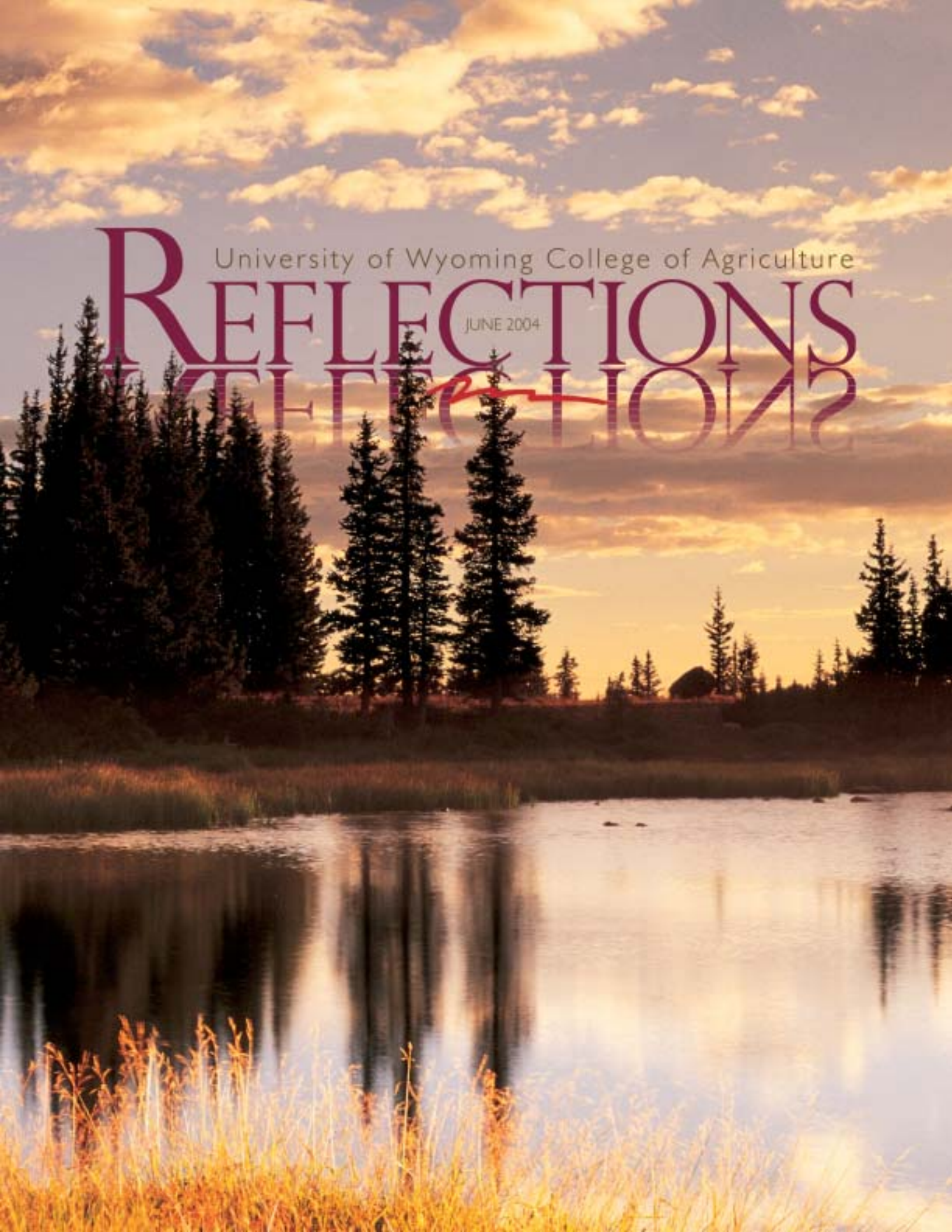

University of Wyoming College of Agriculture
REFLECTIONS
JUNE 2004

"With personnel in every county and with centers located across the state, the College of Agriculture is working hard to provide research and outreach outcomes that are responsive to stakeholder needs."

Jim Jacobs

Sustainability is a term that has been applied to everything from wildlife populations to agricultural production practices to rural communities. When asked, both individuals and groups often find it a challenge to define or outline what sustainability actually means.

Most descriptions, however, touch on the following three components: 1) maintaining or enhancing the resource base, 2) securing economic viability, and 3) achieving acceptance by society. To incorporate these, research and outreach efforts designed to support sustainable systems for Wyoming's agriculture and rural communities require cooperation and collaboration among educators, researchers, and stakeholders.

Located throughout the state, the research and extension centers are one of the resources the University of Wyoming's College of Agriculture has that provides unique opportunities for teamwork with different entities to occur. Through direct contact with stakeholders, researchers and extension educators obtain information and feedback on local issues and needs. Once a concern is identified, the centers serve as field laboratories used by faculty members and students to conduct research on specific needs as well as on sustainable systems for Wyoming's agriculture. The end product is research-based educational materials and programs delivered to residents of the state.

As field laboratories, the research and extension centers play an essential role in this continuous cycle of identifying stakeholder needs, conducting relevant research, and disseminating results.

During the last several years the College of Agriculture has worked with its constituents to reorganize and enhance these centers to provide

THE RIG

field laboratories that encourage studies on sustainable systems and on alternatives for Wyoming's agriculture. With personnel in every county and with centers located across the state, the College of Agriculture is working hard to provide research and outreach outcomes that are responsive to stakeholder needs.

For more information about the College of Agriculture, visit the college's Web site at www.uwyo.edu/agcollege or contact any of the departments listed on the inside back cover. Better yet, stop by one of the research and extension centers, the county offices, or the campus facilities. We will be happy to show you around and to listen to your ideas. Through cooperation we can identify sustainable systems for Wyoming's agriculture and rural communities that are environmentally friendly and economically viable.

This year's *Reflections* highlights field laboratories of all kinds in which UW employees and students conduct and apply research throughout the corners of Wyoming. I hope you enjoy it.

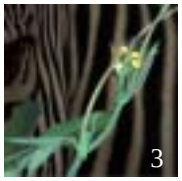
This issue is dedicated to Ronald Delaney, professor of plant sciences, who retires August 31, 2004. Delaney provides an excellent example of the land-grant philosophy, having served the university and the state for more than 30 years with his teaching, research, and outreach activities. Congratulations, Ron, and best wishes for your future.

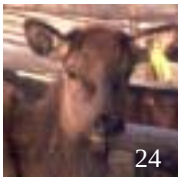
Director and Associate Dean
College of Agriculture
Agricultural Experiment Station

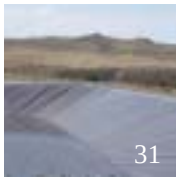
Jim Jacobs, left, meets with research and extension center directors Jim Freeburn (Archer and Torrington), Roger Hybner (Sheridan), and Alan Gray (Powell).

GIVE US THE TOOLS
AND WE WILL
FINISH THE JOB.

Sir Winston Churchill (1874–1965)







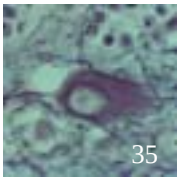
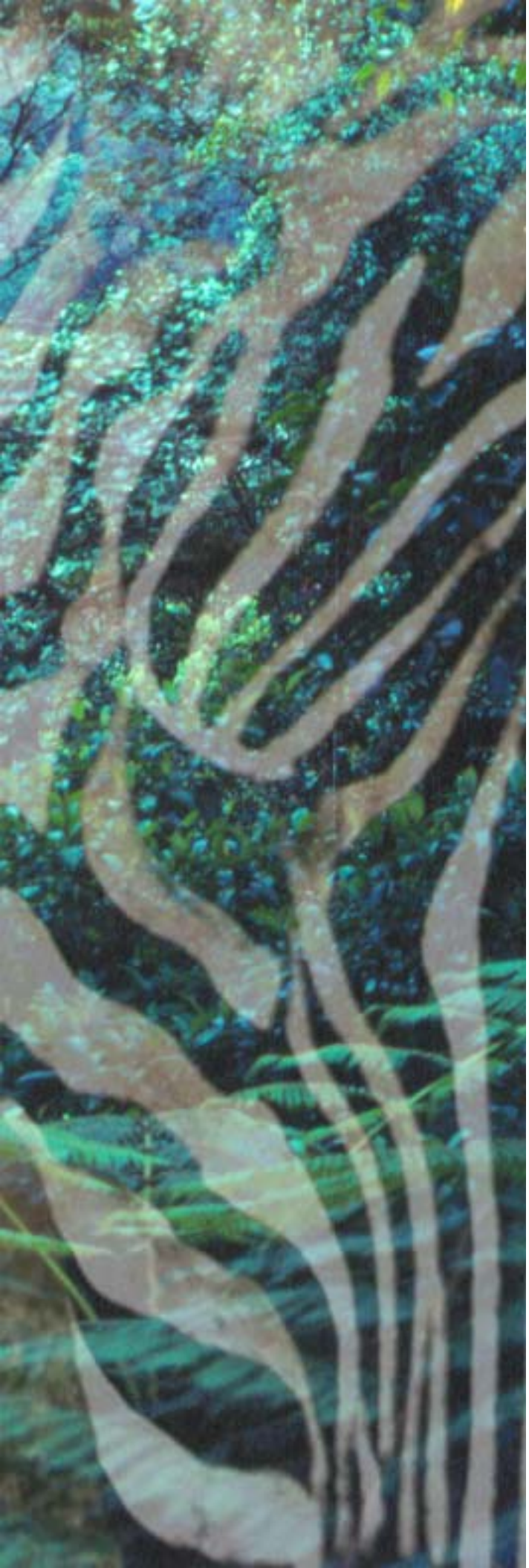


Table of Contents

Feature articles

Research and extension briefs

Collaborative research



Raising ZEBRAS *in* Wyoming

Scott Shaw, Professor, Department of Renewable Resources

For several years now I've been raising zebras at the University of Wyoming as part of an ongoing teaching project for my tropical ecology class. Having live zebras around helps provide my students with a truly unique experience. They are able to study up close the behavior of tropical organisms right here in Wyoming.

One won't find zebras in a local pet store. In fact, to obtain zebras in Wyoming it is necessary to apply for the appropriate USDA permit. That's the first step. Then, once permission to raise the creatures has been obtained, one needs to provide the zebras with a suitable habitat. Being tropical animals, they like it nice and warm and sunny. Ours are kept at 75-80 degrees F during the day and 72-75 degrees F at night. And of course we want to keep them fully contained for their protection. Our zebra space is totally enclosed by glass and fine mesh screens. This keeps the zebras in and also keeps the flies out. We even cover the heater with mesh to keep the zebras from poking inside it with their faces.

I can still quite vividly remember my first encounter with a live zebra in the wild. We were on spring vacation in southern Florida. It was a very hot, sunny day, and we were hiking along a trail near a natural wooded area. Suddenly a lone zebra emerged out of the trees

Zebras are undaunted by the poisonous leaves of passion flowers.

"Suddenly a lone zebra emerged out
It swerved within feet of me and

directly towards me! It swerved within feet of me and then turned back into the forest and disappeared. That was quite an experience for a 12-year-old boy from Michigan.

Now imagine the excitement when our first shipment of zebras arrived. Since there are no wild zebras in Wyoming, we purchased ours from a professional breeder in Texas. They arrived in a box via Airborne Express. Each time a new shipment comes in, I drive directly to the shipping office to pick them up in person. They mustn't get too cold, and it's best to get them out of the box as soon as possible.

Raising zebras means raising lots of plants too. Large plants are needed to provide a proper habitat. Young zebras usually stay very close to their food plants, but the adults like to wander lazily in the sunshine and back into the shade of a forest. They are happiest in a large enclosure with enough small trees to provide some significant shade. At the same time there must be enough open area for them to wander in the light and to provide enough light for their food plants to grow well. They don't really need much water (they get it from the plants they eat), but we have a pond with a waterfall to increase the humidity of the habitat.

Zebras feed on plants, but not just any plants. Adults and young zebras have remarkably different feeding habits. Adult zebras are fairly easy to please provided that they have plenty of flowers. Upon watering the plants, if the leaves are wet, one can sometimes catch a glimpse of an adult zebra sucking drops from them. Otherwise the zebras don't bother with the leaves at all if there are flowers about. Most any flower will do for them, but the more nectar and pollen in the flower, the better they like it. I've had quite good results feeding adults with lantana, jasmine, star of Egypt, and bougainvillea. I've seen it hundreds of times, but it's still fascinating to watch a zebra attempting to get nectar out of a flower with its tongue.

The adults may be picky eaters, but the youngsters are even fussier. Unlike the adults, the young ones like to chew on the leaves of plants, but not just any old plant will do. What they like to eat are the tender young shoots and young leaves of passion flower vines, and not just any old passion flower vines. There are edible passion fruits (try their juice, it is quite tasty), and some of the ornamental flower varieties are quite lovely.

Well, the young zebras could care less about tasty fruit or pretty flowers. They go for wild vines without edible fruits and with rather unimpressive

of the trees directly towards me!
then turned back into the forest and disappeared."

flowers.

And if that isn't strange enough, the leaves they prefer to eat are packed full of dreadful, nasty chemicals. Cyanogenic glycosides, to be precise, and they are so wicked that if one were to eat a leaf (assuming he or she could get past the bitter taste), one would probably vomit (if the bite weren't fatal, which it could be). Virtually no animals are able to eat the poisonous leaves of the passion flowers, but those silly little zebras not only gobble them down but also convert the horrible chemicals into their own defensive chemicals to help protect them from predators. Those little zebras are such finicky eaters that they would sooner starve to death than eat anything other than nasty passion flower leaves. The youngsters won't nibble as much as a single bite of lettuce or alfalfa.

Unfortunately, there is one other thing that the young zebras will eat. Sometimes they will eat each other. Under crowded conditions the picky little eaters often turn cannibalistic. Oddly, when they are very young they tend to feed in small groups for their own protection from predators. But once they gain some size, those same individuals are liable to turn around and consume their smaller brothers and sisters. To avoid watching the process, one can move them around or keep them separated. But then there is likely to be a population explosion. They would eat all their food plants, and they would starve to death anyway. That's nature for you!

On any given sunny day one can see all the zebras feeding, but the adults spend much of their time in more mature pursuits. Although the males and females look rather similar from a distance, it's easy enough to tell them apart by their behavior. The males are rather intent on finding females and spend most of their time patrolling and guarding territories where virgin females are to be found. They can be quite aggressive. Once a male finds a receptive female, he will guard that mate against all others. In an enclosed space there can be a lot of aggressive interactions. Likewise, in a caged space the competition for mates is fierce, and it's not unusual to see two males attempting to mate with the same female.

I suppose people have heard about the duck-billed platypus in Australia laying eggs and all that. I'd bet that most people don't realize that zebras lay eggs, too. They really do. It's just that their eggs are really tiny, and the zebras are really secretive about where they put them. But if an observer picks a female, follows her around, and watches really closely, the spy is bound to see eggs produced. A female zebra will lay a few eggs each day, gluing them very carefully right onto the poisonous plants that the young zebras prefer. Over the course of her adult life, a female zebra can lay quite a few eggs.

As fascinating as it is to watch the zebras in the sunlight, my favorite time for viewing them is at night. By day the adults are moving around a lot, and it's rather difficult to count them all. But at night the adult herd gathers to-

Photo by Kenji Nishida

Wild zebra butterflies sleep together in a Costa Rican forest.

A zebra caterpillar rests on a passion flower vine.

gether in a group to sleep. They snooze so soundly that a person can literally move within inches of them without disturbing them.

Last spring students from my tropical ecology class made a daring night visit into the zebra compound. Flashlights in hand, we sneaked into the enclosure. At night the zebra habitat has a special feel. The shadows of the plants make the caged area seem much larger. It's much quieter than by day. There's no noise from the cooling fans. At night the sound of the waterfall dominates the space. The air is filled with the aromas of orchids, jasmine, and trumpet flowers.

"Where are they?" ask the students.

"Look around, you'll find them." I reply. It ought to be easy enough to spot a herd of black and yellow striped animals.

"There they are!" The "oohs" and "aahs" are inevitable. We have stumbled upon a herd of 20 sleeping zebras. The students didn't spot them at first. They were resting in a small tree about 4 feet off the ground. All 20 adult zebras were hanging by their toes in the branches, sound asleep. Our noise didn't bother them a bit.

Well, by now the reader is either very confused or has long since decided that the writer is thoroughly wacky. Wild zebras in the Florida woods? Zebras in FedEx boxes? Eggs? Yellow stripes? Toes? Toes??

