and a greater awareness of the subject matter.

Reproductive failure impacts over 8 million women in the U.S. annually. Nutrition research in rats has indicated diets high in omega 3 fatty acids of either marine or plant origin will increase the number of eggs released into the oviducts. Research is being finalized to determine if this same effect is borne out in humans. Based on these results, there may be a nonpharmacologic means to improving human reproduction for women that could reduce that cost to women who have problems with conception.

- 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 Research (NC-167) (W-1003)
 - NC-167 (CA, CO, IA, IN, KS, LA, MI, MN, ND, NE, OR, TN, TX, WI, WY)
 - W-1003 (AZ, CA, CO, IN, MI, MN, NM, WA, 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. Wellness in Wyoming (WIN Wyoming) is a new effort and has been expanded to a multi-state project to promote people feeling good about who they are and motivating them to maintain healthy behaviors. Research in the area of human health has focused on intracellular bacteria pathogens and studies on human nutrition and health. Researchers in this area participated in four Hatch projects and three are Multi-state projects. The research effort in this area includes about 2.8 FTEs with expenditures of approximately \$.10 million Hatch and \$.35 million State.

Cooperative Extension Service FTEs	28.27
Goal 3 Allocated Funds	\$2,001,860.00

Goal 3 – IMPACTS

ISSUE: Cent\$ible Nutrition continues impact in Wyoming

The *Cent\$ible Nutrition Program* (CNP) is supported by funds from the U.S. Department of Agriculture’s Food Stamp and Expanded Food and Nutrition Education program and provides education to limited-resource families and individuals across Wyoming.

What has been done

CNP classes taught by the UW CES enable families to develop new skills and gain knowledge to improve their nutritional well-being and increase their ability to manage food resources.

P was drinking six huge mugs of soda per day and eating foods high in fat and sugar. After taking CNP lessons, she began to eat more nutritiously. She lost 50 pounds, reduced her blood pressure, lowered her cholesterol, eliminated her diabetes medication, and improved her mental attitude. She now exercises three times a week and says she feels more in control of her life. She reduced her grocery bill of \$350.00 per month and stays within her \$142.00 food-stamp allocation. Her monthly medications no longer cost in excess of \$400 per month. (Reported by a Washakie County graduate)

Impact

For every \$1 spent on nutrition education, Wyoming and the five other states involved in the Expanded Family Nutrition Education Program (EFNEP) can expect to save \$8.82 in future health care costs by preventing or delaying the onset of nutrition-related diseases such as colorectal cancer, heart disease, stroke, hypertension, osteoporosis, diabetes, obesity, food-borne illness, infant disease, and low birth-weight infants.

In the past year 1,655 households enrolled in lessons. Responses from the graduates indicate that 51 percent now plan meals, 47 percent compare food prices, 45 percent now shop with a grocery list, and for 45 percent, their food lasted all month. Households saved an average of \$38.07 per month on groceries. Improvements were also noted in the area of nutrition practices such as

planning meals, making healthy food choices, reading labels, providing breakfast for children, and preparing foods without salt. Dietary improvements included nutrient intake of protein, iron, calcium, vitamin A, vitamin C, and Vitamin B₆. Participants reported that the intake of fats, oils, and sweets decreased in their diet.

“I’m a father with a 3-year old who works 60 to 70 hours a week and I found the information important enough to take all 16 lessons. I dropped my grocery bill from \$200 to \$150 a month. I gained confidence knowing nutritional information for my child and was pleased with the snack ideas.” (Laramie County graduate)

“Before taking Cent\$ible Nutrition classes, my food stamps lasted half the month. After three lessons, they lasted an extra week. Now I have food stamps for the entire month. I use the cookbook, plan menus, and use less convenient and prepared food.” (Goshen County participant)

“I have learned to cook better and to include fruits and vegetables in my family diet. I have been saving a lot of money. I was spending \$350 a month on groceries, and after this class, I am spending \$150 on groceries. I am very happy about this because my family and I are eating better nutritionally. I am now planning menus which helps not to waste food and to save money. Thank you for this class.” (Teton County participant)

Youth are reached through a five-lesson series which was presented to 1,642 second, fourth, and sixth grade children.

“One of the things I learned was how much sugar pop has. It has a lot, and I knew that pop had a lot of sugar, but I never knew it had that much! I drink like 10 pops a day, but now I am definitely going to stop.” (Laramie County sixth grader)

After a hand-washing lesson, this student wrote, *“I will start washing my hands even when they don’t look dirty!”* (Natrona County participant)

Cent\$ible Nutrition is now available in all 23 counties and the Wind River Reservation in Wyoming.

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ISSUE: Identification of new drug targets in malaria

Annually, over 300 Million people are infected with Plasmodium, a small parasite that causes malaria worldwide including parts of the U.S. Approximately 1.5 Million people die from malaria every year. Due to global environmental changes, an increase in insecticide resistant

mosquitoes which transmit malaria, and a rise in drug-resistant Plasmodium strains, the malaria threat is growing. This development calls for an urgent need of new drug and vaccine targets.

What has been done

We have used a novel computational approach to identify new potential drug targets in the genome of Plasmodium falciparum. Our method identified 9 new putative targets that are currently characterized in our laboratory using powerful genetic and biochemical methods.

Impact

Current anti-malarial drugs are either expensive, have severe side effects, or are no longer effective in some areas in which malaria is endemic. The new targets identified in our bioinformatics approach have a high potential to be effective in the development of new anti-malarial drugs and vaccines.

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ISSUE: The role(s) of forked proteins in actin fiber bundle formation

This project is designed to study the properties of a novel actin binding protein in Drosophila that is associated with parallel actin bundle formation during the development of bristles. These actin-based structures are important in many specialized cell functions ranging from hearing to intestinal absorption. In this project we are studying the roles ranging from hearing to intestinal absorption. In this project we are studying the roles of the forked proteins in assembly of parallel actin fiber bundles. Forked proteins are involved in forming the very large, 100-400 μ m long and 1 μ m diameter, fiber bundles present in developing Drosophila bristles. These fiber bundles appear in the electron microscope to have virtually identical structure to actin fiber bundles in intestinal and kidney microvilli and in the stereo cilia of the ear, which are 1-7 μ m long and .1-.2 μ m in diameter. Studying fiber bundle formation in Drosophila has the advantages that the actin fiber bundles in bristles are very large, and that mutants are available which are defective in fiber bundle formation. The results of these experiments will help in understanding how similar actin bundles are regulated in intestinal microvilli, kidney proximal tubules, and ear stereo cilia. This may result in treatments for some forms of deafness, kidney failure, and intestinal absorption diseases.

What has been done

We have shown that forked proteins are synthesized and concentrated in bristle tips just prior to the formation of actin bundles, and that they can induce actin bundle formation in transiently transfected vertebrate cells. This suggests that they play a critical role in initiating bundle formation. We have identified essential regions of the protein required for bundle formation in vertebrate cells and have further defined essential domains in vivo using P-factor transformation of embryos with altered forked genes. We have made GFP-forked constructs and introduced

them into flies and are currently using these to follow the location of the forked protein in live tissues where bundles are being assembled and disassembled.

Impact

We have increased the knowledge about the roles of forked proteins in bundle development, and this has contributed to the discovery and understanding of similar proteins in vertebrate cells. These proteins, called espins, were originally identified in rat testis ectoplasmic specializations but have now been also found in kidney and intestinal microvilli and in ear stereo cilia where they are involved in regulating actin bundle assembly (Bartles et al., 1998).

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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 depends 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. For example, the Reduced Agent-Area Treatments (RAATs) is a method of integrated pest management for rangeland grasshoppers in which the rate of insecticide is reduced and untreated swaths are alternated with treated swaths. This IPM approach allows predator and parasites to be preserved in untreated swaths and dramatically reduces the amount of insecticide applied and the cost of control.

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 pesticides become certified applicators. Private applicators must be recertified every five years, and commercial applicators must earn recertification every three years. UW CES provides training for both initial certification and recertification of private and commercial applicators. CES cooperates with the Wyoming Department of Agriculture in the certification program. Private applicator training takes place at the county level, with each county holding one or two training sessions per year. Commercial applicator training takes place at the state level. An initial certification school, consisting of 24 hours of training and a 12-hour recertification school were held in 2002. Federal, state, and university personnel provide the training for commercial applicators. Approximately 600 received training and were certified and 200 received training for recertification. CES offers pesticide training materials via internet. Web site access has increased from approximately 50 times per week to 75. Twenty-four Pesticide Education Program Facts Sheets (MP-93.1 through MP-93.14) and others that deal with

various topics are available in both the private and commercial pesticide applicator training programs.

- b. Impact – Approximately 1,100 private pesticide applicators and 200 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 3(d)
- d. Scope of Impact – State Specific

Key Theme – Natural Resource Management

- a. 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. CES educators and specialists conducted 55 educational workshops reaching over 1,105 individuals on topics ranging from “Financial and Natural Resource Conflict Mediation,” “Range Monitoring,” and “Backyard Wildlife Habitat” to “Living on a Few Acres”. In addition, 30 youth participated in Wyoming Resource Education Days learning about natural resource issues. Educators developed “Range College” a series of workshops and online resources available via the web.