It's all true, but we're not describing African zebras, are we? We're talking about the zebra butterfly, a native of South and Central America, Mexico, Texas, and Florida. This remarkable animal also happens to be the state butterfly of Florida, so perhaps readers from the Sunshine State guessed the secret sooner.

English is such a remarkable language. Its words are adopted from a wide variety of cultures and other tongues. "Zebra" for example, is from the ancient Abyssinian dialect. Maybe someday the reader can enroll in my tropical ecology class to see our zebras or even spot them while traveling elsewhere. At any rate, it makes for good party conversation to be able to tell everyone all there is to know about raising zebras in Wyoming and to speak in Abyssinian, too.

Who's a clodhopper?

Steven Horn, Professor, Department of Animal Science

A clod is defined as a stupid person, a blockhead, a dolt. A clod is also defined as a lump of soil. On the farm, heavy, dirt-laden work boots were often called clodhoppers. City folks sometimes referred to their rustic, country bumpkin cousins as clodhoppers. Scarcely a day goes by when conducting studies involving coyotes that a researcher does not feel a little like a clodhopper. Coyotes accept nothing and challenge everything. If there is a way to thwart the best laid plans, they will quickly find it, and when least expected, implement it. "Stupid person," they seem to say, with tail held straight, ears erect, and lips retracted into a grin. If species success can be measured by population growth and expansion of range, then coyotes are very successful animals. They have managed this success in the face of a hundred-year war against their kind. Man has shot them, trapped them, poisoned them, dug them from their dens, and hunted them from aircraft. "Clodhoppers," they seem to say in response, a snarl of contempt on their faces as they swallow another $40-plus million a year of livestock.

In general the word "clod" has been used in a negative context. Hopefully, that is about to change, at least in the vocabulary of those engaged in wildlife damage control. And, the term "clodhopper" is about to take on an entirely new meaning.

1. Graduate student Rebecca Buseck, who is researching the use of the CLOD as part her master's program, secures the device in the coyote-proof enclosure at the UW testing facility.

2. Lured by the smell of the attractant, the coyote first rubs and rolls against the mechanism.

3. The coyote chews in earnest through the lard and flax oil covering.

4. Once the bottle of bait has been opened, the coyote licks the contents, thus ingesting the reproductive inhibitor.

The Coyote Lure Operative Device, known by the acronym CLOD, may someday linger on the lips like "coyote getter" or "M-44" but with a less lethal connotation. A relatively simple device consisting of a small plastic bottle affixed to the top of a metal stake, the CLOD was introduced more than 20 years ago as a means of delivering predacides or other active ingredients for coyote management but never received much attention. Its potential lay dormant until recently.

Research conducted during the last several years in the Department of Animal Science at the University of Wyoming has been directed toward developing orally deliverable compounds that can be used to control the rate of coyote reproduction. Doctoral candidate Charlie Stith, a veterinarian, has investigated techniques for preventing or terminating pregnancy in the female and inhibiting spermatogenesis in the male. Antiprogestins, which block the effects of progesterone by preventing ovulation, inhibiting implantation of the embryo, or aborting the conceptus, have yielded overwhelming success in preventing the birth of pups. The administration of an antispermatogenic compound to males has resulted in an abrupt, temporary cessation of sperm production without affecting libido. Associated research projects are ongoing in order to refine the dosage rates, the dissolution properties of the compounds, the development of bioadhesives for sustained release of the contragestive, and time-release microencapsulation of the antiprogestins.

These reproductive inhibitors are attractive to wildlife managers since they are orally deliverable, non-lethal, environmentally safe, humane, and can be presented in bait. But how can the bait be delivered selectively to coyotes while minimizing its exposure to non-target species? The CLOD may be the answer. Rebecca Buseck, a master's candidate, is conducting research on the development of a coyote-specific delivery mechanism for orally activated baits and used the CLOD in delivering reproductive inhibitors to coyotes during the breeding season.

Coyotes demonstrate inherent wariness of anything new in their environment, especially

food. Therefore, baits must be highly attractive, palatable, and have a moderately long "shelf-life" in the extreme environmental conditions of mid-winter when coyotes are breeding. In preliminary research, a mixture of lard and flax seed oil has proven tasty to coyotes while maintaining a semi-solid consistency even at -20 F. A commercially obtained coyote attractant with a fatty acid base serves as the lure. Almost irresistible, the foul-smelling scent, applied directly to the outside of the CLOD, attracts coyotes to the mechanism.

The coyotes usually rub and roll on the CLOD, often stopping to mark their territory with urine, before biting the 30-milliliter Nalgene bottle containing the bait. Once they taste the lard and flax oil, they quickly open the bottle using their specialized carnassial teeth designed for shearing flesh and then lick out and ingest the contents. The fat-loving antiprogestin compound binds with the bait, and both are ingested. The result will be no pups born the following spring. But the adults are left in place, defending their territory against emigrating coyotes. Without a hungry litter to provide for, the adults are less likely to prey on domestic livestock.

It is imperative that controlled studies with sufficient sample sizes be conducted prior to the submission of a new animal drug permit to the Federal Drug Administration. Likewise, the Environmental Protection Agency requires significant proof of environmental safety before allowing the use of reproductive inhibitors in the field. This necessitated the building of a new and larger coyote research facility in order to provide the number of coyotes and experimental replications necessary for statistical reliability.

With funding from the Wyoming Animal Damage Management Board and USDA's National Wildlife Research Center, a new UW facility was constructed. It consists of a 32-kennel coyote block, an examination room, and an observation booth. Additionally, a coyote-proof enclosure was built to allow an approximation of free-ranging behaviors by the coyotes while they are being presented with the bait delivery mechanism (CLOD). If favorable results are obtained from research on captive coyotes, a protocol for limited field trials on free-ranging coyotes will be developed.

Preliminary research results indicate that coyotes hop right on this simple, yet innovative delivery mechanism for oral baits. Now who's a clodhopper?

In the future, Professor Steven Horn and his fellow researchers hope to develop limited field trials of the CLOD on free-ranging coyotes.

THE TROUBLE

Thomas Foulke, Assistant Research Scientist, *Roger H. Coupal, Associate Professor,*

Natural resource issues tend to be particularly polarizing. Southeastern Wyoming is getting a taste of this with the storm over the Preble's Meadow Jumping Mouse, *zapus hudsonius preblei*. This tiny mammal recently found itself at the forefront of controversy when the U.S. Fish and Wildlife Service (USFWS) designated more than 10,000 acres of critical habitat for the creature in Albany, Converse, Platte, and Laramie counties. The mouse, all nine inches of it (including its tail), was designated as a threatened species under the Endangered Species Act (ESA) in 1998. Since that time, USFWS has been studying the mouse to learn more about its habits, the extent of its range, and whether it really is a unique species. State of Wyoming officials have said they have yet to see scientific proof that the Preble's mouse is an identifiably separate species.

According to USFWS officials, the apparent decline of the mouse may be the result of rapidly expanding residential, commercial, and industrial development along the Front Range.

A group of researchers from the University of Wyoming Department of Agricultural and Applied Economics is trying to estimate the economic impact of the protection of the small mouse on the southeastern Wyoming economy. David Taylor, Roger Coupal, and Thomas Foulke are using a grant from the governor's office to estimate the impact on the regional economy. "Agriculture will bear the brunt of the impact since 77 percent of the critical habitat is on private land," says Taylor. "Additionally, 94 percent of that land is used in agricultural production, so producers have a huge stake in seeing this thing through."

UW researchers are studying the economic impact of preserving the water-area homeland of the threatened mouse.

In addition to the concerns facing the UW researchers and Wyoming producers about preserving the water-area homeland of the threatened mouse, they must also tackle issues related to irrigation, livestock grazing, hay production, and ditch maintenance.

The project started in February 2003 with meetings in five southeastern Wyoming counties (Albany, Converse, Goshen, Laramie, and Platte) where the mouse is thought to live. These "listening sessions" set up by local UW Cooperative Extension Service educators were a chance for landowners and interested citizens to air their feelings about the critical habitat designation's potential impact on their enterprises. From the researchers' perspective, it was a chance to collect primary data on the types of practices that could be affected and their resulting costs.

Anger, frustration, confusion, and distrust were some of the sentiments expressed at these sessions. Landowners and community leaders present were unanimous in feeling that the process used in designating the mouse as a threatened species appeared to bypass some of the fundamental tenants of the

WITH PREBLES

and David T. Taylor, Professor, of the Department of Agricultural and Applied Economics

American way of life. Many of the participants felt that the ESA critical habitat designation procedure was an assault on their property rights since most of the proposed habitat was on private land.

At times, the sessions became emotionally charged. In one instance, after an explanation of how a federal nexus (see text box) would allow USFWS to access private property, one county commissioner stated that if this were so then Wyoming should "secede from the union." Other participants described how three and four generations of their family had settled and improved the land, creating and sustaining habitat for a creature they did not even know existed, only to feel that they were being told that they could no longer participate in their way of life due to the federal

Photo by Alvin E. Staffan

The Preble's meadow jumping mouse.

government's attempt to "save" the mouse. One rancher put it more succinctly: "This is all about access and water — access to private property and control of the water." He later added, "I'm going to the 'big house' because I'm not changing anything I do. I can guarantee you that."

One thing that has helped producers stave off the consequences of ESA actions regarding the mouse is a special rule that allows practices in effect prior to the "threatened" designation in 1998 to continue on a temporary basis until the rule expires. The so-called 4 (d) rule (named for the ESA section of its authorization) allows for the "incidental take" of the animal by agriculturalists. "Incidental take" is the technical term for the accidental killing of the creature during otherwise lawful operations such as haying, controlling rodents around structures, conducting ditch maintenance, and managing weeds. With the 4 (d) rule in effect, producers heaved a cautious sigh of relief that they could at least maintain the status quo while trying to figure out how to fend off more restrictive measures. The 4 (d) rule was set to expire in May of 2004. However, in the critical habitat designation report, USFWS proposed extending the rule for another 10 years.

UW researchers used the information gathered at the listening sessions along with secondary economic data to put together a scenario of what might happen should the most restrictive posture of the ESA be imposed on the region. At the time, critical habitat had not been designated and there was considerable concern that the full extent of the ESA would be imposed. This fear was fueled by some of the federal documents related to the listing and to the language of the ESA, which appears to put biological considerations above all else.

The researchers chose a scenario that

This area along Lodge Pole Creek in Laramie County has been designated as critical habitat.

***Table 1**. The value of the production of irrigated agriculture in southeastern Wyoming*

	Value of production w/ irrigation	Value of production w/o irrigation	Change	Percent change
Hay production	$122,516,662	$37,144,458	-$85,372,204	-69.7
Corn production	$57,709,019	$4,208,579	-$53,500,440	-92.7
Sugar beet production	$34,721,982	$899,798	-$33,822,184	-97.4
Dry bean production	$5,594,749	$1,035,635	-$4,559,114	-81.3
Total	**$220,542,412**	**$43,288,470**	**-$177,253,942**	**-80.4**

***Table 2**. Agricultural employment in southeastern Wyoming*

	Employment w/ irrigation	Employment w/o irrigation	Change	Percent change
Hay production	2,778.8	870.7	-1,908.1	-68.7
Corn production	767.8	67.2	-700.6	-91.3
Sugar beet production	319.5	14.4	-305.1	-95.3
Dry bean production	101.6	16.5	-85.1	-83.8
Total	**3,967.7**	**968.8**	**-2,998.9**	**-90.1**

would show the most drastic effects of a curtailment of irrigated agriculture and a shift to other types of agricultural production in the five-county region. Data from sources such as the U.S. Census Bureau, the U.S. Department of Agriculture, and the Natural Resources Conservation Service were pulled together to build a picture of the economic sector as it currently stands. Then the production values for both livestock and crops on irrigated land were removed and replaced with what the production figures would be for dryland crops and grazing. The numbers were fed into an input-output model to see how income and employment levels in the regional economy would be affected.

The results, shown in Tables 1 and 2, indicate that there would be a considerable impact on the economy in the event that this scenario occurred. The value of production for the region would decrease by 80 percent, and employment in agriculture would decrease by 90 percent. The ripple effect would impact the entire region as reduced secondary spending in the economy would force reductions in enterprises in related sectors such as retail, insurance, and banking.

The researchers submitted their preliminary report to the governor's office in May 2003. USFWS designated critical habitat for the mouse in June. Of the 20,680 acres originally proposed, USFWS designated only 10,540 acres. These acres include approximately 125 miles of rivers and streams in Wyoming. Still, the controversy continues. USFWS is now working on a recovery plan. The researchers are refining their estimates with new models, taking into account the amount of land designated as critical habitat and how regulations in the recovery plan may affect producers. A linear programming model has been built that simulates the effects of changes in hay production and grazing acreage, herd size, and hence the profitability of a ranch. A geographic information systems (GIS) model is also being developed that will more accurately plot suitable habitat acreage and tie it to county tax rolls so that the economic effect of changes in land use on county tax revenues can be assessed.

From an outside perspective, it may appear that little of the region's land base for agriculture is being touched by the mouse's habitat and hence there would be limited economic effects. However, on a local level, individual operators may

be severely affected if they are no longer able to produce profitably due to restrictions resulting from the protection of the mouse. The policy implications are huge and go beyond this one animal to the interconnected issues of the roles of society, government, and endangered species. The central questions being asked are: What price is society willing to pay for the protection of a species? What are the limits of the ESA? Should society allow the ESA to adversely affect the means of livelihood for people on private property without compensation? Is "social welfare" more important than individual property rights? Is it possible for current agricultural practices and the mouse to co-exist?

More immediately, a recent DNA analysis cast doubt on Preble's "threatened" status. Is the mouse actually a distinct species or is it simply an isolated opulation of a more common variety of jumping mouse? The USFWS is currently reevaluating the listing of the mouse under the ESA. Results will be released later this year. There are many answers still to be found before the controversy can be resolved . . . stay tuned.

What is a federal nexus?

The term "federal nexus" has a slightly sinister ring to it. For some Wyoming producers it is more than just slightly sinister. The word "nexus" comes from the Latin word meaning "to bind." Its modern definition means "connection" or "tie." So the term federal nexus refers to a connection or tie with the federal government. In terms of the ESA, a federal nexus refers to a connection between a landowner/operator and the federal government. The ESA is one of the most powerful pieces of legislation in modern times; its authority tromps most other legal precedents. Even the U. S. Department of Defense is bound by its requirements. So when a landowner has a connection with the federal government as through a Farm Services Administration loan or a federal grazing lease from a U.S. Forest Service, Bureau of Land Management, or Natural Resources Conservation Service program, these are considered federal nexuses. Once a federal nexus is established, USFWS can potentially gain access even to private land.

There are potentially thousands of federal nexuses in southeastern Wyoming. It is for this reason that some agricultural producers encountered in the "listening sessions" associated with this project said they were not accepting federal money from any source. Some even went so far as to refuse to accept drought assistance in 2002. They felt that by accepting it they would open the door to the federal government and trespass by USFWS personnel, thus marking the end of their autonomy and their livelihoods.

What is so troubling about this is that it runs counter to the very purpose of many federal programs that are designed to help producers conserve natural resources such as soil and water. These producers understand their predicament. They believe that the leverage a federal nexus gives government agencies over them is so powerful and so onerous that they are willing to forego the money even at the expense of profitability and resource improvements. They believe that federal meddling in private affairs is the real culprit. Preble's mouse habitat is a potential casualty, too, since these producers will no longer be able to afford more efficient improvements that may enhance riparian habitat suitable for the animal.

Part of the problem has been bureaucratic — even ascertaining the definition of what constitutes a federal nexus has been difficult for producers. The existence of a federal nexus has normally been decided on a case-by-case basis by the government agency involved. The closest thing to a definition is found in the critical habitat designation report. In responding to a comment from the Wyoming Game and Fish Department about making a list of all federal nexuses, the USFWS responded by saying: "In general, actions on federal lands and actions on non-federal lands that are funded or permitted by a federal agency have a federal nexus…Preparation of an all-inclusive list of potential federal actions by all federal agencies that would result in a federal nexus is impractical."