Landowners, public policy makers, and ordinary citizens are interested in and affected by the future of rural lands in Wyoming. Important resources such as wildlife habitat, watersheds and groundwater, agricultural infrastructure and arable soils can be adversely impacted by the fragmentation (due to subdividing) of agricultural lands. Important services such as scenic view sheds, wildlife migration corridors, working landscapes, on-site recreation and access to public lands can also be adversely impacted by the fragmentation (due to subdividing) of agricultural lands. In a recent study, agricultural property values were analyzed based on production attributes as well as resource and recreational amenity values. The demand for rural private lands used in agricultural production depends on attributes such as soil fertility, water, buildings, and location. Land demand for rural residential development may be based on recreational and scenic amenities as well. These demands may be competing, driving up land prices, and reflecting the increasing subdividing of agricultural lands. Research concerning agricultural land values was conducted jointly between the Department of Agricultural and Applied Economics and the Department of Botany. Parcel specific production attributes obtained from appraisal sheets for agricultural land sales were combined with Geographic Information Systems (GIS) data measuring on parcel recreational and scenic amenities for 138 agricultural lands sales in Wyoming. The land values, as a dollar per acre amount, are nearly all statistically related with the amenity measurements as with production attributes. On-parcel improvements increased agricultural productivity, fishing opportunities, diverse views from the parcel, and being distant from a town

contributed positively to parcel value. A large share of the state's income is generated from extraction of mineral and fossil fuels. Big sagebrush, if present in pre-mined ecosystems, is required to be re-established according to the Surface Mining Control and Reclamation Act of 1977 and the Wyoming Environmental Quality Act of 1973. The initial process of re-establishing this shrub has been difficult for reclamation specialists. However, they have finally developed techniques to successfully establish the shrub species, but ensuring long-term survival remains a challenge years after initial establishment. Since bond release depends on long-term establishment of big sage brush, reclamationists are now exploring the impacts to big sagebrush survival from wildlife browsing and contemplating management techniques to reduce sagebrush mortality due to wildlife use. To investigate the influence of wildlife utilization on big sage brush growth and survival, a game-proof enclosure was constructed on reclaimed coal mine land at North Antelope Coal Mine near Gillette, Wyoming. During the past two years, field data was collected inside and outside the enclosure on percent browsed/unbrowsed big sagebrush plants, mean annual leader lengths, percent plant species composition, plant diversity, and pellet group counts. Preliminary data indicates higher mortality of big sage brush seedlings outside the enclosure, greater percent of big sagebrush seedlings browsed, lower annual leader length growth, reduced plant composition and diversity, and much higher pellet group densities compared to inside the enclosure.

- b. Impact – Participants 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. One hundred percent of the youth participants showed increased knowledge and skills as a result of educational efforts.
- Grazing permittees have improved finances, improved agency relationships, and increased cattle performance
 - Permittees on an allotment, estimate that as a result of better weight gains, more lengthy stay on ranges and other variables, the monitoring program has been worth approximately \$30,000 to them.
 - Drought management decisions made by producers to manage for drought implications included alternatives such as reducing inventories, weaning early, heavy culling. With 100 producers from two counties comprising 75 percent of the cowherd this year, management decision resulted in \$750,000.

The exploratory research analyzing agricultural and amenity attributes of agricultural land values suggests that there is potential for using GIS to measure attributes in a way that allows economic values associated with recreational and scenic amenity attributes to be estimated from market transactions. Objectively measuring these attributes could improve rural appraisal procedures, valuation of conservation easements and policies related to agricultural lands. As a result of this study, a Wyoming Open Space Partnership has been formed with the Ruckelshaus Institute of Environment & Natural Resources, Wyoming Cooperative Extension Service, Department of Agricultural and Applied Economics, Wyoming Natural Diversity Database, Wyoming Geographic Information Systems Center on campus, and various agricultural and resource interests around the state of Wyoming. This umbrella partnership is positioned to lead informed discussions about open space, land use, and planning with objective/policy neutral information

and facts. Preliminary data indicates higher mortality of big sagebrush seedlings outside the enclosure and has reclamation specialists at North Antelope Coal Mine (and several adjacent mines) concerned about the significant impact of wildlife browsing on long-term big sagebrush survival. Reclamationists are beginning to formulate post-reclamation management procedures and long-term planning to reduce the damage impact on big sagebrush. Considerations of community-level (reclamation site) damage management practices to landscape-level habitat management (enhancing adjacent native rangeland plant communities) approaches are currently being pursued.

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

d. Scope of Impact – State Specific

Multi-state research (W-133) (CA, CA-D, CO CT, GA, IA, MA, ME, MI, MN, MT, ND, NH, NM, NV, NYC, OH, OR, PA, SC, TN, UT, WA, WV, WY)
(W-170) (AL, AR, CA, CO, FL, GU, HI, IA, IL, IN, KS, OK, MD, MI, MN, MO, MT, NM, NY, OR, PA, TX, VA, WA, WY)

Integrated Research and Extension

Key Theme – Biodiversity

- a. In a study using long-term rangeland enclosures, research is being conducted to determine how precipitations, soil, and land use interact to influence ecosystem structure and function in general and biodiversity in particular. The primary venue for these analyses is to use a statewide system of 40 year old livestock enclosures to analyze how the presence or absence of livestock have influenced plant, small mammal, and soil microorganism composition and diversity. Researchers have identified and obtained records for 80 rangeland enclosures established in the 1960s. The sites were visited and intensively inventoried during 2001 and 2002. In another study, weedy invasion sites are being used to select for competitive ability of native plant species. Researchers found remnant native plant individuals in long-term weed infestations in Wyoming and Idaho. Seed propagules are being grown in competitive greenhouse studies. With more than 50,000 species worldwide, braconid wasps are one of the most significant mortality agents of plant-feeding insects in most terrestrial ecosystems. In Wyoming, most braconid wasp species are primary parasites of plant-feeding insects such as caterpillars, bark and wood-boring beetles, flies, and sawflies.
- b. Impact – Results of ongoing research programs are used to educate the public about the role of land use on biodiversity and species composition. Research is being conducted to identify improved native plant genotypes that have existed in long-term weed infested areas. These native plant genotypes may have potential use for revegetation of weed-infested rangelands and to limit the expansion of invasive species. Braconid wasps serve as natural control agents for the regulation of populations of plant-feeding insects. As such, they are very economically important beneficial insects that are extensively utilized as biological control agents for suppressing populations of pest insects in forests, rangeland, and agroecosystems. They are important regulators of pest insect populations in Wyoming forest and rangeland.

- c. Source of Funding – State
- d. Scope of Impact – State Specific
Integrated Research and Extension

Key Theme – Integrated Pest Management

- a. Grasshoppers annually consume 22 percent of rangeland forage in the western U.S. at cost of >\$600 million. In 1996, the USDA abandoned its treatment subsidy, thereby tripling the cost to ranchers and creating an urgent need for pest management strategies to reduce economic costs. In response to this need, researchers developed and refined a strategy that reduces the environmental and economic costs by: using less insecticide per treated acre (“reduced agent”) and treating fewer acres (“reduced area”). The resulting Reduced Agent/Area Treatments (RAATs) rely on movement of grasshoppers into the treated swaths and preservation of natural enemies in the untreated swaths. In addition, researchers have been developing a reliable grasshopper assessment method by which no technical personnel can effectively assess rangeland grasshopper infestations and determine if they are at densities that will threaten forage for wildlife and livestock.
- b. Impact – The RAATs tactic has been endorsed by the National Grasshopper Management Board and has been selected by USDA as the “preferred alternative” in the 2001 Environmental Impact Statement for the “Rangeland Grasshopper and Mormon Cricket Suppression Program.” RAATs typically yields 85-90 percent control of grasshoppers. In the last three years, >300,000 acres of rangeland has been treated in nine western states using RAATs, saving agriculture nearly a million dollars and reducing insecticide use by 150,000 pound relative to the methods available just five years ago. Based on the last major outbreak, the application of a RAATs control program during the next outbreak would save western agriculture \$35 to 50 million and reduce pesticide loads in the environment by more than 5,000 tons, compared to conventional methods. In addition, a grasshopper sampling method to assess rangeland grasshopper infestations has been developed and is being used by Weed and Pest District supervisors in 15 of 16 grasshopper affected counties. The estimated cost of using this sampling method is \$600 per county.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – State Specific
Integrated Research and Extension

Key Theme – Sustainable Agriculture

- a. The focus of research being conducted on sustainability is to increase agricultural producers’ understanding and adoption of agricultural practices and production systems that sustain and protect ecosystems integrity and biodiversity. Research efforts have focused on production practices and systems that reduce inputs, improve ecosystem diversity, and maintain profitability. Examples of such research reported earlier in this annual report are the winter grazing of windrowed hay to reduce the over-wintering costs for Wyoming’s cow herd and

efforts to establish an alfalfa variety that is resistant to Brown Root Rot. Drought of varying local intensity across Wyoming over the past three years has focused attention on the plight of livestock producers, grazing management on public and private lands, and grazing impacts on these lands. Drought is a catalyst for a number of issues involving grazing management strategies, monitoring of grazing use and impacts, and the livestock production systems and practices being used. The reductions in forage productivity associated with drought require monitoring as the tool that allows producers to adjust grazing practices, such as season and intensity of use, to be more effective at supplying forage for animals while conserving the condition of the forage resource. Drought is a recurring meteorological phenomenon that virtually dictates producers have flexible systems allowing adjustment of stocking to variable forage supplies. Changes in the mix of animals, calving seasons, marketing, supplementation and other variable all impact the ability of a producer to make timely adjustments. Many land managers and concerned conservationists assume that drought and grazing place undue stress on forage plants, however, better understanding of these relationships can reduce stressful relations among users, managers, and concerned publics and improve management practices. A research project is under way to provide early predictive ability for summer forage yields. Promising results indicate that in the high elevation plains of Wyoming, April precipitation is a very effective predictor of subsequent forage yields. Plant ecophysiology, grazing management, and monitoring information resources have been synthesized to address the effectiveness of grazing systems/monitoring in facilitating good plant/range health while supplying forage in drought or normal conditions. In general, shorter grazing periods, dormant season grazing, and monitoring of residual forage standards selected to meet plant health and animal production objectives trend to better plant health and animal production. Concomitant research is examining the diversity of ranch livestock management system in Wyoming.

- b. Impact – Predicting forage supplies for the upcoming season with sufficient lead time to adjust stocking, grazing practices and monitoring of forage use, and flexible/profitable animal management systems and practices have been topics of connected research and extension education programs. Preliminary research results indicate that in the high elevation plains of Wyoming, April precipitation is a very effective predictor of subsequent forage yields. While potential profitability is the common currency of evaluation of these systems, flexibility or resilience when facing drought is also an expected interpretation. Recently completed research has found that late spring calving seasons have greater profit potential compared to other seasons. A much larger number of producers, agency managers, and Extension educators are aware of options and decision points. Changes in practices are slower in developing, partly because of the continuation of drought limits change. Changes that have occurred include substantive (40-60 percent) destocking across much of Wyoming in response to lack of grazable forages, hays, or other low cost alternative feeds.
- c. Source of Funding – State
- d. Scope of Impact – State Specific
Integrated Research and Extension

Key Theme – Water Quality

- a. Water quality research and education programs are designed to provide information and technical guidance to clientele regarding the management of aquatic and terrestrial ecosystems to maintain water quality.

Several states within the United States (e.g., Wyoming, Colorado, Montana, New Mexico, and Utah) are exploring methane extraction from their coal resources. As an example, in the Powder River Basin (PRB) of Wyoming, it is estimated that there are 31.7 trillion cubic feet of recoverable CBM (coalbed methane). Recovery of the methane is facilitated by pumping water from the aquifer (product water). At present, more than 16,000 wells are under production in the PRB and this number is expected to increase to at least 30,000. Based on information provided by the Wyoming Geological Survey, approximately 30 trillion L of product water will eventually be produced from CBM extraction in Wyoming. Commonly, 2 to 10 CBM extraction wells are placed together in a manifold system discharging to a single point and releasing into constructed unlined retention ponds. Very little information is available on the geochemistry of CBM product water and associated retention ponds in the PRB. To effectively manage this water resource there is a need to understand the geochemical changes that occur in CBM retention ponds over time. To address concerns, CBM retention ponds in PRB, Little Powder River Basin (LPRB), Bell Fourche River Basin (BFRB), and Cheyenne River Basin (CRB), will be monitored for the geochemical changes and water quality. These studies will be conducted over a period of three years. In attempting to understand the significance and implications of identifying water bodies as impaired or threatened under the Clean Water Act, public sectors of Wyoming reviewed 303(d) listings (impaired or degraded stream reaches) prior to 1996. Results clearly illustrated many impaired streams were listed with less than adequate scientific data. In 1999, Wyoming passed legislation requiring the Wyoming Department of Environmental Quality (WDEQ) to utilize “Credible Data” in decisions concerning the attainment of beneficial uses. Credible data, as defined by the Wyoming Legislature, “. . . includes scientifically valid chemical, physical, and biological monitoring data collected under an accepted sampling and analysis plan, including quality assurance procedures and available historical data.” Analysis and subsequent interpretation of collected data will substantiate the identifications, cause, and plausible restoration of impaired water bodies. The Wyoming Association of Conservation Districts (WACD) assumed responsibility for conducting water quality monitoring within their local districts to fulfill the intent of Wyoming’s water quality monitoring programming. A cooperative training program was initiated and it included local, state, and federal agencies. This program focused on education material that provided federal and state agencies, landowners, industry, and the public with confidence and credibility in WACD’s monitoring program. State-wide training consisted of five phases: 1) Function of watersheds and stream dynamics; 2) Development of a water quality monitoring plan; 3) Equipment use, care, maintenance, and calibration; 4) In-field, collection of credible data with WDEQ; 5) Data analysis and interpretation. Seven training sessions have been conducted since 1999 and all continue to be offered each year to update new employees and the general public.

- b. Impact – The research associated with CBM water quality is influencing the development considerations associated with this industry. This research helps determine the water quality

and fate of trace elements (complexation, adsorption, and precipitation) in CBM retention ponds. Such information will help water users (landowners, agriculture and livestock producers, and ranchers) and water managers (state, federal, and local agencies) with the planning and management of CBM product water within the PRB. Currently, 33 of 34 Wyoming Conservation Districts have implemented water quality monitoring programs to collect baseline data and provide further information for the listing or de-listing of water bodies. A four-year case study of the implementation, evaluation, and interpretation of one district's monitoring program, following Wyoming's credible data legislation, has now been completed. A single process for analysis of chemical, physical, and biological data collected is now available for consideration by other districts, WACD, WDEQ, and the Wyoming public. The WACD in cooperation with NRCS, UWCES, WDEQ, and USGS continues to train and educate conservation districts and the Wyoming public about water quality issues.

c. Source of Funding – Hatch, State

d. Scope of Impact – State Specific

Multi-state Research (W-184)
 (AZ, CA, CO, DE, FL, GU, HI, IA, ID, IL, IN, KS, MN, MT, ND, NM,
 NV, TX, UT, VA, WA, WY)
 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 Education
3. Rangeland and Riparian Management
4. Biological Control

Researchers in this area participated in seven Hatch projects and six of the seven are multi-state projects. The research effort includes 7.75 FTEs with expenditures of approximately \$.18 million Hatch and \$1.7 million State.

Cooperative Extension Service FTEs	10.96
Goal 4 Allocated Funds	\$1,015,940.00

Goal 4 – IMPACTS

ISSUES: Integrating rangeland ecology, management and monitoring with ranching systems under drought conditions

Drought is a catalyst for a number of issues involving profitable grazing and long term sustainability. Drought-induced reductions in forage productivity require that grazing practices be more effective at supplying forage for animals while conserving the condition of the forage resource. Monitoring is a tool that allows producers to tune their management to get the best

results. Drought is a recurring meteorological phenomenon that virtually dictates that producers have flexible systems allowing adjustment of stocking to variable forage supplies, yet few do. Many land managers and conservationists assume that drought and grazing place undue stress on forage plants, however better understanding can reduce stressful relations among users and improve management practices. Results of an ongoing project indicate that in the high elevation plains of Wyoming, April precipitation is a very effective predictor of subsequent forage yields. Plant ecophysiology, grazing management, and monitoring information resources have been synthesized to address the effectiveness of grazing systems/monitoring while supplying forage in drought or normal conditions. In general, shorter grazing periods, dormant season grazing, and monitoring of residual forage trend to better plant health and animal production. Concomitant research is examining the diversity of ranch livestock management system in Wyoming.

What has been done

Predicting forage supplies for the upcoming season with sufficient lead time to adjust stocking and grazing practices and flexible/profitable animal management systems and practices have been the topics of connected research and extension education programs during the last three years of drought in Wyoming. Results of an ongoing project indicate that in the high elevation plains of Wyoming, April precipitation is a very effective predictor of subsequent forage yields. Plant ecophysiology, grazing management, and monitoring information resources have been synthesized to address the effectiveness of grazing systems/monitoring while supplying forage in drought or normal conditions. In general, shorter grazing periods, dormant season grazing, and monitoring of residual forage trend to better plant health and animal production. Concomitant research is examining the diversity of ranch livestock management systems in Wyoming. While potential profitability is the common currency of evaluation of these systems, flexibility or resilience when facing drought is also an expected interpretation. Late spring calving seasons have greater profit potential compared to other seasons. A synopsis of recommendations incorporated in education efforts would trend toward 1) livestock production systems composed partly of yearlings or other kinds/classes of stock that can be sold when forage supplies become limited. 2) Because of the predictable effect of April precipitation, stocking level decisions and sale of excess animals should occur at the end of April. 3) Utilization of residual forage stands limit negative impact to plant health and animal production. 4) Shorter duration and post seed set or dormant season grazing minimize grazing effects. 5) Water sources and herding are the best tools to regulate animal location, timing and degree of use.