TV spots education

Gene Gade, Cooperative Extension Service Educator, Crook County

On a cold, snowy, wind-blasted day, University of Wyoming Cooperative Extension Service Educator Eric Peterson of Sublette County turned his collar up and pulled his hat down as he faced a video camera and held forth on the topic of blowing snow. Fast-moving, horizontal snowflakes have had great importance to the ecology, history, and economy of Wyoming because they strongly influence where plants and animals can live, how precious water is distributed, how and where humans can travel, and so on. The backdrop for Peterson's TV spot was the sagebrush-dominated Martin's Cove area where more than 130 people from a Mormon handcart company perished in a blizzard in 1856. Both the sagebrush and the tragic history are a result of blowing snow, and both are examples of the kinds of topics featured in a series of television spots being produced by UW CES to teach Wyoming residents about the natural resources of their state.

As Greg Irwin adjusts his equipment, Eric Peterson ponders his explanation of how blowing snow sublimates (passes straight from solid snowflakes to atmospheric water vapor) during filming near the site of Martin's Cove in western Natrona County.

The Martin's Cove television segment is only one of 32 single-topic pieces produced by the CES Sustainable Management of Rangeland Resources Initiative Team and broadcast on Casper's KTWO television station. The one-minute programs have been filmed in several areas of the Cowboy State and have featured topics as diverse as why greasewood and saltbushes are found in some places while Limber pine, aspen, sagebrush, cottonwoods, and wheatgrasses dominate other places. The spots have also provided explanations of why leaves change color in the fall, why it's unwise to feed grain to deer in the winter, why a rancher can't support a dozen horses on five acres of Wyoming rangeland, and how fire is an important factor in several state ecosystems.

Peterson and CES educators Zola Ryan of Carbon County and Gene Gade of Crook County have been responsible for writing the scripts and appearing on camera in the segments. For most of 2003, the spots were part of KTWO's Wednesday evening and Thursday morning local news broadcasts. The station estimates that about 30,000 people saw at least some of the segments. It is likely that the spots will be rebroadcast either on KTWO or on other Wyoming TV stations and that the series will continue.

Beyond the intrinsic or practical value of the

deliver natural resources to Wyoming communities

Zola Ryan explains that Wyoming's salt desert shrub ecosystems exist because of harsh environmental conditions – aridity, geology, and soil limitations – not mismanagement by humans. Greg Irwin is the camera man.

information and beyond the favorable visibility that the segments create for UW and CES, the TV-spot endeavor provides a good case study of how CES is operating as it enters the 21st century. The program delivery mode may be increasingly electronic, but the connection between the organization and the people it serves is still face to face at the "grass roots" level. The impetus for developing the natural resource TV programs came from agricultural clients.

"You should spend at least part of your effort teaching the people who aren't involved in agriculture about natural resources," suggested a rancher/county commissioner during an area advisory board meeting for CES. "Yes, we ag producers need technical information on how to manage our rangeland and water, but it's at least as important for the general public to know more about Wyoming's resources and to take part in the stewardship. Too many people just don't understand how things work." Several other advisory board members immediately expressed strong agreement with these statements.

There was considerable hand wringing a week later when the initiative team responsible for developing educational programs related to natural resources considered the advisory board's suggestions. The team agreed that the public needed to understand what the state's resources are and how they work, but the group was unclear about how to deliver the information effectively. A few minutes into the discussion, Tom Heald, a CES educator from Casper, cut right to the chase. "If you want to deliver education to the masses, you need to use mass media - specifically television," he said.

Heald's comment was based on his experience with "From the Ground Up," a television series that for years has been providing gardening and landscaping information to homeowners via Casper's TV stations. Through that base, Heald has developed a good working relationship with Greg Irwin, a video producer, and with the staff of KTWO TV.

UW CES Director Glen Whipple attended the initiative team meeting and liked the idea of using television to communicate information. He and Frank Galey, dean of the UW College of Agriculture, agreed to provide funding for a dozen TV spots on a pilot basis beginning in

Camera man Greg Irwin and Zola Ryan, seated, wait while Gene Gade makes last-minute script changes on Round Top mesa near Thermopolis during filming of a segment explaining how undisturbed "relic areas" are used as a standard for comparison when judging the condition of similar range sites.

The streamside vegetation at the bottom of Ten Sleep Canyon provides a spectacular setting for a discussion of why tree color changes in the fall.

There have been enough phone calls, e-mails, and folks walking up the street to tell the educators that they've seen the segments to verify that they are being watched, understood, and valued.

February 2003. After the first spots were aired and evaluated by CES, TV station representatives, and clients, an additional 24 segments were approved, produced, and broadcast.

Television is a relatively new medium for Wyoming extension in several ways. For technically trained educators used to the scientific jargon and nuance of academia, it's hard to adjust to the soundbite world of popular culture. Developing a complex concept in 60 seconds without polysyllabic vocabulary is a real challenge for university types.

Assessing the impact of short TV programs is also difficult because there are not clear ways to find out whether or how most viewers are using the information. However, there is no question that citizens throughout Wyoming are seeing the spots and remembering at least some of their content. There have been enough phone calls, e-mails, and folks walking up the street to tell the educators that they've seen them to verify that the segments are being watched, understood, and valued.

Another series of natural resource spots is planned for KTWO in the spring and summer. Similar programs are being developed to spread the word to an even larger radio audience. Most of the state's small towns have one or more radio stations, and short segments about Wyoming's resources will soon be heard over the airwaves.

Radio and television are hardly new technologies, but administrators and initiative team members are enthusiastic about expanding their use for informing both the public and extension's traditional clients about Wyoming's natural resources and how they add interest, beauty, and character to the state as well as providing an economic base.

An interdisciplinary master's degree in early childhood development: A no-brainer!

Karen Cachevki Williams, Associate Professor and Head, Department of Family and Consumer Sciences

It's difficult to open a newspaper, flip through a magazine, or turn on a television set without hearing about the importance of early brain development to young children's growth and well-being. It has been well established that brains are being wired for learning from the time children are born. Early childhood educators have always known that children's positive interactions with parents and caregivers help with their early learning and emotional development. Now that there has been documentation by the medical field as well, more and more disciplines are recognizing the need for professionals to have backgrounds in early childhood development.

Since 1988, members of the Interdisciplinary Early Childhood Task Force at the University of Wyoming have worked together to collaborate on research projects, publications, and academic programs. Participants include faculty members and graduate students from family and consumer sciences, elementary and early childhood education, communication disorders, kinesiology and health, psychology, and nursing. Early childhood development was recognized as an area of strength in the 1999 academic plan for the university. It was a "no-brainer" for the group to see the need for a master's degree program that would allow students to specialize in early childhood development. The program was approved by the UW Graduate School in the fall of 2000 and was formalized by the UW Board of Trustees in March 2001.

"Early childhood special education is essentially an interdisciplinary field," says Michelle Buchanan, an early childhood special education faculty member, about her program's reason for supporting the initiative. "Early childhood special educators work closely with early childhood educators, speech and language pathologists, occupational therapists, nurses, psychologists, social workers, and others to provide comprehensive services to young children with special needs and their families."

Buchanan adds, "An interdisciplinary master's degree option is ideal for early childhood special education students who wish to pursue graduate studies. Taking coursework in family and consumer sciences, communication disorders, kinesiol-

Pursuing the interdisciplinary early childhood option allows graduate students to study all aspects of child development.

Many of the courses are offered through distance delivery wish to continue their professional development and incre

Associate Professor and Human Development Specialist Randy Weigel of the Department of Family and Consumer Sciences, right, is part of the UW interdisciplinary child development team.

ogy and health, psychology, and nursing as well as education provides excellent preparation for leadership in the field of early childhood special education."

A graduate student desiring the early childhood development specialization first applies to one of the six departments involved. If the student is accepted, his or her packet is forwarded to the Early Childhood Development Academic Standards Committee for review. The current committee includes faculty members Karen Williams (chair) of family and consumer sciences, Buchanan, Margaret Cooney of early childhood special education, Karen Bartsch of developmental psychology, Tami Benham-Deal of kinesiology and health, Teresa Ukrainetz of communication disorders, and Mary Beth Stepans of nursing.

The student then forms a three-person master's committee, one member of whom must be from the academic standards committee and outside the student's home department to ensure that the student completes a thesis with a focus on early childhood. The final transcript reflects the early childhood development specialization.

Students have the benefit of taking coursework in their fields, but at least nine credits must come from approved early childhood courses outside of their department. In addition, students take a team-taught interdisciplinary seminar. The seminar was presented for the first time in 2003 by Bartsch and Ukrainetz. Their focus was the intersection of early childhood policy, practice, and research.

"Co-teaching the first interdisciplinary early childhood seminar with Dr. Teresa Ukrainetz was a fun experience," says Bartsch. "Even before the class started, we realized that combining disciplines to study early childhood would be interesting. Students from psychology, speech pathology,

y to meet the needs of students who are place-bound but ase their opportunities for career advancement.

kinesiology, and education contributed to this first seminar, and it was very enlightening."

Ukrainetz adds, "I found the seminar to be a valuable opportunity for me as an instructor to experience other perspectives on a common area. Some participants were educational, some clinical, some policy, and some in basic research. We learned that we had to reflect on our own fields, make explicit our assumptions, define our terminology, and be open to others' ideas. There were different research methodologies, different topics, and different concerns. There were also points of meeting in unexpected places."

The next seminar will be taught in the spring of 2005 by Williams and Peggy Cooney. "I'm excited to have the opportunity to work with students from so many specializations," says Williams. "I've served on graduate committees from each discipline before, but graduate students from health sciences, agriculture, arts and sciences, and education are rarely in the same classes. The interdisciplinary seminar allows students and faculty members to have richer discussions and to challenge each other's assumptions in a way that allows everyone to grow."

Many of the courses are offered through distance delivery to meet the needs of students who are place-bound but wish to continue their professional development and increase their opportunities for career advancement.

Sarah Steidley is just such a student. She has chosen to follow this degree program because, according to her major professor, she feels that it will improve her ability to work in clinical teams with diverse specialties. This concentration will provide a foundation for a career as a speech-language pathologist in preschool and early intervention settings. Others who would benefit are those who work in state departments of health, education, and social services, in at-risk early childhood programs, as child care health consultants, or as child psychologists.

Perhaps Cooney expresses the advantages of the specialization the best. "The UW interdisciplinary program is nationally acknowledged as a positive step in the field of early childhood development. Many other universities find the turf issues too deep to overcome and continue doing their own work in isolation. Our collaborative approach benefits faculty members, students, children, and parents by acknowledging multiple approaches to studying children's well-being."

An interdisciplinary master's degree option at UW allows students to focus on young children's growth and well-being.

Shifty weeds adapt

Andrew Kniss, Graduate Research Assistant, Department of Plant Sciences

Lisa Boggs, former Graduate Research Assistant, Department of Plant Sciences

Sandra Frost, former Graduate Research Assistant, Department of Plant Sciences

Stephen Miller, Professor, Department of Plant Sciences

The idea that plant communities change in response to their environment is nothing new to science. The environmental conditions prevalent throughout the arid western plains have allowed the expansive short-grass prairies people are accustomed to seeing in Wyoming prosper. This evolutionary process took place over thousands of years, with plant species continually adapting to changes in the environment so that only the most competitive remained.

The numerous plant species that make up an ecosystem can be altered over the course of several years by an extended climatic event such as drought or in a matter of days by a catastrophic disturbance such as a wildfire. Natural ecosystems, however, are not the only plant communities where this dynamic competition takes place.

Since the very first plant was cultivated by man in an attempt to harvest its bounty, weeds have grown in the same fields, limiting the yields that farmers may reap. Every technological advance to battle these invaders has led unwittingly to the development of weeds better adapted to infest those fields. Each tillage operation, herbicide application, and even irrigation procedure is a selection pressure imposed by man that often favors one weed species or an individual plant at the expense of others. It is in this context that many weed scientists study the ecological trends of weeds within a farmer's field.

Changes in the composition of weed communities as a result of crop management are often referred to as weed shifts. Examples of these weed shifts are not difficult to find. A farmer

A common lambsquarters plant is tagged for further study after surviving two applications of Roundup.

to Roundup Ready® crops

who tears up an alfalfa field to plant a row crop such as corn will often see the dominant weed problem in his field change from a perennial or winter annual such as dandelion or downy brome to an annual weed such as kochia or green foxtail. Similarly, deep tillage operations such as plowing will often favor large-seeded weeds like sunflower or cocklebur whereas reduced or no-till practices favor small-seeded species such as Russian thistle.

Provided that the weed community can be managed with available control tactics, a shift in the weed species composition is generally of little consequence. However, certain adaptations can create weed populations that are quite challenging to combat. Nowhere in history have these adaptations been more rapid and more apparent than with the advent of herbicides.

Roundup Ready® corn is shown after the application of Roundup® Ultramax at one pint per acre (left) compared to one quart per acre (right). (Photo by Robert G. Wilson)

As many Wyoming farmers already know, the repeated use of a single herbicide family can lead to weed populations that are resistant to the herbicide. Repeated use of ALS-inhibiting herbicides such as Pursuit and Upbeet has led to widespread resistance in troublesome weeds such as kochia. Once a weed population develops herbicide resistance, the herbicide family often becomes useless for managing the resistant species. In order to defend against the loss of herbicides as a management tool, experts have long recommended utilizing a variety of weed control practices including rotating and tank mixing herbicides, interrow cultivation, and crop rotation.

For more than 30 years, the broad spectrum herbicide Roundup® has been used to control unwanted vegetation by farmers and homeowners alike. However, Roundup® also kills most crop plants and lawns and thus traditionally could not be applied to selectively dispose of weeds. That was until the arrival of Roundup Ready® crops.

Roundup Ready® technology allows farmers to spray the powerful weed killer over their fields without fear of damage to crops. Roundup Ready® varieties of corn have been available to growers for several years. Varieties of sugar beets, spring wheat, and alfalfa have been developed and will likely be released for sale in the near future. When these crops become commercially available, Wyoming farmers could potentially grow a three or four-crop rotation utilizing Roundup® herbicide

as the sole weed management tactic.

It is difficult to predict what effect a continuous Roundup Ready® cropping system will have on the weed species composition in Wyoming fields. Thanks to a group of university researchers from Wyoming, Kansas, Nebraska, and Colorado, answers may be available before the release of the Roundup Ready® varieties. In the spring of 1998, this group of weed scientists had the foresight to initiate a research project aimed at examining weed shifts and possible weed resistance from the continued use of Roundup® herbicide in genetically modified Roundup Ready® crops.

Continuous corn and corn-sugar beet-wheat rotations using Roundup Ready® crops were established to monitor seed banks and weed populations. Within each crop rotation, four herbicide treatments were applied every year: a high Roundup® treatment, which is the recommended rate for most Roundup Ready® crops; a low Roundup® treatment of half the recommended rate; alternating Roundup® treatments with Roundup® applied every other year and conventional herbicides used in non-Roundup® years; and finally a no Roundup® treatment, which received only conventional herbicides.

After six years of continuous study at the Torrington Research and Extension Center, there is no evidence that any weed species has developed resistance to the herbicide. However, some interesting trends have surfaced. Wild buckwheat is a weed that has been historically difficult to control even with the standard rate of Roundup®. If the rate of Roundup® is reduced, as in the low-rate treatment, one would expect this species, which possesses a slightly higher natural tolerance, to survive the application and be allowed to reproduce. Over time, the species could then increase in numbers until it became a dominant weed.

At first glance, this seems to be exactly what happened. Wild buckwheat, which was not present in detectable

Through all six years of the study, no yield differences were observed between herbicide treatments, implying that all herbicide treatments were adequate to keep weed populations below economic significance. During the first five years of the study, yields were also similar between crop rotations. In 2003, however, the corn-sugar beet-wheat rotation resulted in a 15 percent greater corn yield than the continuous corn.

So what does all this mean for Wyoming farmers contemplating a switch to Roundup Ready® crops? First, there seems to be very little negative impact from using Roundup Ready® technology in consecutive years as long as the recommended rate of Roundup® is applied. Through six years of the study, the high Roundup® treatment gave excellent control of most weeds, and only common lambsquarters showed any tendency to increase in this treatment. However, this trend was minimal at best and may have been due to environmental

Surviving wild buckwheat and common lambsquarters plants are shown after treatment with the low rate of Roundup®.

quantities in any treatment in 1998, multiplied to more than 100 plants per 120 feet of row in 2003 after continuous treatment with a low rate of Roundup®. Weeds that are highly susceptible to even the low rate of the herbicide were removed, permitting the wild buckwheat to utilize soil nutrients and sunlight with less competition. However, the trend was only observed in the continuous corn rotation. It is unclear why the same herbicide treatment did not cause a similar increase in wild buckwheat in the corn-sugar beet-wheat rotation.