Impact

A much larger number of producers, agency managers, and extension educators have been made aware of options for dealing with drought. Changes in practices are slower in developing, in part because drought itself limits change. One example of a substantive outcome of adopting recommendations if used, is that if cow/calf pair numbers beyond those supportable on forage levels predicted in April had been sold then, \$200/pair additional return would have been received compared to the sale of the same pairs in July.

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ISSUE: Reducing environmental and economic costs of rangeland grasshopper management

Grasshoppers annually consume 22 percent of rangeland forage in the western U.S. at a cost of >\$600 million. In 1996, the USDA abandoned its treatment subsidy, thereby tripling the cost to ranchers and creating an urgent need for pest management strategies to reduce economic costs.

What has been done

In response to this need, we developed and refined a strategy that reduces the environmental and economic costs by: 1) using less insecticide per treated acre (“reduced agent”) and 2) treating fewer acres (“reduced area”). The resulting Reduced Agent/Area Treatments (RAATs) rely on movement of grasshoppers into the treated swaths and preservation of natural enemies in the untreated swaths.

Impact

The RAATs tactic has been endorsed by the National Grasshopper Management Board and has been selected by the USDA as the “preferred alternative” in the 2001 Environmental Impact Statement for the “Rangeland Grasshopper and Mormon Cricket Suppression Program.” RAATs typically yield 85-90 percent control of grasshoppers with 2-3 times higher benefit: cost ratios than the standard approach of using high rates of insecticides with blanket coverage. Hence, it is possible to reduce the amount of insecticide by 60-75 percent while doubling rancher’s profits. In the last three years, >300,000 acres of rangeland has been treated in nine western states using RAATs, saving agriculture nearly a million dollars and reducing insecticide use by 150,000 pounds relative to the methods available just five years ago. Based on the last major outbreak, the application of a RAATs control program during the next outbreak would save western agriculture \$35 to 50 million and reduce pesticide loads in the environment by more than 5,000 tons.

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ISSUE: Agricultural land values and conservation

Landowners, public policy makers, and ordinary citizens are interested in and affected by the future of rural lands in Wyoming. Important resources such as wildlife habitat, watersheds and groundwater, agricultural infrastructure, and arable soils can be adversely impacted by the fragmentation (due to subdividing) of agricultural lands.

What has been done

Seminars have been presented to state and county officials, planning offices, citizen groups, agricultural landowners, and county extension educators. They have been consulted as to the unique nature of issues and concerns about land use and planning in given counties. Several focus groups with multiple meetings of a wide range of citizens have been conducted. From these meetings, land use and planning preference surveys have been designed and ultimately administered on a county-specific basis. Bulletins and academic papers have been published with the former made available on the Department of Agricultural and Applied Economics Web site.

Research was conducted jointly between the Department of Agricultural and Applied Economics and the Department of Botany. Parcel specific production attributes obtained from appraisal sheets for agricultural land sales were combined with Geographic Information Systems (GIS) data measuring on parcel recreational and scenic amenities for 138 agricultural land sales in Wyoming. GIS data was obtained first by mapping parcel boundaries, and then by overlaying the parcel with measured attributes. The on-parcel production and amenity attributes measured and analyzed are given in the following list: Production-total deeded acres, percent range acres, percent irrigated cropland acres, percent irrigated meadow acres, a measure of improvement such as building and fencing per acre, and percent of acres of leased public range. Amenity: an index of scenic view measured from the parcel's center, meters of stream per acre, an index of fishing productivity on the parcel, acres of elk habitat, and the distance by road to the nearest town of 2,000 persons. The land values, as a dollar per acre amount, are nearly all statistically related with the amenity measurements as well as production attributes. On-parcel improvements, increased agricultural productivity, fishing opportunities, diverse views from the parcel, and being distant from a town contributed positively to parcel value.

Impact

Preferences for land use and planning have been elicited. Presentation of findings were provided in seminars and bulletins. The Wyoming Open Space Partnership has been formed with the Ruckelshaus Institute of Environment & Natural Resources, Wyoming Cooperative Extension Service, Department of Agricultural and Applied Economics, Wyoming Natural Diversity Database, Wyoming Geographic Information Systems Center on campus, and various agricultural and resource interest around the state of Wyoming.

This umbrella partnership is positioned to inform the discussion about open space, land use, and planning with objective/policy neutral information and facts.

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

Overview

Money/personal finances and investment, family and child development, and economic issues were identified among the highest priorities for State of Wyoming residents when asked to identify the most pressing issues facing families in the next three to five years.

The economy of Wyoming communities has been at a critical juncture. Per capita income growth statewide from 1994 to 1996 was less than 60 percent of the national average, and Wyoming experienced an 8 percent growth rate in jobs, while neighboring states enjoyed a 13 percent growth rate.

Researchers are working with Wyoming communities, assisting them with identifying impacts of change, developing community network resources, and identifying growth opportunities for existing businesses. Preliminary results from research concerning U. S. Forest Service (USFS) policy changes indicate that one national forest brings in \$75.7 million to a three county area. Multi-state projects interface retailers, small manufacturers, and home-based businesses; helping these businesses identify economic development and growth opportunities in their rural locations.

Children, youth, and families at risk have been a major foci of child and family studies researchers. Researchers have been participating in multi-state projects involving welfare reform and at-risk youth resilience to violence. In-depth research on child health and safety provided the basis for curriculum development and training for child care providers statewide.

Key Theme – Family Resource Management

- a. CES Family and Consumer Science Educators in five extension areas conducted 26 financial management classes reaching 491 individuals. Topics included Money 2000 & Beyond: Credit, Savings Insurance and Risk Management, Retirement Planning, Savings for College, Budgeting for a Baby, Pocket Change Series, and Using a Financial Calculator. Of the 491 total participants, 363 attended single topic workshops and 128 completed in-depth financial management courses that entailed three to five sessions in length. Consumer fraud was addressed in two programs reaching 70 individuals.
- b. Impact – Individuals enrolled in Money 2000 & Beyond completed evaluations at the conclusion of the course and a follow-up evaluation was conducted nine months following the course. Impact documented through evaluations:
 - 60 percent of participants established at least one financial goal.
 - 80 percent better understand the costs of credit and dangers of making only the minimum payment.
 - 90 percent reported they learned new information in the classes.
 - 45 percent have set a long term financial goal and have a written plan for managing debt.
 - 80 percent will review their insurance policies to check level of risk management.

- 100 percent reported they were making changes in their money management practices.

Evaluations from “Power Pay” classes indicated that four families planned to use information from the program to pay off debt faster, saving \$51,252 from interest and paying off debt seven to nine years earlier than their current payment plan.

Pre and post tests were used to determine the impact of SCOPE financial series.

95 percent gained knowledge about use of credit cards.

30 percent of students planned to share information with their parents.

100 percent of students set financial goals for themselves including:

- postponing credit card acquisition
- making the decision not to use a credit card in lieu of checks
- live within a set monthly budget allowing students to pay their debts off each month

Evaluations for the “Pocket Change” four week series were conducted at the conclusion of each class and a final evaluation at the end of the course. Participants reported an increase of their awareness of money issues and a change in attitude towards money. Seventy-five percent reported they changed their spending behaviors or skills such as: taking only the amount of cash allotted, decreasing use of credit cards, putting more thought into purchases, not buying on sale because of impulse, and paying credit card bills soon.

Evaluations from the “Transfer of Non-Titled Property” indicated participants raised awareness of the importance of family discussions and making wishes known regarding non-titled property. Ninety-seven percent said they plan to discuss the transfer of non-titled property with their children or make up a list for disposition.

c. Source of Funding – Smith-Lever

d. Scope of Impact - State Specific

Key Theme – Children, Youth, and Families at Risk

- a. Young people and families confront numerous risk factors, ranging from those that cause unhappiness or lost human potential to those that are life-threatening. One group that is particularly vulnerable are the “latch-key” children who are unsupervised during the period after school and before their parents or adults return home. UW CES, through the CYFAR project and in collaboration with schools, community and state agencies, provides training, materials, web resources on youth development, and workforce preparation skills (science, tutoring, life and job skills, community service, career exploration) and recreation activities to youth, adult professionals and volunteers. Through CYFAR, community educators offer after-school programs for children and youth at four grant funded community sites: Platte, Crook, Campbell, and Park Counties; one grant-funded technical site: Sheridan; one YAR site: Wind River Reservation.

CYFAR supports, through sponsorship, the largest youth assets conference in the state – Healthy Communities/Healthy Youth. Additionally, youth-at-risk programs are conducted in Uinta and Goshen Counties through county and outside funding.