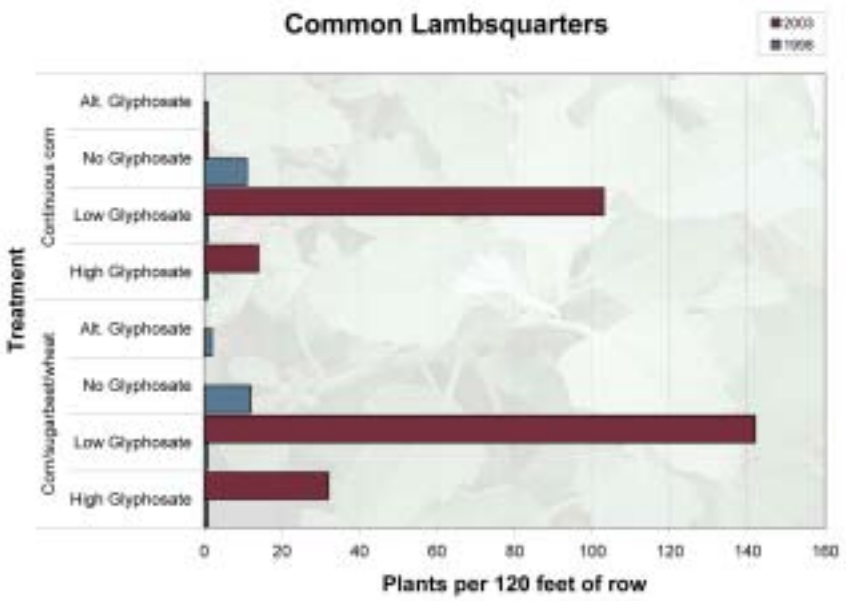
Common lambsquarters also increased from less than one plant per 120 feet of row in 1998 to more than 100 plants in 2003 when treated with the low rate of Roundup®. Unlike wild buckwheat, though, the crop rotation had no effect on this weed. There is also evidence that this species may be increasing in the high Roundup® treatment as well although further study is needed to confirm this.

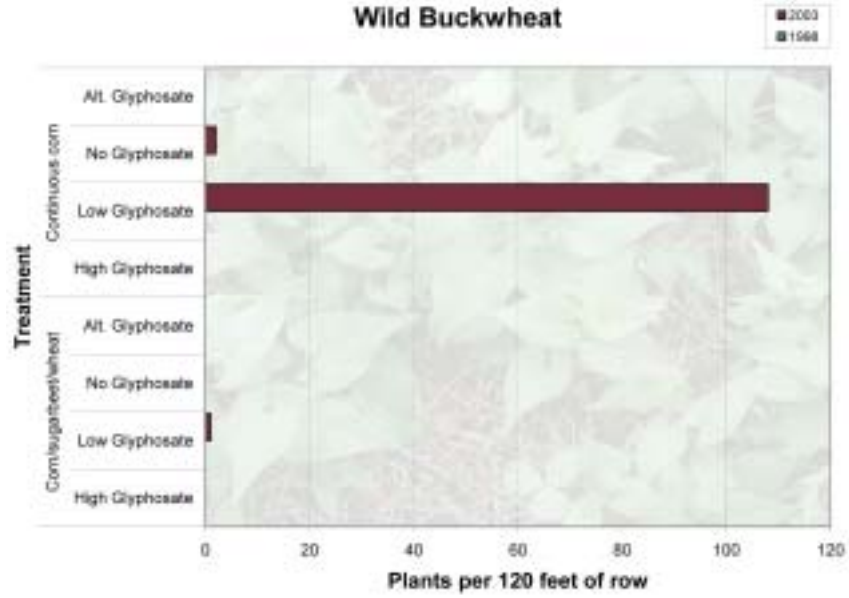
conditions more than the herbicide treatment.

The wild buckwheat and common lambsquarters shifts were observed only when the rate of Roundup® was decreased to half of the recommended rate. This serves as a caution to producers that even though cutting the herbicide rate may save money in the short term, in the long term there may be negative consequences.

Second, even though weed management strategies in Roundup Ready® systems may remain constant over several years, there is still a benefit to rotating crops. This is evidenced by the yield differences observed in 2003 as well as the wild buckwheat increase in continuous corn but not in the corn-sugar beet-wheat rotation.

Finally, no amount of research can be substituted for good crop management. While the risk of weed populations developing resistance to Roundup® seems to be small, the potential should not be ignored. Several weed species around the world are





now resistant to Roundup®, and it is probable that with increased use more cases of resistance will be confirmed. Producers should use Roundup Ready® technology judiciously, continuing to scout for surviving weeds on a regular basis.

Unraveling chronic

Elizabeth Williams,
Professor,
Department of
Veterinary Sciences

This elk sick with CWD is in very poor body condition.

By now everyone who watches the news, reads newspapers, or listens to the radio knows that bovine spongiform encephalopathy (also called BSE or "mad cow disease") was found in a dairy cow in Washington. Many can recite the basics of BSE epidemiology and weigh the importance of this disease alongside their current view of a good steak. It is also widely known that there are other related animal and human diseases that fall into the same family as BSE called transmissible spongiform encephalopathies or prion diseases. Chronic wasting disease (CWD), a prion disease that strikes and eventually kills deer and elk, has been featured in headlines for the last few years. Finding CWD in white-tailed deer in Wisconsin resulted in a burst of media and public interest. In Wyoming and Colorado, however, CWD has been present and studied for more than 30 years.

In the early years, CWD was thought to be an interesting oddity but of no significant consequence other than locally. That was before its cousin, BSE, was found in the United Kingdom in 1986. A decade later, variant Creutzfeldt-Jakob disease, which is the human form of BSE, was identified. These diseases and another one affecting domestic sheep and goats called scrapie are classified as transmissible spongiform encephalopathies. They are considered to be similar because all are thought to be caused by "prions," which are unusual infectious agents apparently comprised strictly of proteins.

At the time CWD was identified as a spongiform encephalopathy disease in 1977-78, CWD research was severely constrained by a lack of funding. Because there was no evidence linking CWD to diseases of domestic animals or humans, only wildlife managers believed it was an important disease. They were concerned that it might adversely affect populations of deer and elk. To deal with that worry, researchers from the University of Wyoming, the Colorado Division of Wildlife, and the Wyoming Game and Fish Department worked together to study CWD.

In Wyoming and Colorado CWD has been present and studied for more than 30 years.

the mysteries of wasting disease

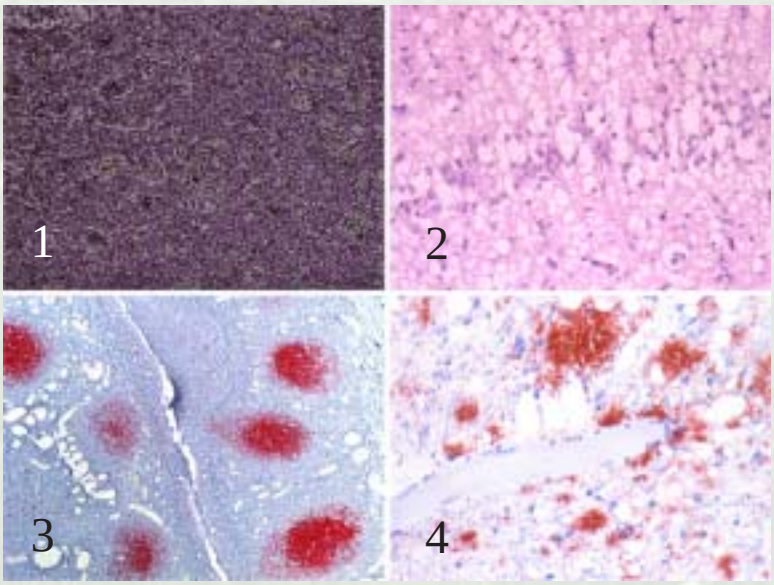
One of the first projects was to develop a description of the illness (loss of body condition and strange behavior) and the damage that occurs in animals that have the disease. This was important because in order to make a diagnosis of CWD, criteria needed to be established so that veterinarians and pathologists could be consistent in their conclusions. These descriptions have changed over the years as new techniques have improved the ability to diagnose CWD.

The lesions of CWD are literally holes in the head. "Spongiform encephalopathy" tells a pathologist what the damages in the brain and spinal cord look like. Spongiform means sponge like, and encephalopathy refers to a disease of the brain. The holes in the brain occur in specific locations; the damage to these areas results in the signs that are shown by sick animals. So, for example, if there is damage in a part of the brain that influences water balance (supraoptic nucleus, paraventricular nucleus), the infected deer can no longer concentrate urine, and the sick animal will quickly dehydrate if it cannot drink a lot of water.

New techniques for the description and diagnosis of prion diseases were then applied to the study of CWD. These improvements required the development of specific antibodies that could detect accumulations of prion agent, and these antibodies worked well with CWD. One of the most useful techniques was immunohistochemistry. Accumulations of the prion protein stain bright red in central nervous tissues and lymphoid tissues, allowing the tracking of the protein in tissues of the body and greatly assisting in the diagnosis of animals infected with CWD.

Mapping the locations of the damage in the brain also resulted in some practical techniques for diagnosing the disease in surveillance. It was found that a specific area of the brain called the obex, which is found near the attachment of the spinal cord, can be examined from an animal to check for CWD. These areas are now tested by immunohistochemistry to see if the prion protein is present.

Understanding how, when, and where the prion protein occurs in the body of the natural



1. A histologic section of a normal deer brain as viewed under a microscope is shown.
2. A histologic section of a deer brain with CWD as viewed under a microscope is shown.
3. A histologic section of a tonsil from a deer with CWD shows an accumulation of abnormal protein (red stained material) in lymphoid follicles.
4. Through the use of immunohistochemistry, an accumulation of abnormal protein (red stained material) is revealed on this histologic section of a brain from a deer with CWD.

hosts of CWD, mule deer, white-tailed deer, and elk has been the focus of much of the research. Because the incubation period of CWD is very long, this kind of study requires years to conduct. Animals are experimentally exposed to CWD, and then they are monitored until they get sick. Much has been learned from this research about incubation periods (years), the distribution of prion protein in the body (primarily tissues of the lymphatic system and the central nervous system), and the sequence of involvement of different tissues. An outcome of this work was the recognition that there is early and extensive involvement of the lymphoid tissues even before the brain is affected. This was a very useful finding because it meant that the sensitivity of the diagnostic tests could be improved by testing the lymph nodes. Currently the retropharyngeal lymph nodes (lymph nodes in the neck) are the best samples to collect for CWD testing in deer.

Surveillance for CWD in free-ranging deer and elk in Wyoming has been ongoing since 1983. It was started by gathering a few hundred heads from hunter-harvested deer. CWD was not found right away in the wild in Wyoming. Large scale surveillance by the Wyoming State Veterinary Laboratory and the Wyoming Game and Fish Department was begun in 1997, and since that time CWD has been recognized in a large portion of the southeastern quadrant of Wyoming. Long-term surveillance is important so that changes in the distribution and amount of CWD can be tracked.

Are cattle susceptible to CWD? Obviously this question is of great concern because of the serious effect BSE has had on the cattle industry and the fact that CWD and BSE are related diseases. In 1997, researchers began a collaborative study to evaluate the potential of cattle becoming infected with CWD through natural routes. A group of cattle was given an oral inoculation of CWD, and two other groups of cattle are living with deer and elk infected with CWD. As of January 2004, these cattle will have been exposed for more that six years, and there is no indication that they have contracted CWD. However, because prion diseases have a long incubation period, these studies will continue for a total of 10 years.

Figuring out how CWD is transmitted is a major focus of the research now being conducted in Wyoming. Working with the Colorado Division of Wildlife, the Wyoming Game and Fish Department, and researchers in the departments of veterinary sciences, molecular biology, and zoology and physiology, a team of experts has been trying to determine how the CWD agent is shed from an infected deer or elk, how

Hand-raised mule deer are being used in studies to try to understand CWD.

susceptible deer and elk become infected with the agent, and how CWD infections spread in populations of deer and elk. This interdisciplinary work spans the spectrum from the study of prion genetics to monitoring the movement of deer across the landscape. Obviously this is long-term research; scientists will not be able to unravel all the features of transmission for a long time.

It is clear from three decades of research on CWD that without an interdisciplinary and interagency approach to these studies, investigators will not be able to understand and ultimately manage or control the disease. The expertise of protein biochemists, toxicologists, ethologists, landscape ecologists, molecular biologists, geneticists, wildlife managers, pathologists, and veterinarians have been brought to bear on CWD during the last 30 years, and similar contributions from individuals in these disciplines will be needed in the next 30 years of CWD research.

Large scale surveillance by the Wyoming State Veterinary Laboratory and the Wyoming Game and Fish Department was begun in 1997, and since that time CWD has been recognized in a large portion of the southeastern quadrant of Wyoming.

Cattle are also being used in research determine if they are susceptible to CWD.

The Wyoming Comm

Supporting rural land-use

Jeffrey Hamerlinck, Research Scientist and Associate Director, Wyoming Geographic Information Science Center

Diana Hulme, Assistant Director, Ruckelshaus Institute for Environment and Natural Resources

Scott Lieske, Assistant Research Scientist, Department of Agricultural and Applied Economics

Mary Randolph, Executive Director, Wyoming Rural Development Council

Wyoming communityviz™ Partnership

City and county planners in the rural West face growing challenges due to accelerated development and sprawl-promoting land use practices in and around their communities. Issues range from traffic congestion and the increased cost of community services to the loss of productive agricultural land and open space. Understaffed and underfunded, most rural planning offices are ill equipped to properly evaluate proposed land use activities or to explore and propose alternative scenarios which can promote economic development while preserving the quality of life.

Recently, computer-based decision-support technologies have been explored as one set of tools for assisting planning professionals and local elected officials. Many of these tools are focused on "place-based" decision making, using the mapping and spatial analysis capabilities of geographic information systems to better inform decision makers. These support systems are unique in their focus on planning needs and on the land-use development process, providing tools for modeling, analysis, and design as well as communication, visualization, and information dissemination.

The Wyoming CommunityViz™ Partnership was established in 2002 to promote the use of geographical information systems-based planning support systems and related decision-support technologies in community land-use planning and economic development activities in the state. Founding members include the Wyoming Rural Development Council, the Wyoming Business Council, the Wyoming Community Foundation, and numerous city and county government entities. Technical support is being provided by the University of Wyoming through the William D. Ruckelshaus Institute for Environment and Natural Resources, the Department of Agricultural and Applied Economics, and the Wyoming Geographic Information Science Center. The focus of the partnership centers on the implementation and use of the Community-Viz™ suite of GIS-based planning tools. Developed by the Orton Family Foundation of Rutland, Vermont, and Steamboat Springs, Colorado, CommunityViz™ bridges the gap between complex modeling and communication and is specifically geared toward small town rural planning.

In June 2002, the partnership initiated a three-phase plan to promote CommunityViz™ in Wyoming. Phase I of the project served as a "proof of concept" in demonstrating how the CommunityViz™ planning support system might be incorporated into a small town planning process in Wyoming. The project also identified potential challenges for broader adop-

unityVis™ Partnership:
planning with technology

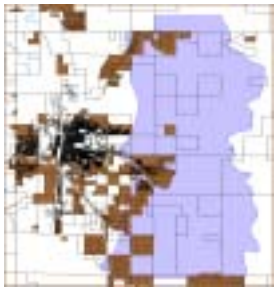


Fig 1a. Current conditions.

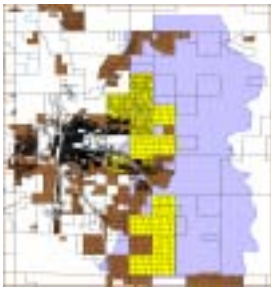


Fig 1b. Continuation of current trends

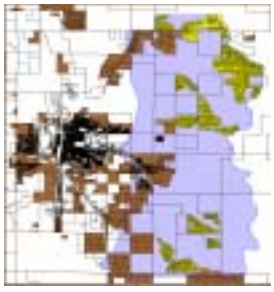


Fig 1c. Aquifer protection.

Fig 1d. Density shift.

tion of its suite of software tools including digital geospatial data requirements, computing infrastructure, and technological expertise. The Phase I project tackled planning issues associated with the implementation of a joint city/county aquifer protection plan for the city of Laramie and Albany County. In 2002/2003, the city and county approved an overlay zone based on the Casper Aquifer Protection Plan.