SUCCESS Program – Wheatland High School – science and technology education; mentoring and study skills “In-Focus”; natural resource field experience. (170 students)

Kids Taking Care of Business (KTCB) – Moorcroft, WY – after school program featuring science activities using Wonder Wise; mentoring; study skills, recreation activities. (60 youth)

Keep Every Youth Successful (KEYS) – Gillette, WY – peer mentoring; asset building; assets camp; social responsibility training for youth. (47 trained in Character Counts; 30 trained in Reducing Youth Aggression)

Just Say YES – Wyoming Girls School and Normative Services – Sheridan, WY – enrichment and animal care activities to assist residents in making positive life choices. (103 youth)

PC PEP – countywide Third Gathering Assets Celebration, and peer mentoring program – (15 peer mentors, 250 youth; Assets Celebration reaches 1,700)

- b. Impact - A recent USDA publication, Reforming Welfare: Implications for Rural America, emphasized that the stable employment of single mothers may depend on state child care policies. Policy-makers from rural states will be able to use policy analysis from the multi-state research project when establishing state child care policies.

CES programs resulted in:

Students in two sites received tutoring and study skills assistance.

- In the Platte County project, six students had an average GPA gain of one half letter grade through participation in In-Focus.
- In the Platte County project, 65 percent of students receiving assistance were successfully passing all classes after participating in “In-Focus”. One hundred percent of students returned to school for the fall semester. Six students toured Wyoming to learn about natural resource conflicts and strategies.
- Crook County participants who were either “at-risk” or “latch-key” benefited from at least 7,000 child-hours of educationally enriching, adult supervised activity. Individuals improved academically and the group served by CYFAR more than held its own in terms of academic achievement. When youth were at CYFAR sessions, the students were involved in active, mentally stimulating activities in a safe environment, while without this program, risk for some of them would have been much higher.

Students in all sites identified teamwork, accountability, patience, and time management as benefits of participation in programs.

Impacts from the Sheridan Girls’ School 4-H program for at-risk youth included:

- 86 percent of residents enrolled in the program completed a project.

- The value of the horses increased due to the time the students spent training horses, validated through the sale of the horses.
 - The at-risk youth said the project taught them trust, patience, responsibility, and problem solving skills.
 - In Park County, the Third Gathering Youth Asset event was held featuring Park County Peer Education Program (PCPEP) youth who had fun activities for youth and a dance. One hundred fifty young people participated and three new teens were recruited for PCPEP. A Peer Education Program started resulting in 15 older youth being trained who now work with over 250 younger youth on community projects.
 - Two “Reducing Youth Aggression” trainings by Boys Town were presented in two counties. A follow up evaluation indicated professionals rated the training 4.5 on a 5 point scale, with 5 = excellent. The main use reported by agencies has been with individual troubled youths by maintaining a calm, rational approach with consequences to bad behaviors.
- c. Source of Funding – Smith-Lever 3b&3c, Hatch, State, County
- d. Scope of Impact – State Specific
 Integrated Research and Extension
 Multi-state Integrated Research and Extension (W-193, NC-223)
 (AZ, CA, CO, ID, IN ,KY, LS, MA, MI, MN, MO, NE, NH, NV, OH, OR, UT, WY)

Key Theme – Farm Safety

- a. Statistics show that agriculture is one of the most dangerous occupations. Since nearly all agricultural operations in Wyoming are operated by families, those hazards affect all family members as well as any visitors to the agricultural environment. Two farm safety day camps were held for 375 youth in two Wyoming counties. Safety topics taught related to firearms, lawn mowers and equipment, wildlife, large animal handling fire, sun, PROs and pinch point hazards, flowing grain and grain bins, electricity, 4-wheelers and ATVs, exotic animals, chemicals, tractors, rural roads and railroad crossings, and hazard identification. Two counties focused on equestrian helmet safety, where educational programs were presented and jointly with 4-H and other youth groups provided helmets for special needs youth, low income families or other youth in need. An additional two dozen helmets have been distributed. In addition, one county created a mock disaster display during their county fair, which included six “accidents”. Audience participants received prizes for identifying hazards.
- b. Impact – A follow up survey sent to farm safety camp participants indicated:
- 50 percent of participants could name at least three new things they learned at farm safety camp.
 - 75 percent could name at least one safety practice they started or corrected at home as a result of the day camp.

·100 percent reported at least one safety skill they had taught to someone else that they learned at day camp.

c. Source of Funds – Smith-Lever 3(d), State, County

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. Communities comprise many components that create a complex, interrelated system. Extension educators and specialists conducted programs to address issues of community infrastructure, social and family issues, citizen involvement, and the ability of each community to address resident issues. Twenty-two community economic development analysis projects were conducted and educational workshops, classes, and seminars reached over 571 individuals. Topics included facilitation skills, women in agriculture, mediation training, immigration law, customer service for business, public speaking, and leadership development. In 2002, researchers provided base line studies outlining some of the emerging trends in Wyoming’s travel and tourism sector and mineral sector. Additionally, some of the benefits as well as the drawbacks of this type of economic development are illustrated.
- b. Impact – A total of 22 community economic development analysis projects were conducted, which were supported by \$170,000 in extramural funding. Outcomes from the analysis included:
- County commissioners in five counties were able to have concerns addressed in the U.S. Forest Service’s Thunder Basin EIS.
 - State government and Park County were able to show the economic importance of snowmobiling in Wyoming to the National Park Service.
 - The State Land Board is considering ways to upgrade its agricultural land holdings to improve revenue for schools, retain land in agriculture, maintain open space in Wyoming, and improve recreational access.
 - The participants in a leadership development program in Jackson have a better understanding of the structure and trends within their local economy.
 - The Wyoming Department of Transportation, Aeronautics Division was able to estimate the economic impact of airports in Wyoming.
 - Residents of Park County were able to compare the costs to them for financing a new jail using alternative revenue generation approaches.
 - The Medicine Bow National Forest will be able to consider the economic importance of the forest to Albany, Carbon, and Converse Counties as it revises the Forest Plan.
 - The Bighorn National Forest will be able to consider the economic importance of the forest to Big Horn, Johnson, Sheridan, and Washakie Counties as it revises the Forest Plan.
 - The Wyoming State Fair was able to show the economic benefits of the construction of an equine center at the State Fair Grounds.

- Uinta County has been able to get the USFS to consider the effects of the Wasatch-Cashe Forest Plant revisions on the local economy.
- The Wyoming Economic Atlas Web site provides timely information to the people of Wyoming and includes all the Trends series publications. In 2002, the Web site served over 26,000 sessions.

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. Participants in the Women's Ag Symposium indicated their knowledge improved (82 percent), their skill/ability improved (56 percent) and their confidence improved (64 percent). Participants in workshops and classes could identify new knowledge gained, and follow-up evaluations showed over 60 percent of individuals were implementing some change in practice as a result of educational efforts.

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

d. Scope of Impact – State Specific

Multi-state Research (W-194) (CO, MT, NY, WA, WY)

Integrated Research and Extension

Key Theme – Youth Development/4-H

- Positive youth development is a process of growing up and developing one's capacities in positive ways. (Walker & Dunham, 1994). This development typically takes place in the context of family, peer group, school, and community. 4-H becomes part of the total contextual environment for positive youth development. The length of time keeping youth actively involved in 4-H makes a difference in terms of asset and skill development. UW CES has a proven track record of successfully teaching youth life skills through the 4-H program. Life skills were defined as communications, problem solving, planning ability, decision making abilities, striving for excellence, leadership, and interpersonal relationship building. Wyoming had 6,299 youth and 2,777 volunteer leaders enrolled in the traditional 4-H youth program. Over 120 workshops, camps, and clinics were held in counties throughout the state reaching over 3,400 youth.
- 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, self confidence, and develop interpersonal skills. One hundred percent of members could identify one thing they had learned and how they could use the information in their project work. 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.

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 tests, 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 2,777 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. Four hundred forty-seven leaders attended 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.

4-H volunteer leaders are required to complete a screening process conducted by the Department of Family Services. This was the second year for the new component which included a potential criminal background check. Approximately 900 leaders were screened either for the first time as new volunteers or re-screened after the initial five-year screening time frame. Leaders going through screening receive leader certification training on risk management and the 4-H program.

Three educational videos were produced and/or provided to each county for use in teaching leaders and youth about poultry showmanship, scrapies in sheep, and sheep quality assurance.

b. Impact - Over 447 volunteer leaders, approximately 16 percent of the total 4-H 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 86 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. In Wyoming the U.S. Forest Service, Bureau of Land Management, National Park Service, U.S. Bureau of Reclamation, and U.S. Fish and Wildlife Service control a combined 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. In recent years, the management of federal lands has become much more contentious with the number of interest groups with divergent concerns becoming more involved in the planning process. One area of debate that is of particular importance to Wyoming is the economic implications for local communities of alternative federal land management decisions. Often these discussions are based on emotion rather than solid economic information. As a result, federal management agencies, state government, and local governments in Wyoming and the West, all have a need for reliable information on the effects of federal land management decisions on the economies of local communities.
- b. Impact – Economic analyses provide information on the impacts of public land activities and policies. As a result of these efforts, federal land management decisions in Wyoming have been improved through the addition of more relevant information. For example, information from the economic analysis of snowmobiling in Wyoming was used by state government to respond to the National Park Service’s Winter EIS for Yellowstone and Grand Teton National Parks. Study results of specific National Forest Plans are being used in the on-going Medicine Bow National Forest Plan Revision and will be used in the upcoming Bighorn National Forest Plan Revision. Using information for these studies, local officials have been able to more effectively express their concerns regarding the effects of federal land management decisions on their communities.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – State Specific
 - Multi-state Integrated Research and Extension (W-133)
 - (CA, CA-D, CO, CT, GA, IA, MA, ME, MI, MN, MT, ND, NH, NM, NV, NY, OH, OR, PA, SC, TN, UT, WA, WV, WY)
 - Integrated Research and Extension

Civil Rights – Diversity

Key Theme – Multi-cultural and Diversity Issues

- a. The Extension Civil Rights coordinating committee conducted six 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. Training was also provided to Experiment Station staff at their annual meeting.