The Casper aquifer is the primary groundwater source of drinking water for Laramie. It supplies approximately 50 percent of the city's drinking water.

The CommunityViz™ project analyzed three possible alternative future land use scenarios in the vicinity of municipal well fields and groundwater recharge areas and their impacts on water quality and related resource indicators. The situations represent

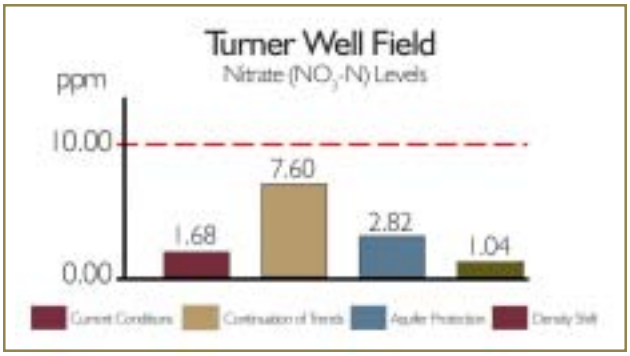


Figure 2

Worst / Medium / Best	Continue Trends	Aquifer Plan	Density Shift
Quantity of Water	Medium	Worst	Best
Quality of Water	Worst	Medium	Best
Local Tax Revenues	Worst	Medium	Best
Municipal Expenditures	Medium	Worst	Best
Traffic Impacts	Worst	Medium	Best
Vertebrate Species Distribution	Worst	Medium	Best
Recreation Access	Best	Medium	Worst
Visual Sensitivity	Medium	Worst	Best
Riparian Coincidence	Worst	Medium	Best

Figure 3

Figure 4

different patterns of development and provide a way of quantifying and informing decision makers about the implications of each planning approach on the aquifer recharge area. Four scenarios were created: (1) current conditions, (2) the continuation of existing trends, (3) aquifer protection, and (4) density shift.

The current conditions scenario was based on data from the year 2000. Projections were based on two critical criteria. First, renewable resources such as groundwater require a long-term view to maintain. Consequently, the planning horizon of the project was 50 years. Alternate scenarios were established to reflect development patterns and growth impacts in the year 2050.

The second criterion used in creating the situations was the rate of growth of residences in the delineated aquifer protection area. Residential development within this aquifer protection area increased at an annual rate of 2.5 percent between 1990 and 2000. The 2.5 percent growth rate would, over the course of the planning horizon, amount to an increase of 1,331 new residences in the aquifer protection area. This was the number of new parcels added to each projection.

Figure 1A shows the **current conditions scenario**, including current land use, subdivisions, and ownership patterns in the study area in the year 2000. Figure 1B depicts the **continuation of existing trends scenario** for the year 2050. Development continues on the western edge of the aquifer protection area due to the suitability of soils for building, favorable slopes, and proximity to the city. Lot sizes in this plan were based on Albany County land use regulations.

Figure 1C portrays the **aquifer protection scenario,** which is based on recommendations found in the Casper Aquifer Protection Plan. Development impacts on vulnerable features (such as faults, hydrological features, etc.) are mitigated through the careful placement of new residences on the landscape. Development is (a) 100 feet from recharge features, (b) 100 feet from faults, and (c) built on suitable soils using a greater than 2 percent slope in consideration for the requirements of building mound-type septic systems. Subdivisions near city limits are annexed into the city so they may be connected to city water and sewer.

Figure 1D illustrates the **density shift scenario** in which projected subdivisions are clustered completely outside the aquifer protection area. Such developments concentrate the demand for city services and amenities, lowering infrastructure costs while keeping development away from environmentally sensitive areas.

Results were measured quantitatively using indicators which included both water quality (summarizing the pollution implication of nitrates due to septic system failure) and water quantity (summarizing the amount of water used by the community in gallons per day). Figure 2 displays the results for the quality of water indicator, comparing calculated nitrate levels across the scenarios.

Although the emphasis of the project was on groundwater protection, land use decisions are rarely made on a single issue. In total, nine indicators were evaluated. Results were summarized in a "report card" for how each scenario performed relative to the indicators (Figure 3).

In addition, CommunityViz™ provided the capability to "visualize" the impacts of possible future alternatives on the landscape (Figure 4).

Building on the success of the Phase I demonstration project, the partnership is continuing to build on its capacity for planning support system use with a series of cooperative Phase II projects targeting specific planning issues in Cheyenne (exurban growth), Sheridan (historic downtown design), and Worland (business park development). For more information, please visit the partnership's Web site at www.wygisc.uwyo.edu/dss.

Coalbed methane co-produced water: MANAGEMENT OPTIONS

George Vance, Professor, Department of Renewable Resources

Lyle King, Graduate Student, Department of Renewable Resources

Girisha Ganjegunte, Research Associate, Department of Renewable Recourses

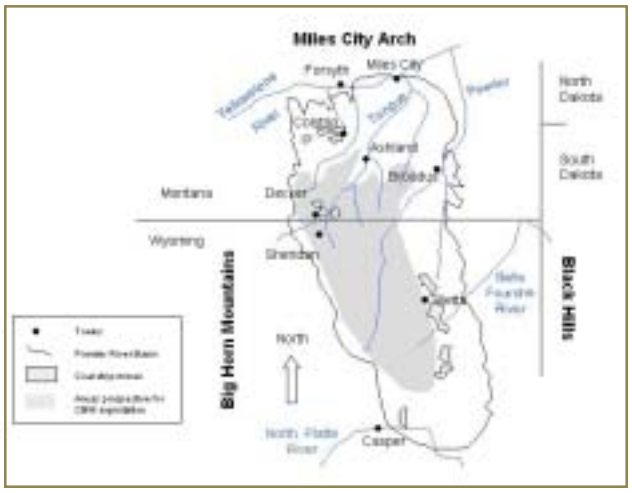
Natural gas is used to heat most of our homes and fuels a majority of the newest power plants in the U.S. An important source of natural gas is coalbed methane (CBM), which currently accounts for about 9 percent of the nation's natural gas production. Unlike traditional natural gas production, CBM is recovered by pumping water from coal seams to allow gas to desorb from the coal.

CBM production has dramatically increased during the past 20 years, in part because of the simplicity of developing CBM wells, low costs associated with start-up expenses, and state and federal economic incentives. Of the areas with extensive CBM production in the U.S., Wyoming and Montana's Powder River Basin is currently the most active because of its sizeable coal reserves.

To produce the gas, water is pumped from CBM wells, reducing the hydrostatic pressure and allowing the gas to desorb. Development involves completing wells in grid patterns, typically with one well per coal seam for each 80 acres. CBM water is drawn from a coal seam through a water line while the gas flows up the well casing and is conveyed via gas lines to centrally located low-pressure compressors. These compressors receive gas production from several wells comprising a pod and advance the production to a high-pressure compressor station that receives gas from several pods, moving it into pipelines for delivery to market. Depending on local conditions and production rates, individual CBM wells may be productive for 7 to 20 years.

A primary concern with CBM development in the Powder River Basin is related to water that must be removed to access natural gas. A single CBM well typically produces from 1 to 30 gallons per minute, which decreases with time. In parts of the Powder River Basin, coal seams serve as primary aquifers for agricultural and domestic uses. Removal of CBM co-produced water has been extremely controversial due to the potential for landowner well water depletion and impacts from the disposal of saline-sodic-enriched waters. These impacts will continue until CBM production ends and groundwater levels recharge to baseline conditions. Some CBM water is used by farmers and ranchers for livestock watering, irrigation, and other purposes. The necessary disposal of large volumes of saline and sodic CBM water has resulted in lawsuits and the development of a multitude of innovative technologies and approaches to water management.

Multiple coalbed methane wells from three stacked coal seams are shown.



This map shows the location of the Powder River Basin in Wyoming and Montana.

There are more than 20,000 CBM gas wells permitted or drilled in the basin, with estimates ranging from 50,000 to 100,000 new wells to be drilled in the future. Total CBM water production in the basin is expected to peak at close to 400,000 acre-feet per year in 2006. Cumulative CBM water production from 2002 through 2017 is projected to exceed 3,000,000 acre-feet, which would cover an area approximately 70 by 70 miles with a foot of water. During initial production phases within a given gas field, water pressure in each coal seam is high, leading to high water production rates. Discharge rates from individual CBM wells vary depending on the time since pumping began, the position in the field, the size of the CBM field, and local aquifer conditions. The recovery of water levels in aquifers will begin when CBM production ends. The extent and timing of recovery will depend on the distance from the CBM well field, the extent of development, the proximity to recharge, and aquifer characteristics.

Coalbed methane water management choices are influenced by numerous factors, some of which include the price of natural gas, regulatory permitting, CBM water quality, land ownership, legal issues, and environmental impacts. Water issues surrounding CBM are contentious. For example, Powder River Basin farmers and ranchers have expressed discontent over CBM production causing water well depletion and also over the impacts of excess water discharge on their lands. The use and disposal of CBM waters is one of the primary environmental concerns of the public, resulting in legal and regulatory battles associated with

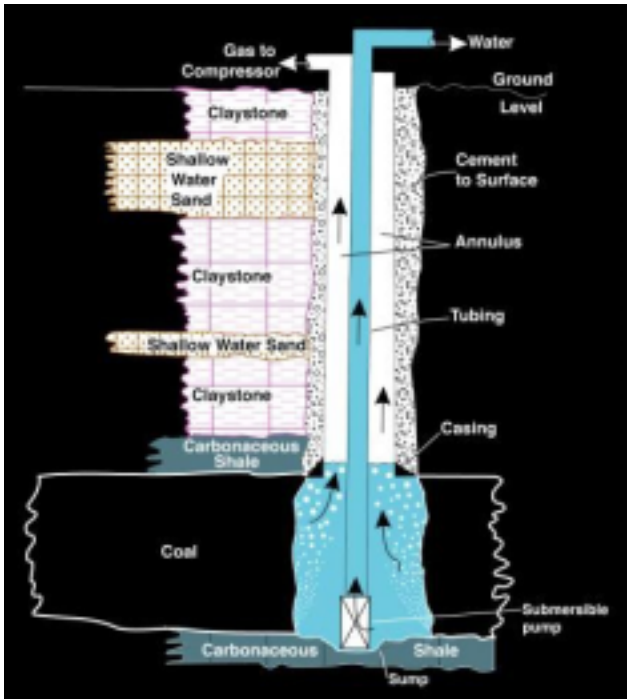
CBM water management in Wyoming and Montana as well as in other CBM regions.

Wyoming allows some CBM producers in the basin to release limited amounts of CBM water directly into waterways. Currently there is a moratorium on additional direct discharge permits, in part because limits on downstream users are being analyzed. Water directly discharged to a surface-water body is piped from a CBM well to a discharge point and released to the receiving water. Outfall structures are used to minimize erosion, and discharge permits are required.

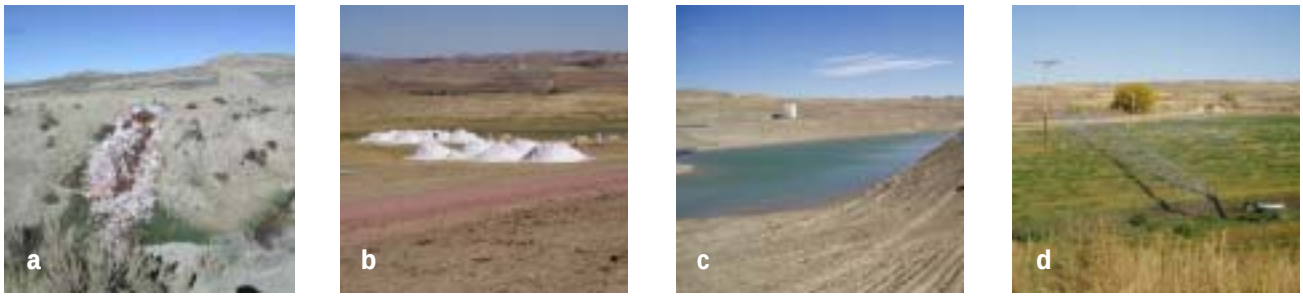
Treatment methods are effective and can result in high-quality waters that can be used for various purposes. Unfortunately, ion exchange, reverse osmosis, and other similar types of treatment often require large industrial columns and filters, treatment equipment, and operation and maintenance that are very expensive. After treatment with amendments, producers could potentially release CBM water into streams and other waterways or use the water for irrigation and other beneficial purposes.

CBM water can be discharged into lined or unlined reservoirs or impoundments. Storage in lined impoundments allows CBM waters to be treated prior to land application for agricultural purposes or disposal and provides enhanced control over the timing of discharges to surface-water bodies during non-irrigation seasons. Unlined impoundments allow water to leach into the subsurface environment or percolate into the surrounding soil. Unlined impoundments have been identified by the Bureau of Land Management as the primary process for disposing of CBM in Wyoming's Powder River Basin. Lateral migration of salt, which impacts the surrounding streams and terrestrial ecosystems, has been suggested as a possible consequence of long-term CBM water disposal in unlined impoundments. Recharging to shallow aquifers may be a benefit if water quality is compatible.

Some CBM waters are currently being used for land application on rangelands and for production agriculture; however, direct land application of saline-sodic high bicarbonate CBM waters can potentially cause permanent damage to native soils and vegetation. CBM producers have developed water management programs that include sulfur burners to eliminate bicarbonate and soil treatments designed to tackle problems that might occur due to pH changes, calcium carbonate formation, and clay dispersion by saline and toxicity. Methods for the application of CBM water include center-pivot and side-roll irrigation systems, portable water



This is a typical production schematic for a coalbed methane well.



Various options for coalbed methane water use include (a) direct discharge over an outfall rock structure, (b) gypsum treatment, (c) an unlined impoundment reservoir, and (d) land application using side-roll irrigation.

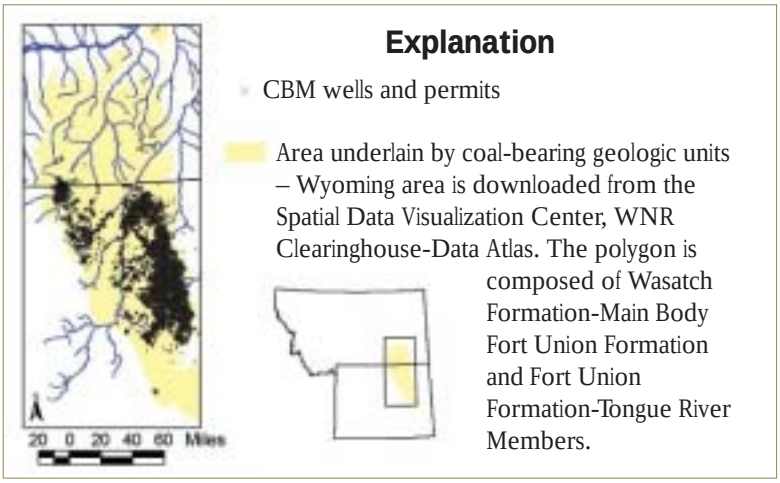
canons, and misters. Complex site-specific environmental factors such as topography, land use, soil types and quality, existing salinity levels, soil hydrologic characteristics, water quality and application rates, and vegetation types and tolerances are considered when determining site-specific application methods. Non-environmental factors such as equipment installation and operating costs, landowner agreements, and regulatory environment are also important.

The application of CBM waters with high salinity can result in reduced water uptake and water stress in plants due to the increased energy requirements needed for plants to obtain soil water. While tolerance to salinity varies among crop types, it is generally accepted that saline conditions have negative impacts on all crops at some level. Meanwhile, changes in soil physical and chemical properties associated with increased sodicity could, when coupled with poor vegetation cover, alter the resistance of soil to water and wind erosion, thus aggravating problems caused by saline-sodic CBM water applications.

Vegetation management concerns regarding the land application of CBM waters include changes in the relative composition and dominance of vegetation communities from differential tolerances of individual species to altered conditions; the establishment of non-native, invasive vegetation species, especially those with aggressive growth characteristics; and the effect of CBM water application on vegetation forage quality, including impacts associated with the application of soil and water amendments and treatments.

Maintaining productive vegetation communities will help mitigate impacts from the application of saline-sodic CBM water. Studies have indicated that soil structure and soil permeability can be improved and saline removal accelerated by planting hay and pasture grasses or by cropping. Investigating the tolerances of native and agricultural plant species to the application of saline-sodic CBM water will provide information to enhance the reclamation potential.

It is anticipated that CBM gas production will continue to develop at a rapid rate, creating economic benefits and extensive impacts to the environment of the Powder River Basin. Tackling these impacts in a meaningful way will require continuing data collection through the monitoring of CBM production and recovery responses and ongoing research projects. Data collection should focus on all aspects of the impacted environment including geology, surface and ground hydrology and water qualities, soils, vegetation, wildlife, and possibly cultural resources. These analyses should also include the development of accurate models to provide valuable guidance for permitting and development decisions. The examination of this information and successful public dissemination of the interpretations will be crucial to developing successful strategies for managing the impacts of CBM production.



Coalbed methane well density in the Power River Basin is shown in this figure.

Neurological diseases in cattle:

Considerations for the producer and practicing veterinarian

Donald Montgomery, Associate Professor, Department of Veterinary Sciences

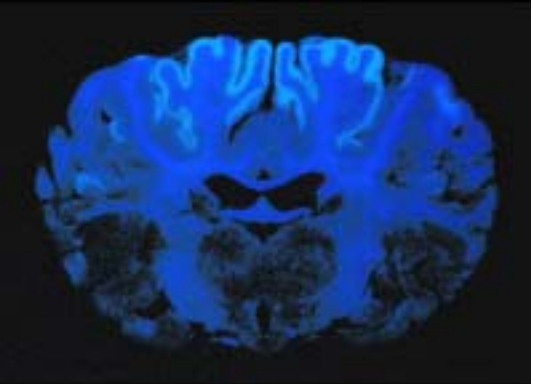
The current extensive knowledge of neurological diseases in cattle can also be attributed to the practicing veterinarians who go the extra step in characterizing the disorders from a clinical standpoint and who submit animals or tissues for diagnostic evaluation.

Disorders of the nervous system are important diseases in domestic animals, and cattle are certainly not an exception. Some diseases are of zoonotic potential and can seriously impact human health. Other disorders are of herd health significance, leading to increased sickness and death. Lastly, some diseases affecting the nervous system are congenital or hereditary and have the potential to adversely affect the reproductive health of a herd for years if not recognized.

It is realistic to ask where we stand concerning our knowledge of neurological diseases in cattle. The spectrum of diseases affecting the nervous system of cattle is extensive. This body of knowledge is a tribute to the care and concern animal producers, seeking to better understand and correct potential health problems that exist in the herd, have for their animals. The current extensive knowledge of neurological diseases in cattle can also be attributed to the practicing veterinarians who go the extra step in characterizing the disorders from a clinical standpoint and who submit animals or tissues for diagnostic evaluation. Producers, clinical veterinarians, and diagnosticians also have to be continually cognizant of new emerging or exotic diseases, with bovine spongiform encephalopathy (known as “mad cow disease”) being a perfect example.

There is no doubt that the antemortem (prior to death) diagnosis of these disorders is problematic and that a definitive diagnosis is often elusive until after the death of the animal when appropriate samples can be collected and tests performed. Even then, the complexities of the nervous system may confound the best attempts at diagnosis. To start with, there is no substitute for collecting all the pertinent information possible. The age of onset, breed, any change in feed or management, the introduction of new animals, the character and progression of symptoms, and any other informa-

A normal brain (top) and a brain from a calf with cerebellar hypoplasia (bottom) due to utero bovine virus diarrhea (BVD) infection are shown.



Polioencephalomalacia in a steer is shown. This coronal section of brain viewed under ultraviolet light reveals a laminar pattern of bright blue fluorescence indicating areas of brain damage.

tion that may be deemed important, however minor, should be collected.

Animals affected at birth or during the neonatal period or of a specific breed may be victims of congenital or hereditary problems. Sudden changes in feed or rations may cause systemic changes or disturbed metabolism that may be manifested as neurological disease. Replacement animals in a herd may introduce new diseases. A good clinical examination and knowledge of the progression of symptoms may help localize the injury to certain areas of the nervous system. Antemortem tests including blood work and serology may point to a specific cause but are often unrewarding. Animals with vague, usually non-progressive, neurological disease may recover, or the symptoms may remain static. Severely affected animals and animals with progressive diseases are commonly killed or die of the condition.

Postmortem examination is often the only way of arriving at a specific or at least a more precise diagnosis. Even if not definitive, a diagnostic workup may help to better characterize and place a disorder into a more definitive category of disease, hence the producer may be more aware of the potential impact on the health of the herd.

An entire freshly dead or terminal live animal, along with a complete history, is the best specimen for further diagnostic workup. A complete field necropsy is the next best option for gathering information. It is important to emphasize that a complete necropsy is needed. Diseases affecting other organs can result in neurological disease, with acute or chronic liver disease leading to liver failure being a prime example. Clinical signs will often point to specific areas of the nervous system for sampling. The collection and submission of brain samples alone may be unrewarding if clinical signs point to a spinal cord or peripheral nerve disorder. Removal of the brain and spinal cord can be problematic under field conditions.

Despite some misconceptions, the nervous system can withstand postmortem decomposition fairly well, and it is certainly permissible to send an entire head and/or spinal column (divided into segments, some is better than none) for removal by diagnostic laboratory personnel. The brains of fetuses and neonates have very high water content, making intact removal difficult. In these situations, it may be preferable to send the entire head to the lab.

For very careful postmortem examination by a pathologist, the brain and spinal cord need to be removed intact with as little disruption as possible. This allows for more precise correlation of anatomy and brain function with the presence of lesions. If rabies or other septic/infectious diseases are a consideration, swabs may be taken of portions of the brain, or small sections of cerebellum and terminal brain stem can be removed and submitted fresh for the appropriate testing. Another misconception is that the intact brain does not fix well in formalin. The brain should not be randomly sliced prior to fixation because this often disrupts the tissue, preventing adequate sectioning on arrival at a laboratory.

Traditional categories of diseases affecting the central nervous system can be complex. Practicing veterinarians are well aware of the common diseases affecting the nervous system of cattle. Clinical signs and history can often point to a specific diagnosis, but confirmation usually requires laboratory testing. The primary example of a disease with public health impact is rabies, and all individuals must be cognizant of this disease.

Common infectious or septic disorders, some occurring sporadically, include the congenital brain malformations associated with in utero bovine virus diarrhea infection, meningitis associated with neonatal septicemias, brain abscesses, listeriosis, and thrombotic meningoencephalitis caused by *Haemophilus somnus*. Parasitic disorders include *Neosporum* and *Sarcocystis* as well as the neurological disease associated with intestinal coccidiosis. Metabolic diseases associated with liver or other organ failure, acid-based disturbances, and micro mineral imbalances are commonly associated with neurological deficits. One metabolic disease, polioencephalomalacia, is commonly associated with disturbances in rumen micro flora, often due to a change in diet, ruminal acidosis, or increases in dietary sulfur. Toxicities from exposure to or ingestion of lead and other heavy metals, salt (most often accompanied by water deprivation), pesticides, and poisonous plants can lead to significant death losses.

The final category of diseases affecting the nervous system is those having a familial or hereditary basis. Purebred cattle are most commonly affected, but some diseases can occur in crossbred animals. The various disorders can be associated with neurological symptoms at the time of birth, but clinical signs with several of the diseases are delayed and may not be apparent until the animals are several days, weeks, or months old.

Diseases affecting the cerebellum

These disorders are generally manifested as incoordination, and clinical signs can be observed at or near the time of birth or can be delayed. Breeds affected include Angus, Charolais, Ayshire, Shorthorn, Hereford, and Polled Hereford crosses.

Table 1. Storage diseases reported in cattle categorized by type of storage material and breed(s) affected.

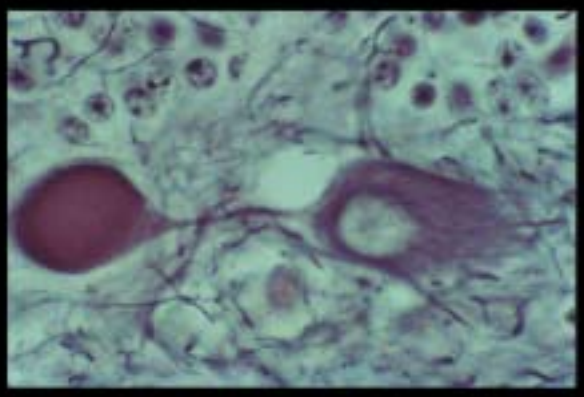
Storage material	Cattle breed affected
Gangliosidoses	Friesian
Mannosidoses	Angus, Murray Grey, Galloway, Salers
Glycogenoses	Beef Shorthorn, Brahman
Ceroid lipfuscinosis	Devon cattle, Beefmaster

Storage diseases

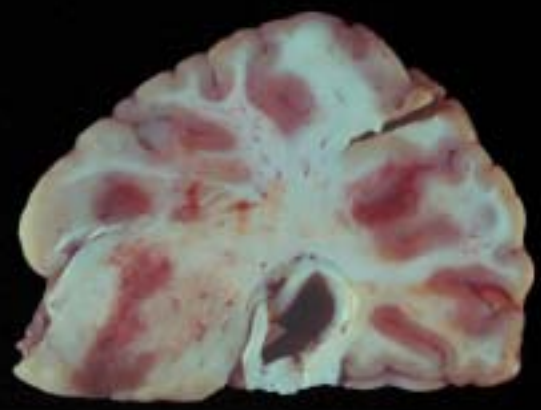
These diseases are associated with specific enzyme deficiencies or intracellular metabolic defects that allow the accumulation of metabolic products within cells of the nervous system, leading to altered function of the cells. Clinical signs are varied and reflect altered mentation to locomotor difficulties. These diseases are categorized further by the specific enzyme deficiency and the primary substance that is accumulated in the cells (see Table 1).

Metabolic encephalopathies

These disorders are due to specific defects in metabolic pathways used by cells in different organs throughout the body, but clinical signs and lesions are generally referable to the brain. The diseases include maple syrup urine disease in Herefords and citrullinemia in Friesian cattle. Affected animals usually display clinical signs within a few days after birth. The disease in Herefords is due to the defective metabolism of branched-chain amino acids that allows the acids to accumulate. These amino acids impart a characteristic sweet odor to the urine. The disease



This microscopic photo of hereditary cerebellar disease in an Angus calf shows a Purkinje cell (one of the neuronal types in the cerebellum) with a fusiform swelling of the axon called a "torpedo body."



Blotchy areas of hemorrhage and inflammation due to *Haemophilus somnus* are shown in a steer with thrombotic meningoencephalitis.

Clinical signs and history can often point to a specific diagnosis, but confirmation usually requires laboratory testing.

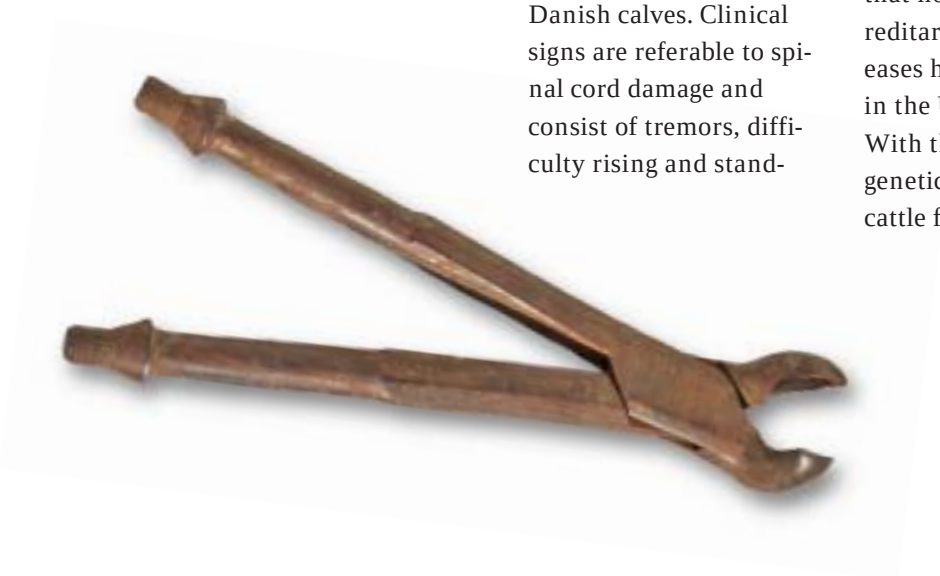
rapidly progresses to recumbency and death. Citrullinemia is due to a defective enzyme in the urea cycle, allowing ammonia to accumulate in blood. Clinical signs are depression, blindness, seizures, and rapid progression to coma and death within four to six days.

Motor neuron diseases

These diseases are reported in Hereford, Brown Swiss, and Red Danish calves. Clinical signs are referable to spinal cord damage and consist of tremors, difficulty rising and standing, wobbly gait, and incoordination. Herefords are usually affected within a few hours of birth while the disease in Swiss and Danish cattle is delayed two to six weeks.

Additional familial or hereditary diseases have been reported in Simmental, Limousin, Brown Swiss, Murray Grey, Holstein-Friesian, and Charolais cattle. It should be mentioned that not all of these hereditary or familial diseases have been reported in the United States. With the global trade in genetic material and cattle for breeding purposes, it would not be unexpected that some of these "exotic" diseases could occur in this country or arise spontaneously in native cattle.

The Wyoming State Veterinary Laboratory (WSVL) employs experienced and knowledgeable specialists in several disciplines who can assist producers and practicing veterinarians in the diagnosis and further understanding of these difficult-to-diagnose and often complex disorders affecting the nervous system in cattle. For additional information or assistance, please feel free to call the WSVL at (307) 742-6638.



EVOLVE encourages community leadership

Rhonda Shipp, Cooperative Extension Service Educator, Park County

Evolve \i-valv,-ivolv\ vb 1: to give off: emit 2a: derive, educe b: to work out: develop c: to produce by natural evolutionary processes. (Webster's Dictionary)

EVOLVE does not describe an event; it describes a process. The Cooperative Extension Service's community–based leadership development training program is an educational process that seeks to increase the leadership capacity of individuals and organizations. The method was developed by the CES Enhancing Wyoming Communities and Households Initiative Team at the University of Wyoming.

EVOLVE stands for Extension Volunteer Organization for Leadership, Vitality, and Enterprise. Headed by Roger Coupal, CES community development specialist, and Milt Green, CES educator at the Wind River Reservation, the process was modeled after the successful Park County Leadership Institute and Washakie Leadership Institute, both extension programs.

Based on the premise that everyone can function as a leader in some capacity, initiative team members believe that Wyoming citizens have the right, the capacity, and very often the desire to participate in community decision making. Community leaders are everywhere – in schools, neighborhoods, civic organizations, and government agencies. Definitions of leadership have changed, evolved, and become specific to the type of needs.

evolve

Mike Becker, left, manager of the Yellowstone Regional Airport, and Cody City Councilman Joe Bush participate in an EVOLVE leadership development training program.

"It has been almost 50 years since I was in a classroom. Most of my experience comes from behind the barn so to speak - from experience and doing. After only two sessions, I realize what I have missed over the years. I already look forward to the next class."

Washakie Leadership Institute graduate

Successful economic and community development depends on having a strong base of good leaders. Researchers have created an economic development model that illustrates the need for strong leadership in sustaining local economies. By investing in the development of leaders, a community can become stronger, healthier, and even grow. A community-based guidance program helps build a critical mass of informed and capable leaders.

In large Wyoming areas with varied resources, leadership programs already exist. In small communities with more limited resources, EVOLVE can empower citizens to effectively mobilize for the common purpose of building their human and social capital. Members of a community-based process thoughtfully examine their needs, look at possibilities, and then plan, implement, and evaluate their own program.

There are three components of EVOLVE that can be developed by a committee of local residents assisted by CES. They include building skills, understanding community resources, and assessing leadership. Building skills is a personal development approach that focuses on increasing individual capacity. Working through conflicts, learning to listen actively, and planning are skills that enhance individual qualities.

A second component is gaining a greater understanding of community services and issues. These include resources like health care, education, government, military, civic, business/industry, spiritual, transportation, and technology organizations.

A third direction is identifying leader skills through assessment. This provides a unique opportunity to learn how others view one's talents and abilities as a leader. Using a fishbowl technique, individuals work through five simulations while trained observers note their behaviors. Participants receive feedback from the observations that detail their personal actions and the reactions they receive from others.

Successful economic and community development depends on having a strong base of good leaders.

Most communities in the EVOLVE planning stages choose a combination of these components. Currently, several areas in Wyoming are planning leadership programs with the guidance of CES educators. A group in northeast Wyoming from Weston and Crook counties is creating the Black Hills Leadership Institute. Other leadership organizations are being developed in Lincoln, Fremont, and Big Horn counties.