- b. Impact – All 27 Cooperative Extension county offices have gone through a comprehensive training and assessment review on Civil Rights and Diversity. Forty-five percent of county CES staff have written Civil Rights into their individual or county plans of work. Other counties will be writing Civil Rights goals into plans of work as directed by state administration when performance appraisals are complete. 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:

The economies of Wyoming communities, personal finances, and family and child development were identified as high priorities by Wyoming residents. University of 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. Children, youth, and families-at-risk have been major foci of child and family researchers and educators at the University of Wyoming. Researchers in this program area participated in five Hatch projects and all five are multi-state projects. The research efforts include about 2.5 FTEs and expenditures include \$.26 million Hatch and \$.37 million State.

Cooperative Extension Service FTEs	38.79
Goal 5 Allocated Funds	\$3,243,740.00

Goal 5 – IMPACTS

ISSUE: 4-H is changing lives one member at a time

In this, the 100-year anniversary of 4-H, it is appropriate to take a look at where 4-H came from and where its supporters hope to go. In the past 100 years, countries fell and new countries sprang to life, men walked on the moon, and new technologies were developed which connected the world. 4-H remained constant, giving youths the opportunity to unlock their potential.

What has been done

The goal of 4-H is to foster youth development by teaching young people valuable life skills that will enable them to become the leaders of tomorrow. This goal is accomplished by providing formal and informal community-focused experiential learning and by fostering leadership and volunteer opportunities. Sometimes 4-H youth educators focus too intently on teaching project-specific knowledge and lose sight of the big picture: promoting positive youth development. That is why it is important to keep the focus on developing life skills and promoting 4-H as a youth organization that is helping make the world a better place.

Impact

Comments from 4-H members illustrate the impact the organization has had on their lives:

“When I first started 4-H, I was not very involved in anything. In fact, my first few years I didn’t even complete the one project I signed up for. I then started going to Leaders’ Council meetings and found out how much fun 4-H could be. Two years ago, Warren Crawford persuaded me to start teaching classes on fly tying. Since then, the list of classes I have taught has grown considerably. Before, I could never have gotten up in front of a bunch of people to talk, much less teach. 4-H has made me discover a different part of me that I never knew existed.” *Zach, 17, six-year 4-H member*

“I like to encourage, teach, and help others any chance I get. I am really glad that leadership is a part of 4-H. I truly believe that 4-H is one of the reasons I have so many leadership qualities within my self.” *Antenniell, 15, seven-year 4-H member*

“4-H helped me become a better citizen. I used to do nothing for my community, but now after I joined 4-H I also joined girl scouts. 4-H has helped me be a better person because now I do everything I can for my community, and that gives me a better feeling about myself.” *Maelee, 10, two-year 4-H member*

“As I look back on the last decade of my life in 4-H, I don’t think of the ribbons I won, awards I received, or even the contests I placed well in. I think only of the people I have met and the experiences I’ve had. The projects and contests didn’t keep me in 4-H, rather it was the friendships and importance of making a difference. As I say goodbye to 4-H, I realize that I will never have to say goodbye to the memories, experiences, and friends I’ve gained through this wonderful program.” *Adrielle, 18, ten-year 4-H member*

Involvement in the 4-H program can be a life-changing experience. Whether members are in the first few years or the last few years of the program, the life skills they learn will last a lifetime.

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ISSUE: Freedom rings true to 4-H Motto, “To Make the Best Better”

Due to the tragedy on September 11, 2001, in New York City and at the Pentagon, many people have been considering what it truly means to be an American citizen. Freedom, independence, opportunity, and integrity are American ideals that are often taken for granted. These ideals are supported by 4-H, a foundation-building organization for young people. To promote the 4-H motto of “Make the Best Better”, Project Freedom Rings was designed by 4-H to generate a

heightened public awareness and commitment to the citizenship and freedom bestowed upon each American.

What has been done

Campbell County is faced with rapid population growth. Gillette has grown from 19,000 people in 1999 to 23,000 in 2002. To help promote leadership skills, positive attitudes, and personal pride among the increasing number of youths in the area, the UW CES looked to Project Freedom Rings.

For the program, CES offered a two-day educational tour with a motivating and inspiring curriculum that not only taught but also allowed for complete participation and practice in the areas of citizenship, parliamentary procedure, character, 4-H officer training, community service/congressional awards, and public speaking. Values and skills important to youths and adults in American society were stressed along with a true appreciation for American culture.

Hour-long sessions taught by 4-H leaders, staff members, volunteers, and young people reached 61 participants. The highlight of the two-day workshop was a true-to-life account of the situation at ground zero in New York City by Stu Anderson, emergency management coordinator for Casper.

Impact

Sixty-one youths and adults from Campbell County showed that they were capable of using parliamentary procedure in meetings and that they felt comfortable with the process. Of the participants, 16 teenagers from the YES House Crisis Shelter formed their own youth council in the house for the first time and began having meetings. The council has elected officers and plans to enroll at least eight teens from YES in the 4-H program. CES 4-H leaders will teach projects in areas like woodworking, leathercraft, and technology. A medal of honor was presented to each participant in the graduation ceremony at the end of Project Freedom Rings, and all the YES House teens wore their medals in a Fourth of July parade, in 2002.

Participants learned flag-folding, flag etiquette, the history of the flag, and proper flag placement. Character workshops focused on respect, responsibility, caring, trustworthiness, citizenship, and fairness. The youths also learned team-building skills which have been used not only by the YES House teens but also by other Campbell County 4-Hers in their club work and community service projects. The young leaders in Campbell County who participated in Freedom Rings have since taught six leadership workshops. Seven of the young leaders who participated made presentations, including one on flag etiquette, at the county presentation contest. Just two presentations were made the year before.

Eighty-one percent of the new 4-Hers who attended Project Freedom Rings ran for club offices in the fall. In addition, 96.7 percent of the participants reported that Project Freedom Rings was worthwhile, and 93.4 percent said that they would use the information they learned in their club activities or in their daily lives. All of the participants reported that they could name at least two ways to do community service projects. Additionally, five youths reported that they would begin to work on congressional awards in the fall of 2002.

Participants, leaders, and parents involved in Freedom Rings commented:

“Are you going to have Freedom Rings next year? I would love it.”

“This was really an educational experience for all. Thanks!”

“I now know that one should say ‘I move,’ not ‘I make a motion.’ I have been saying that for years.”

“I’m going to start my congressional award; will you help me figure out projects to do?”

“Please call if you need excellent quotes on Freedom Rings.”

Project Freedom Rings was successful in developing lifeskills consistent with American ideals and lifestyles. All participants now know how “To Make the Best Better!”

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ISSUE: Facilitation is both Science and Art

Being part of today’s workforce means going to meetings, working in groups, and being part of teams. Even in the home, families gather to talk.

Meetings help people plan, strategize, advise, implement, and evaluate their progress toward goals. With so many important goals to achieve, skilled facilitation has become increasingly important in organizations, businesses, and communities.

Developing skills involves learning about the ladder of inference, questioning, listening, agendas, conflict resolution, interventions, preventions, and process skills.

The community economic development pyramid suggests that a strong foundation of effective leadership is critical for future economic success. Leaders skilled in facilitation know how to achieve group results.

What has been done

To promote the learning of meeting skills, the University of Wyoming Cooperative Extension Service (UW CES) of Park County offered five two-day workshops in “Facilitation: The Science and Art” during 2002.

Impact

A total of 102 people across the Big Horn Basin from all walks of life—government agencies, health care, education, chambers, banks, organizations, and community colleges—attended the trainings. In addition to receiving a background in facilitation, participants experienced hands-on interventions and learned tools to demonstrate the use and effectiveness of interventions in various situations. Continuums and a “talking wall” showed ways to involve everyone in meetings. Brainstorming in a graffiti style demonstrated a different way to generate ideas. Tools

like flipcharts, portfolios, and paper and pencil worksheets along with sharing ideas gave participants many choices to use to improve productivity in meetings. By the end of the second day, participants rated the course an average of 4.8 on a 1 to 5 scale (with 5 meaning very good) and requested a second level of training with role-plays and information about how to critique personal skills in a fishbowl-like format.

A follow-up evaluation was mailed several months after the course.

Participants wrote:

- *“I used it in the community setting. It involved forming a committee to look into community issues. The process went smoothly thanks to the skills I learned, and I felt comfortable in how I handled the group.”*
- *“In my workplace we have become facilitators at our department meetings. Each week we have a department staff meeting, and each month we choose someone to facilitate. It has been a great success as we are much more productive and on task. We have shortened meetings by 30 minutes.”*
- *“As a volunteer in an organization, I was able to help members discuss differences and work out solutions.”*
- *“At meetings I can now figure out what the facilitator is up to, where he/she wants the group to go, etc. I have used some of the techniques for clarification, even a one-on-one level, e.g., paraphrasing what someone said to make sure I understand and asking probing questions.”*
- *“I have been a more able participant in ID teams and group meetings. I have also developed a much deeper respect for the work that goes into being the facilitator, especially with a confrontational group of people.”*

When asked the most significant thing they remembered from the training, respondents answered:

- *handling conflict and challenging situations*
- *working in groups to solve problems and make decisions*
- *ground rules and use of flipcharts*
- *involvement by all participants and listening*
- *learning what type of leader I am and how to use that to an advantage*
- *different ways to gather opinions*
- *how helpful the training was for use in being a member of a group, not just as a facilitator*
- *how to listen with your eyes as well as your ears*

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ISSUE: SCOPE Financial Management Training

- The average family has 10 credit cards.
- Almost 50 percent of American families don't pay their entire credit card balance each month. The average balance due is \$4,000 at 18.9 percent.
- Consumer debt is big business. In the late 1990s, the total consumer debt exceeded \$1,230 billion.

To help teach high school students how to avoid financial traps, the local employment office, which serves both Johnson and Sheridan Counties, initiated a new program in the spring of 2002 called SCOPE. It is a special program that invites a small number of young people who are pursuing GEDs to participate in life-skills coursework while preparing for their examinations. The students are taught job and workplace skills, financial management skills, and more.

What has been done

The UW CES participated in their pilot program, presenting information on credit cards, debt, basic budgeting, checking accounts, loans, savings plans, and insurance. Six hours of financial management instruction were included in each SCOPE training session.

Ninety percent of the 17 students first involved in the SCOPE courses did not understand the difference between "credit limits" and "money" in relation to credit card usage. Sixty percent were from families that were struggling or had struggled with financial issues. Eighty percent considered credit cards and their use "desirable" and a sign of adulthood. None of the students knew what the term "annual percentage rate" meant.

Impact

At the end of the courses, the students were able to define an annual percentage rate and how it related to the use of credit cards and the balances carried on credit card accounts. A total of 95 percent of the students recognized that credit cards extended their users short-term, high-interest loans rather than actual money, and 30 percent of the students said they intended to share some of the knowledge they had gained with their parents. The students established personal goals in relation to their current and future budgets, their use of credit cards, and their plan for saving money for emergencies and retirement.

After learning how interest compounds and the benefits of establishing savings towards retirement beginning at 18 or 20, one student asked, "What do I need to say when I go to the bank to start doing this?" His question was answered, and he was also told that by investing \$18,000 over the next nine years, he could have as much as \$570,000 waiting for him in a retirement account. In the short term, a commitment to saving money would help him be able to purchase his first vehicle and his first home.

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ISSUE: 4-H Animal-Care as Therapy for At-Risk Youths

Animals have long provided positive benefits to individuals such as hospital patients, nursing home residents, prison inmates, and disabled people. Animals can also play an important role in adolescent development. As a source of love, companionship, and responsibility, animals can help smooth the transition from childhood to adolescence to young adulthood.

Research has indicated that animals might have special meaning to children and youths who are at-risk emotionally, socially, or behaviorally. These young people often have poor self-esteem and difficulty maintaining relationships. Many have suffered abuse or neglect from parents or caretakers. A dynamic in abused children and youths is identification with aggression. Adolescents may either believe they are at fault for the abuse, or they may transfer abusive behavior toward others. It is believed that encouraging nurturing traits through the careful introduction of companion animals may reduce antisocial behavior in young people.

What has been done

To capitalize on the potential benefits of connecting animals with at-risk youths, the Sheridan County CES joined with others to develop a 4-H animal-care program at the Wyoming Girls School (WGS), a state residential childcare facility located in Sheridan. Funding for this program was provided by UW CES's Children, Youth and Families at Risk (CYFAR) and local foundations. The students are 12 to 18-year old girls who have been court-ordered to the facility for rehabilitation as a result of inappropriate delinquent behavior or offenses.

Approximately 40 WGS residents participated in the animal-care program by working with miniature horses, llamas, goats, cattle, and rabbits. Students were responsible for the daily care of feeding, cleaning, gentling, grooming, and training the animals as well as completing a daily responsibility chart.

Impact

The girl's school residents, in self-assessments of their 4-H experiences, reported that their animals provided a therapeutic effect by serving as teacher, listener, comforter, distracter, and friend.

Animals as teachers. Working with the animals taught the residents valuable life skills. As the students observed, even though the animals were "corrected" as they were being trained, they continued to work with the students. The girls became more self-aware and were able to see and learn from a situation where animals are corrected in behavior and still loved.

Animals as listeners. Throughout their lives, many WGS residents have learned that it is dangerous to talk to others. Communication involves the risks of ridicule, sarcasm, criticism, and vindictiveness. However, many of the young women said that their animals seemed to listen; they provided unconditional, empathetic, non-verbal feedback and were a good sounding board as the students worked through personal issues.

Animals as comforters. Grooming animals has a therapeutic effect for many people. Several of the WGS residents come from families where positive emotions, hugs, and comfort are not expressed. Grooming the animals allowed the students to feel and touch in a calming way. Grooming the soft fur of the rabbits or the shiny coats of the horses was comforting to many of the students.

Animals as distractions. The school treatment plan for the residents includes dealing with personal issues. Training animals allowed the students to focus on the present moment and proved a temporary distraction from the stress, pain, and anxiety they were experiencing.

Animals as friends. A term repeated frequently in the assessments by the residents was that their animals were “friends.” In an environment where young women were dealing with problems of trust and broken relationships, the animals provided unconditional, uncompromising friendship. The residents often gave human-like qualities to this friendship, calling the animals “someone I could talk to,” “someone I could hold,” “someone who would listen.” One student summed up the importance of this friendship.

“The bunny program has benefited me in many ways. Most of all it gave me a friend. When I was struggling, I was able to go out there and hold it and even sing to her. It was really comforting to know that she was there to help make me feel good. It was also a good feeling because she relied on me. I have really never been needed, and she needed me. She counted on me to give her food, water, and attention.” (WGS resident, age 16)

For those who have worked with animals in 4-H, their value in the physical, emotional, and psychosocial development of children and youths is well known. But for many at-risk youths, interacting with animals is a new experience and one that appears to have therapeutic value.

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ISSUE: *Wonderwise* – Science and Career Aspirations Combine in a New Youth Curriculum

News flash! Understanding science is desirable in an increasingly technological and urbanized world.

News flash! There are many rewarding career opportunities for people with training in science.

News flash! Women and ethnic minorities are not represented proportionately with Caucasian males in science careers.

News flash! The percentage of the total youth population interested in traditional “cookin’, sewin’, and cows” 4-H projects is decreasing.

Editorial Opinion: To remain relevant in the 21st century, 4-H must embrace science, technology, and additional audiences.

What has been done

A new science curriculum called *Wonderwise* that responds to the situation described above has been introduced to the Wyoming 4-H youth development program. Developed by the University of Nebraska, *Wonderwise* was not originally designed with informal education in mind, but in many ways it is ideal for 4-H. *Wonderwise* is committed to the same “learn-by-doing” philosophy that characterizes 4-H at its best. The program is designed for youths in grades four through six; precisely the age group comprising the bulk of 4-H members. It personalizes science by focusing on particularly charismatic female scientists and building learning activities related to their work. Science thus becomes less intimidating than it often is through the typical disciplinary approach. Because all of the featured scientists are female and many represent minorities of the U.S. population, youths see excellent and diverse role models for scientists. The curriculum can be used by individuals or in a variety of group situations including clubs, camps, and after-school projects. The *Wonderwise* program has been specifically modified with 4-H in mind, now including suggestions for fair exhibits, presentations, and service projects in the teaching materials. Each *Wonderwise* kit contains a beautifully photographed video of a featured scientist and her work. The kits also contain an interactive CD ROM and a series of hands-on activities related to featured scientists’ work. These activities highlight the process and content of science, but they also include topics related to geography, art, human nutrition, learning games, etc.

Three and a half years ago, the people who developed *Wonderwise* received a major grant from the National Science Foundation to produce new modules and to modify all previous modules for informal educational settings, specifically 4-H programs. Crook County CES was asked to represent Wyoming 4-H in a pilot project to suggest new lessons and modifications of old ones and to field test the materials, train 4-H educators and leaders in the use of *Wonderwise*, and generally promote its use. Training on *Wonderwise* was conducted for UW Educators, and 4-H Program Associates. Volunteers from 13 Western states participated in *Wonderwise*’s training at the Western Regional Leaders Forum hosted by Wyoming.