Evidence of the success of EVOLVE can be found in the Park County Leadership Institute created in 1995 under the direction of CES Educator Rhonda Shipp. Graduates from that program have documented increases in their involvement in the county, have developed and honed their skills, and have become a positive force in the area. One graduate said, "The most important thing I learned from PCLI was trust and how important it is to successful organizations." Other classes are benefiting from the experience of past graduates.

The Washakie Leadership Institute graduated its first class more than two years ago. One individual wrote, "It has been almost 50 years since I was in a classroom. Most of my experience comes from behind the barn so to speak - from experience and doing. After only two sessions, I realize what I have missed over the years. I already look forward to the next class."

EVOLVE communities and counties now have an opportunity to participate in a national study to determine how class participants can benefit from a community-based leadership development program. A Park County class already completed its first survey.

What can Wyoming communities expect to gain from EVOLVE? Documentation and other evidence indicates that personal growth and self-efficacy, stronger community commitment, shared vision and purpose, better informed citizens, and increased engagement in community decision making are the likely results of the program. Working with UW CES professionals, people can create their own outcomes following the process outlined in the EVOLVE handbook.

Participants work in small groups to discuss shared community issues during a CES leadership development program.

If Wyoming communities are to build and maintain the quality of life that their residents desire, they must invest in the development of people as well as in the production of "bricks and mortar." The National Community Leadership Association says there is no greater statement of faith or hope in a community than to bring together the best talent to learn and grow together.

Sharing anecdotes is part of the process in community-based leadership training.

Monitoring: A link between managers

Michael Smith, Professor, Department of Renewable Resources

Quentin Skinner, Professor, Department of Renewable Resources

Cotton Bousman, Graduate Assistant, Department of Renewable Resources

Trust is a byproduct of good communication between permittees and agencies in the managing of public grazing permits. Over the long term, a permittee's need for profitable livestock production must be melded with an agency's concerns about resources, forage for other users, and scenic values. Trust fails to develop when one or the other feels that problems are not being discussed or when the terms or results being used to describe the impacts of a grazing plan are not being understood. Monitoring the trends in desired rangeland values and annual use provides one of the best approaches to the development of common understanding, effective communication, and the trust needed to effectively manage grazing on public lands.

University of Wyoming Cooperative Extension Service and Department of Renewable Resources specialists have worked for several years to provide educational programs for permittees and land management agency personnel. These programs have included discussions on the benefits of monitoring, the establishment of monitoring objectives, the designation of monitoring locations, and the determination of what methods to use and how to implement those methods. Active participation in the establishment and continuation of monitoring on selected grazing permits has resulted in successful demonstrations of the benefits to agencies and permittees. An evaluation of the monitoring of data from one particular permit will describe the efficacy of the methods and sample sizes being used and may lead to more successful

Photo by NRCS

monitoring of other areas in the future.

Permittees can view monitoring as a tool for effectively managing their grazing animals, as a means of communicating with rangeland managers, and as protection from negative assertions about the effects of grazing on public lands. To be most useful, monitoring locations and objectives should be developed jointly by a permittee and agency range specialist. Utilization levels or stubble height standards are commonly employed by agencies to specify and limit the amount of grazing use on allotments. For permittees to meet these standards, they must be able to systematically measure the degree of grazing use on appropriate plants during the grazing season and move their stock accordingly. Positive resource condition reports for such things as plant species composition, willow abundance, and stream banks are among the desired outcomes of grazing management programs. Trend monitoring is used to determine if these resources are changing as expected. The combination of annual use and long-term trend monitoring provides a permittee and agency manager with early indications of the effectiveness of grazing strategies and implementation, often suggesting timely mid-course corrections. These monitoring tools reveal resource conditions as well as the compliance of a permittee with the terms and conditions of the permit, both frequent sources of public concern. Monitoring methods suitable for permittee use are available and widely accepted.

Water condition reports are collected to monitor grazing management programs.

Agency managers usually have a large number of permits to supervise and little time to devote to single permits. Permittees are most frequently on their allotments and are moti-

and grazing permittees

UW Cooperative Extension Service educators and agency personnel provide training for the voluntary monitoring of rangeland resources.

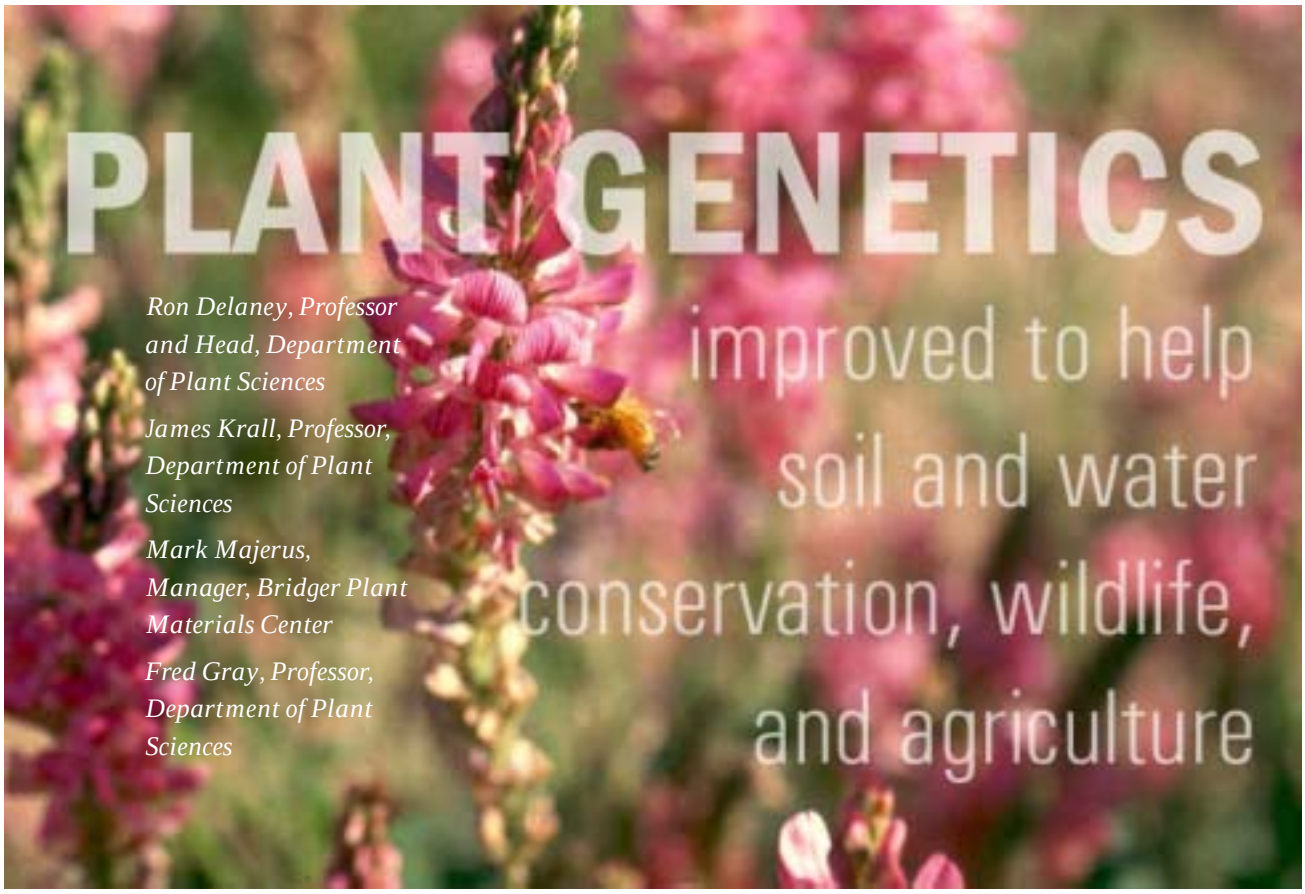
The effects of grazing on public lands are monitored by studying plant species composition.

vated to provide timely monitoring. The Wyoming Range Service Team, a group of rangeland managers from federal agencies, the Wyoming Department of Agriculture, and University of Wyoming rangeland extension specialists, has developed the *Wyoming Rangeland Monitoring Guide*, now in its second printing, to give permittees the monitoring tools needed to provide credible data that will help satisfy both their desires and those of agencies. The guide has been endorsed by agencies, a professional society, and producer organizations.

The *Wyoming Rangeland Monitoring Guide* describes and provides forms for implementing vegetation composition and use-measurement methods that provide, as much as is possible, adequate standards for objectivity, similar results among observers, and reliability. The methods are derived from those described in agency technical manuals. Long-term techniques include the utilization of permanent photos, cover-by-life ground transects, and stream bank green line stability reports. Annual use monitoring devices include landscape appearance methods, grazing use mapping, and stubble height measurement. Recommending these methods does not preclude the acceptance of others that may be familiar to users or already implemented. The grazing response index is a tool included in the book which provides a means to assess, either before or after grazing, the probability of a particular grazing strategy resulting in positive changes in plant communities.

There is a likelihood that positive, trusting relationships between federal grazing permittees and their respective agency rangeland management specialists can be greatly enhanced by the adoption of effective monitoring techniques and by the communication embodied in setting objectives, locating sampling points, and discussing annual uses and trends on an equal footing. Permittees will have a heightened awareness of agency objectives and the impacts of grazing on reaching those goals and will also be able to respond quickly to ensure that progress is made. Agency managers will have data supporting the efforts of permittees toward reaching annual use and long-term objectives. The public should thus receive assurance that public resources are being properly used.

Ranchers collect data to help monitor the effective management of grazing animals by permittees.



Ron Delaney, Professor and Head, Department of Plant Sciences

James Krall, Professor, Department of Plant Sciences

Mark Majerus, Manager, Bridger Plant Materials Center

Fred Gray, Professor, Department of Plant Sciences

The colorful legume sainfoin is a popular food item for wildlife and domestic livestock.

The availability of plant species adapted to Wyoming's environment and its soil resources is critical to the sustainability of the state's landscapes, wildlife, and agricultural production. Historically many of the plant species used for the revegetation of disturbed sites, windbreaks, and other uses on the Wyoming landscape were not native species. They were introduced species so well adapted that many expressed a weediness behavior. Land managers were in the mode of believing that the grass was greener across the oceans. The world was traveled in search of ideal rapid-growing species with extreme drought tolerance. Thirty years ago it was astounding to witness shelterbelts being bulldozed across farm landscapes in parts of the Great Plains. Did farmers think the dirty 30s would never return? In retrospect it may have been a blessing that some introduced and potentially invasive plant species were removed.

Research is now highlighting the need to be able to identify native plant biotypes that are broadly adapted. It is also necessary to identify the appropriate agronomic and/or horticultural plant culture techniques necessary to economically provide a quality seed source. When a native landscape is the goal, the land manager must have readily available plant materials.

The human food supply will continue to rely heavily on the genetic improvement of non-native field and horticultural crops. Introduced species provide a low-cost diet. The continuing genetic improvement of yield and quality traits for crop species has allowed U.S. cultivated agriculture to continue without additional encroachment on native landscapes. Field and forage crop plant genetic improvement by the University of Wyoming's Department of Plant Sciences is focused on improving yield, quality, and disease resistance in new crops to provide cropping system diversity.

Conservation and Wildlife Species

The Department of Plant Sciences in cooperation with the U.S. Department of Agriculture Natural Resource Conservation Service's

Bridger Plant Materials Center has been active in the release of native plant species selected for improved genetic traits or for identified source germplasm. These releases allow for seed or vegetative reproduction and the resulting availability of native plant materials with a known level of performance. The ready availability of plant materials is frequently a limitation in the planting of native species on the landscape in Wyoming.

Pondera floodplain silverberry germplasm was selected for its vegetative spread and winter hardiness characteristics. Its intended use is for riparian restoration and the stabilization of upper streambank and floodplain terraces. Dupuyer streambank silverberry germplasm has improved flood tolerance to allow for streambank stabilization. These silverberry releases may also be used in windbreaks to provide cover and food for wildlife.

Antelope slender white prairieclover is a perennial native legume. This germplasm is palatable and nutritious for all classes of livestock and is an important forb for antelope, deer, and upland birds. In addition, prairieclovers fix nitrogen, which then becomes available to associated grasses. Prairieclover can be used for land reclamation, range renovation, and conservation reserve plantings.

Winter wheat trials in the spring have led to the development of agronomic species.

Open range winterfat is a perennial native shrub measuring 1.0 to 2.5 feet tall. One-third of the genetic background of this release came from the Red Desert in Wyoming. The variety contains improved yield and establishment characteristics. Winterfat is an important high-protein winter browse species for deer, antelope, and elk and is also grazed by livestock. This shrub can be established in seed mixtures for mined land reclama-

Genetic improvement on the

Alfalfa - Selections of surviving alfalfa plants were made from a field near Eden in 1998. Plants were picked for their persistence in the presence of a newly identified fungal disease called brown root rot. This disease was first identified from diseased plants collected near Farson. Breeder seed was produced in the plant sciences greenhouse in 1998, and foundation seed was produced at the UW Powell Research and Extension Center in 1999. Forage yield trials are currently underway in Wyoming and Montana. A varietal release of this non-native forage legume species is anticipated in 2005 or 2006 and will constitute the first U.S. variety with resistance to this disease.

Annual medic - In the development pipeline are an annual medic variety uniquely suited to “Ley” farming and two new winter wheat varieties. Farther down the development track are varieties from such crops as winter canola and foxtail forage millet and the promise of a new high-protein grain lupin for stock feed.

Bur oak - This native deciduous tree offers excellent potential for increased diversity, longevity, and branch strength in windbreak and shelterbelt systems across the northern Great Plains. A 384-tree evaluation study representing 24 seed sources from Montana, North Dakota, and South Dakota were completed in the winter and selections are being made prior to the 2004 growing season. A selected class release is anticipated for 2005 based on superior rate of height growth, seeding survival, vigor, and form.

Idaho fescue - After evaluating several collections from the mountains and foothills of Montana and Wyoming, three selections have been made — one from the western mountains of Montana, one from the rolling ponderosa pine savannas of southeastern Montana, and one from the Big Horn Mountains of Wyoming. Idaho fescue is an important late summer native forage for all classes of livestock and wildlife. The only other commercial releases of this species are from Idaho.

Prairie coneflower - This perennial native forb is palatable to most livestock and wildlife, especially in early growth stages. It is commonly used as a native wildflower component in reclamation mixes on coal strip mines and highway roadsides and as a wildlife planting. The 2004 release is a combination of five superior accessions collected in Carbon and Stillwater counties in south central Montana.

tion, range renovation, and wildlife habitat restoration.

Rimrock Indian ricegrass was released for its ability to retain mature seed. Reduced seed shattering reduces seed costs. This perennial native grass exhibits high seed-protein content, and the plant is highly palatable to livestock. The species is used in seed mixtures on rangelands for the reclamation of disturbed sandy soils and for wildlife plantings, especially for upland song and game birds.

Hunter germplasm ponderosa pine was selected for its superior growth height, seedling survival, and vigor. This release was primarily picked to provide an improved germplasm for windbreaks and shelter belts. It also has other conservation applications for wildlife habitat enhancement, field borders, native landscaping, carbon sequestration, logging road revegetation, and mined land reclamation.

Great northern western yarrow was evaluated for winter and drought survival, vigor, height, seed head production, leafiness, and limited spread (weediness). The intended uses of this release include providing diversity in seed mixtures for rangelands, mine lands, and roadside revegetation and also as a replacement for introduced invasive species.

The perennial legume Antelope slender white prairieclover is shown in its native environment. It provides nutrition for animals, fixes nitrogen, and can be used to reclaim lands.

High plains sandberg bluegrass is a native cool-season perennial bunch grass. This release is composed of the genetics of plants collected in Natrona, Uinta, and Campbell counties in Wyoming. The traits evaluated include stand establishment, vigor, forage yield, and seed pro-

horizon for a variety of plants

Sainfoin - The non-bloating legume sainfoin is a favorite food item of wildlife and domestic livestock. This non-native forage legume species is highly palatable and nutritious with a protein content similar to that of alfalfa. It can either be hayed or grazed. Selections were made in 1982 from multiple sources which had persisted in the presence of the northern root-knot nematode in southeastern Wyoming. The germplasm has produced excellent yields in Wyoming and Montana trials. A varietal release is anticipated in 2005.