Impact

Wonderwise has been used extensively for two years in the 4-H after-school enrichment projects in Moorcroft and Sundance, funded by the Children, Youth, and Families at Risk (CYFAR) initiative of the U.S. Department of Agriculture. *Wonderwise* has also been used in the Healthy

Communities/Healthy Youth program in Hulett. The program at the 2001 Weston-Crook 4-H Camp at Mallo Canyon was built almost completely around Wonderwise, and the new modules were a major part of the 2002 camp. Classroom teachers in the Crook and Park County school districts have also used the materials. Several individuals used Wonderwise as the basis for self-determined 4-H projects. Evaluation in all of these contexts indicates that Wonderwise accomplishes all of its goals: teaching science processes and content and making it fun, stimulating youths to consider careers in science, and breaking down gender and ethnic stereotypes about who can become scientists.

A strong effort has been mounted to train extension personnel and volunteer leaders to use Wonderwise. In May of 2002, CES educators taught a two-day workshop in Jackson, Wyoming, at which CES personnel from eight additional Wyoming counties, the Wind River Indian Reservation, and seven additional adult volunteers were trained. Wonderwise has already enriched the lives and experience of several hundred Wyoming youths, and it will continue to expand as a resource in the coming years.

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ISSUE: Federal land policy economic analysis

The federal government manages much of the land area in the Western United States. In Wyoming, the U.S. Forest Service, Bureau of Land Management, National Park Service, U.S. Bureau of Reclamation, and U.S. Fish and Wildlife Service control a combined 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. In recent years, the management of federal lands has become much more contentious with the number of interest groups with divergent concerns becoming more involved in the planning process. One area of debate that is of particular importance to Wyoming is the economic implications for local communities of alternative federal land management decisions. Often these discussions are based on emotion rather than solid economic information. As a result, federal management agencies, state government, and local governments in Wyoming and the West, all have a need for reliable information on the effects of federal land management decisions on the economies of local communities.

What has been done

The following is a listing of activities associated with federal land management planning efforts in Wyoming and the Western United States during the past year. These efforts provide important information used to assist in the planning process to make decisions that are critical to the future of Wyoming.

- Review of Wasatch-Cache Forest Plan Revision as it relates to Uinta County and participate in a collaborative effort between the U.S. Forest Service and the County Commissioners. These discussions have generated a separate economic analysis for Uinta County.
- W-192 Multi-state Committee – This committee is a regional effort that focuses on the relationship between federal lands and rural communities. The committee is working to combine firm and community level economic analysis with the social impact analysis. A pilot project on livestock grazing is currently being conducted in Fremont County.
- Review of the Thunder Basin National Grassland portion of the U.S. Forest Service’s Northern Great Plains Management Plans Revision. Participated in government-to-government discussions regarding the draft EIS at the request of the Wyoming Office of Federal Land Policy. These discussions involved the Forest Service, state government agencies, and county commissioners. The results of these discussions were incorporated into the final EIS for the Thunder Basin.
- An economic analysis of snowmobiling in Wyoming for the Wyoming Department of State Parks and Cultural Resources. The information from this study was used by State government to respond to the National Park Service’s Winter EIS for Yellowstone and Grand Teton National Parks. Study results are also being used in the on-going Medicine Bow National Forest Plan Revision and will be used in the upcoming Bighorn National Forest Plan Revision. Participated in a review of research related to the Winter EIS for the Wyoming Department of State Parks and Cultural Resources, through the Institute for the Environment and Natural Resources. Reviewed the economic studies used in the Winter EIS for the National Park Service. Also updated an analysis of the economic importance of winter visitors for the Park County Commissioners. The county commissioners used this report as part of their response to the National Park Service on the Winter EIS as a cooperating agency.
- Updated the economic analysis of the Jack Morrow Hills CAP for the BLM to incorporate revised alternatives. This analysis will be used by the BLM in decisions regarding natural gas development in the Jack Morrow Hills area of Wyoming.
- An economic analysis of the Bighorn National Forest Plan Revision for the U.S. Forest Service. The analysis considers livestock grazing, timber, recreations, and USFS operations in Big Horn, Johnson, Sheridan, and Washakie counties. In addition an economic profile was developed for each county. This analysis will be used by the Forest Service in decisions regarding the future use of the Bighorn National Forest. This is a collaborative effort between the University of Wyoming, U.S. Forest Service, and the State of Wyoming.
- An economic analysis of the Medicine Bow National Forest Plan Revision for the U.S. Forest Service. The analysis considers livestock grazing, timber, recreations, and USFS operations in Albany, Carbon, and Converse Counties. In addition an economic profile was developed for each county. This analysis will be used by the Forest Service in decisions regarding the future use of the Medicine Bow National Forest. This is a collaborative effort between the University of Wyoming, U.S. Forest Service, and the State of Wyoming.
- Payments in Lieu of Taxes (PILT) are an important source of revenue from the federal government for county government in Wyoming. However, the calculation of PILT payments is not well understood and may be affected by federal agency management

decisions. To assist in the understanding of these payments a set of fact sheets have been developed annually for the last four years. These fact sheets summarized the PILT calculation for each county in Wyoming.

- A regional investment analysis of coalbed methane development is being developed for a coalition of county governments in Northeast Wyoming. This analysis will be used by the counties to evaluate the fiscal impacts of coalbed methane development.

Impact

As a result of these efforts the decision making process regarding federal land management decisions in Wyoming has been improved through the addition of more relevant information. In addition, local officials have been able to more effectively express their concerns regarding the effects of federal land management decisions on their communities. The University of Wyoming is now seen as a reliable source of technical information regarding economic issues associated with federal land management.

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B. Stakeholder Input

The UW CES is continuing the 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 experiment station will be built to replace the two existing stations. Stakeholder input will come to the College of Agriculture Cooperative Extension Service and Agricultural Experiment Stations through a variety of methods. A joint research and extension needs assessment process is underway as outlined in the Plan of Work written for Wyoming 1999-2004. Focus groups were conducted in eight areas of the state to determine a vision for the College of Agriculture. During the same period, the Wyoming Department of Agriculture has developed a strategic plan and utilized focus groups to determine agricultural research needs in the state. Information from both focus groups was used to develop an issue based needs assessment survey instrument. The development of the needs assessment instrument and internal review through UW human subject panel has extended the time line for the needs assessment. It is scheduled to be mailed spring 2003. Due to the delay, findings from the needs assessment will be used not only for development of current programs and research efforts but will be utilized as we develop our next four year POW. A stratified sample will be used to determine program and research needs in the state. The survey will also address preferred delivery methods by Wyoming citizens. Stakeholder input gathered through all methods will be shared with CES initiative teams comprised of field educators, extension specialists, UW department heads, and administrators. Information will be used in development of CES programs and applied research.

As described in the CES strategic plan, advisory committees have formed in the nine Extension areas. The 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. CES associate directors and local county commissioners provide approval of advisory committee members. In addition, the Director of CES has formed an advisory committee of County Commissioners who meet during quarterly meetings of the Wyoming County Commissioner's Association.

In the past year approximately 50 percent of Wyoming counties utilized advisory committees to determine county program direction. 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 have in the past year, 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. Each of the four 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 & Consumer Sciences, and Veterinary Sciences, have separate advisory committees that provide input on programs in those departments.

C. Program Review Process

A merit review was not conducted in FY 2002.

D. Evaluation of the Success of Multi and Joint Activities

(1) As outlined in the Stakeholder input section, the UW CES and two of the R&E Centers went through a strategic planning process. Because of the two reviews, changes are currently in process that will affect the 5-Year Plan of Work. CES has received approval from the UW President's Office to proceed with implementation of the strategic plan. AES will be closing two stations and building one in a new location 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 Enhancing Wyoming Communities and Households.

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 18 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. WIN the Rockies is an example

of a successful multi-institution research effort which combines efforts of UW with Montana and Idaho. 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.

(2) When developing the individual's plans of work, they either included a separate plan to address diversity or included 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 hiring two bi-lingual coordinators for the Cent\$ible Nutrition program, preparing nutrition materials in Spanish, developing a business course for youth and adults on the Wind River Reservation, developing a gardening course for the Honor Farm incarcerated, and involving Girl's School residents in the 4-H program.

There are 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, NC-223 and WIN the Rockies. However, researchers need to continue to seek ways to better address the needs of these population groups in their future efforts.

(3) The programs describe 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.

(4) 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. However, the multi-state activities have not been auditable. 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 AESIS (Accountability, Evaluation System Information Software).

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, 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.

Appendix C

**U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)**

Institution University of Wyoming
State Wyoming

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

Title of Planned Program/Activity	Actual Expenditures				
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
<u>Goal 1: Enhance agricultural systems that are highly competitive in the global economy</u>			<u>309,919</u>		
<u>Goal 3: Enhance a healthy, well- nourished population</u>			<u>46,246</u>		
<u>Goal 4: Enhance greater harmony between agriculture and the environment</u>			<u>98,548</u>		
<u>Goal 5: Enhance economic opportunity and quality of life for Americans</u>			<u>127,182</u>		
Total			<u>581,895</u>		


Director

3/11/03
Date

Form CSREES-REPT (2/00)