Sweetgrass - This perennial grass (often called vanilla grass because of its distinct vanilla smell) has a long history of ethno-botanical uses by Native Americans and early pioneers. The 2004 release will be a vegetative one because this species is a very poor seed producer. Its origin is in the Sweetgrass Hills of northern Montana near the Canadian border. Although this grass is cherished primarily because of its cultural significance, it can also be used in riparian and wildlife situations.

Western snowberry - This woody deciduous shrub is native to broad areas of Montana and Wyoming. The 2004 new release will be a selected class prevarietal one representing five seed sources from Wyoming and Montana. Western snowberry is desirable in living snow fences, as the short-stature component in windbreak or shelterbelt systems, for forage road rehabilitation projects, and for wildlife plantings. This selection will offer superior seedling survival and growth rate on excessively well-drained sites in modest precipitation zones.

Winter wheat – Arrowsmith hard white winter wheat is adapted to dryland sites in western Nebraska and eastern Wyoming where tall wheat is desired. In trials, Arrowsmith (11 site years) exceeded Antelope (11 site years) and Nuplains (13 site years) in height under dryland conditions by 2.5 and 3 inches, respectively. Release of this variety is expected within the next year.

Antelope hard white winter wheat has shown exceptional productivity during irrigated trials in western Nebraska and eastern Wyoming. Under irrigation (6 site years) where shorter stature is desirable, Antelope and Nuplains were equal in height whereas Arrowsmith was 3.2 inches taller. Release of this variety is expected within the next year.

duction. This species is adapted for use in land reclamation seed mixtures, conservation reserve plantings, wildlife habitat plantings, and native plant community restoration. Livestock, deer, antelope, and mountain sheep utilize Sandberg bluegrass forage early and late in the growing season. Birds and small mammals consume its seeds.

Garnet mountain brome is native to the mountains and foothills of the Rocky Mountains. Garnet was selected for superior disease resistance, stand longevity, ease of stand establishment, and forage and seed production. The intended uses of Garnet include as plantings for quick cover and erosion control, in seed mixtures to revegetate big game and livestock ranges, and to protect road cuts, mined land revegetation, and burned forest lands in areas with 15 or more inches of annual precipitation.

Bridger-select Rocky Mountain juniper was chosen for growth

Winterfat is grown for seed production at the Bridger Plant Materials Center in Montana.

height, form (as it reflects appearance and tolerance to snow breakage), vigor, and crown density. This release is an excellent selection for windbreak and shelter belt plantings in the northern and central Great Plains.

Agronomic Species

Researchers and breeders representing universities and agencies in Wyoming, Nebraska, Colorado, Montana, Kansas, and Australia are among the list of collaborators who have increased agronomic species. The development program relies on the resources and personnel of the Wyoming Agricultural Experiment Station as well as the good will of long-time farmer cooperators who provide field research locations.

The genetic improvement effort has led to the release of five new winter wheat varieties, one millet variety, and a new forage pea.

In 1996, the variety Pronghorn hard red winter wheat was released as a replacement for Buckskin. Pronghorn exhibited superior resistance to stem rust. Since then the hard red winter wheat Wesley has been released for irrigated production because of its short stature, stem-rust resistance, acceptable

Winter canola and peas undergo trials at the UW Torrington Research and Extension Center.

quality, and yield performance. Nuplains was the first public hard white winter wheat released for production in Wyoming.

The release of the hard red winter wheat Wahoo came about because it outyielded Buckskin in trials. Wahoo is considered to be a long coleoptile (2.1 inches) semi-dwarf wheat that helps with emergence under dry conditions. Wahoo performed well in Wyoming on dryland. In 2001, at the time of its release, the variety Buckskin was grown on 58 percent (110,200 acres) of the dryland winter wheat acreage in Wyoming. Wahoo in statewide field trials outyielded Buckskin by an average of 3.6 bushels per acre across 13 environments. If Wahoo at the 2001 average price of $2.70 per bushel had replaced Buckskin, it could have meant an additional $1.07 million added to the Wyoming economy in 2001.

The latest wheat release, Goodstreak, is adapted to dryland wheat production systems in western Nebraska and Wyoming where conventional height wheat cultivars with long coleoptiles are needed for good emergence and harvest in low-moisture conditions. Goodstreak has higher yield potential, similar straw strength, and superior disease and insect resistance compared to Buckskin. An advantage of Goodstreak is that it is decidedly taller in stature than Wahoo.

Horizon proso millet has the potential for early harvest with high yield while maintaining desirable seed weight and grain volume characteristics. This sets it apart from the currently produced varieties.

Forager pea has performed well in both grain and forage trials. As a grain pea it has potential as a protein supplement in stock feed. It was released because of its early maturation, which should give it an advantage in yield reliability, especially in a dry spring.

Ewe selection a factor in lamb response to maternal undernutrition

Climates with extreme variations in precipitation, as is the case in Wyoming, routinely experience significant fluctuations in both quantity and quality of forage. In fact, prolonged bouts during early gestation in which less than 50 percent of the National Research Council's requirements for feed are met are common. Sheep on rangeland may lose a significant amount of weight from early to mid gestation, and even after supplementation later in gestation the health and growth potential of their lambs has been shown to be compromised.

Growth and carcass characteristics of ruminants are known to vary considerably even when genetics and nutritional management are constant. The fetal origin of adult disease hypothesis, which is the basis on which the Department of Animal Science's Center for the Study of Fetal Programming was founded, proposes that alterations in fetal nutrition and endocrine status result in developmental adaptations that permanently change structure physiology and metabolism, thereby predisposing offspring to cardiovascular, metabolic, and endocrine disease in adult life. More specifically, maternal undernutrition during the first part of gestation in humans and rodents has been shown to be associated with intra-uterine fetal growth restriction and an increased incidence of obesity, Type II diabetes, high blood pressure and coronary heart disease in their offspring.

There is no information, however, about the impact of diverse management regimens under which ewe selection is accomplished on the health and growth efficiency of lambs. The objective of one study conducted at the center was to compare the impact of a constant reduction in feed intake to 50

Two groups of ewes raised under different management systems have been tracked at the College of Agriculture's Center for the Study of Fetal Programming to determine the effects of maternal undernutrition on their offspring.

The fetal origin of adult disease hypothesis proposes that alterations in fetal nutrition and endocrine status result in developmental adaptations that permanently change structure physiology and metabolism.

percent of the National Research council requirements from day 28 through day 78 of gestation in ewes selected for several generations under markedly different management systems.

In ruminants, the placenta attaches to discrete areas of the uterine wall called caruncles. These caruncles are aglandular proliferations of connective tissue which appear as knobs or buttons along the uterine luminal surface. These caruncles are arranged in two dorsal and two ventral rows throughout the length of the uterine horns. Ruminant placental membranes attach to these caruncles via finger-like projections called chorionic villi at vascularized areas on the surface of the placenta called cotyledons. There are between 80 and 100 caruncles in sheep. The caruncular-cotyledonary unit is called a placentome and is the functional area of physiological exchanges between the mother and fetus.

A morphological classification system has been developed in sheep to reflect the relative maternal and fetal contributions to individual placentomes. As a placentome progresses through type A, B, C, and D, its transport efficiency and vascularity progressively increases. With the advancement of gestation, individual placentomes progress from type A through type D in response to the increasing nutrient and oxygen demands of the exponentially growing fetus. In sheep, the first half of gestation is critical for placentome growth, differentiation, and vascularization.

In this study, researchers compared two groups of multiparous Rambouillet ewes se-

lected under two markedly different management systems to determine their response to prolonged maternal undernutrition. The first group of ewes was adapted to a nomadic existence, grazing from desert terrain to high mountain pastures in the Baggs area. The second group of ewes was obtained from the University of Wyoming flock and was adapted to a relatively sedentary lifestyle and supplied with nutritional inputs. Both the UW and Baggs ewes were fed to 50 percent (nutrient restricted) or 100 percent (control fed) of the National Research Council requirements from day 28 to 78 of gestation.

The model of nutrient restriction led to a progressive decrease in maternal body condition score and body weight from day 28 to day 78 in both Baggs and UW ewes, with UW ewes losing more body condition and a greater percentage of body weight than Baggs ewes during the nutrient-restriction period. Furthermore, while there was a 30 percent reduction in fetal weight in the nutrient-restricted versus control-fed UW ewes on day 78, no effect of nutrient restriction was seen on fetal weight in Baggs ewes.

Neither placentome weight nor surface area of attachment differed between nutrient-restricted Baggs and UW ewes; however, placentome type was more advanced (more B, C, and D placentomes) in Baggs ewes than in UW ewes. Conversion to more advanced (i.e., efficient) placentomal types resulted in similar placentomal efficiencies (fetal weight/placentomal weight) for nutrient-restricted and control-fed Baggs ewes. In contrast, the placentomal efficiency of nutrient-restricted UW ewes declined markedly when compared with the control-fed control group.

These data suggest that a relatively severe (50 percent) nutrient deprivation during the first half of gestation has variable impacts on placentomal differentiation and fetal growth which appear to be related to the production system in which the dams were selected. The long-term consequences of these maternally dependent changes in placentomal and fetal growth and development on offspring health, growth efficiency, and longevity are currently under investigation.

Stephen Ford, Professor, Department of Animal Science

Ewe selection has been shown to alter the susceptibility of lambs to bouts of maternal undernutrition.

Master Gardeners

Horticulture in Wyoming is booming. Surprised? Don't be. Wyoming has almost every type of horticultural business imaginable and also its share of questions and problems regarding gardening and landscape issues. The Master Gardener program in the state steps in to help consumers and homeowners with these questions and problems.

The program is housed in the University of Wyoming Cooperative Extension Service, and it is part of a nationwide group of volunteers united in a love of horticulture and a desire to assist others. All Master Gardeners work with CES and their state land-grant university and are based in county extension offices.

Wyoming currently has active programs in Campbell, Crook, Weston, Goshen, Laramie, Natrona, Park, Fremont, Sweetwater, and Lincoln counties. More than 100 new volunteers are trained annually across the state. Participants are required to take at least 40 hours of classroom instruction provided by county experts and/or campus-based specialists. In order to become full-fledged Master Gardeners, trainees must provide at least 40 hours of volunteer service to their county office during a one-year period. This volunteer service could involve answering horticultural telephone calls, sending out appropriate bulletins, assisting advanced or veteran Master Gardeners with site visits, writing articles, or conducting educational programming. Advanced or veteran Master Gardeners must obtain at least eight hours of continuing education credit annually to remain active.

One of the biggest problems in training volunteers has been the lack of a standard reference for teaching horticultural topics specific to Wyoming. That need is being met in the form of a new reference handbook that is being developed. Adapted from the Oregon State University and Washington State University *Sustainable Gardening* manual, the UW CES training handbook should be ready in the summer of 2004. Chapters are being revised and in some cases totally rewritten to reflect conditions in the state. Not only is content changing, but the layout of chapters is also changing – a major endeavor requiring the use of sophisticated publishing software. This is a team effort requiring assistance from county horticulture educators, Master Gardeners, state specialists, staff members, industry and government representatives, and the College of Agriculture Office of Communications and Technology.

The new handbook is yet to be named, but it will contain at least 20

Master Gardeners gather in Laramie County for a pruning workshop.

combine experience and continuing education

chapters including everything from basic botany to turf care to an extensive glossary. A few chapters on advanced topics will also be included on such subjects as plant propagation and arachnids. The manual will be available for public purchase and will be required reading for new gardener trainees. A draft of the handbook was sent to the ten current program coordinators in the state in early 2004. In addition, eight new horticulture bulletins are being published to supplement information in the handbook.

UW CES Master Gardeners are an exceptional group, as are their county coordinators. There are more than 100 veterans active in Wyoming, and their expertise and value to UW CES is impressive. For example, from October 2001 to September 2002, total Master Gardeners contacts (new and veteran) exceeded 5,100, and at least 4,000 hours of time were contributed to UW. At an average pay rate of $10 per hour for the skills they have, the value of Master Gardeners to UW CES that year was about $40,000, and the number of contacts and hours climbs each year.

For further information about the Master Gardener program in Wyoming, check the bulletin *Guidelines for the Master Gardener Program in Wyoming* (MP-109) available through all UW CES offices. It is also on the Web at www.uwyo.edu/ces/PUBS/MP109.pdf along with many other horticultural bulletins.

Karen L. Panter, Cooperative Extension Service Horticulture Specialist, Department of Plant Sciences

Natrona County Master Gardeners learn pruning techniques at the Sheridan Research and Extension Center.

Laramie County Master Gardeners design and plant a garden for the winner of a Mother's Day raffle.

Wyoming expertise in grasshopper management shared

Alexandre Latchininsky and Jeffrey Lockwood are shown in the ancient city of Samarkand in Uzbekistan.

University of Wyoming entomologists Jeffrey Lockwood and Alexandre Latchininsky presented their work on grasshopper control strategies in Wyoming at an international "train-the-trainers" workshop on locust and grasshopper control in the ancient city of Termez, located in southern Uzbekistan.

The two were invited by the Food and Agriculture Organization of the United Nations to be featured speakers at the event. More than 50 locust control specialists and agricultural officers from the six central Asian nations of Uzbekistan, Turkmenistan, Tajikistan, Kyrgyzstan, Kazakhstan, and Afghanistan attended the five-day spring event.

The control strategy developed in the United States by Lockwood and validated in Russia and central Asia by Latchininsky is called Reduced Agent and Area Treatments (RAATs). It foregoes the blanketing of pest infestations with high dosages of broad-spectrum insecticides in favor of producing a "zebra" of treated and untreated parallel swaths using low rates of selective insecticides and target-specific formulations that include highly attractive vegetable oils. This strategy allows for reducing the amount of insecticide by up to 75 percent and for preserving grasshoppers' natural enemies in the untreated swaths, thereby sustaining the suppression of the infestation.

RAATs has proven to be economically profitable and environmentally benign in Wyoming. It is attractive to landowners because it typically reduces the cost of treatment by at least 50 percent. If a standard insecticide application costs $2.50 per acre for protection, the equivalent RAATs program costs approximately $1.15 per acre. In 2003, about 400,000 acres of rangeland were protected from grasshoppers in Wyoming using RAATs, which saved local agriculturists more than half a million dollars and reduced the amount of insecticide left in the environment by several tons. In 2003, successful operational RAATs programs to control grasshoppers and Mormon crickets were conducted in 10 western states on about two million acres.

The strategy works even better against old world locusts, which are much more mobile than their North American "cousins." As such, they move more quickly into treated swaths to pick up a lethal dose of the insecticide. For central Asian countries where grasshoppers and locusts infest between 5 and 20 million acres annually, the adoption of RAATs would mean millions of dollars in savings in a region of the world that is struggling economically. It would also lead to a dramatic reduction in the insecticide load and its negative impact on humans and the environment.

Lockwood and Latchininsky's participation in the seminar was funded by the United Nations and the Association for Applied Acridology International (AAAI), the first and only humanitarian-based, non-profit organization of entomologists in the world providing expert advice, training, and applied research to people and nations in need. AAAI was created in 1999, and it operates under the auspices of the University of Wyoming.

For more information about RAATs and AAAI, visit the "Grasshoppers of Wyoming and the West" Web site at www.wygisc.uwyo.edu/grasshopper/ghwywfrm.htm.

Alexandre Latchininsky, Assistant Professor/Cooperative Extension Service Entomologist, Department of Renewable Resources

Jeffrey Lockwood, Professor, Department of Renewable Resources

The Asian migratory locust is a pest with swarms that can fly more than 1,000 kilometers from their breeding areas.

internationally

Modern tools help establish a new agricultural research and extension center

The establishment of a new agricultural research and extension center is a rare event, full of opportunities for success. The University of Wyoming purchased land in 2003 to launch a new center to replace facilities in Torrington and Archer. The Sustainable Agriculture Research and Extension Center (SAREC), which consists of approximately 367 irrigated, 1,525 dryland crop, 1,915 pasture/rangeland, and 60 farmstead acres, is located west of Lingle in Goshen County along the North Platte River. It will be a field laboratory for investigating various aspects of crop and livestock production.

Initially, baseline soil and yield data were collected for land-use planning to identify areas best suited for various types of experimental work. A monitor that measured grain yield as it was harvested and a soil electrical conductivity meter were both coupled with Global Positioning System equipment that recorded longitude and latitude coordinates of each data point and were used to create detailed maps showing the variability of yields and soils. More than 140 data points per acre (or one point every .007 acre) were recorded. This level of detail is helpful because many research studies occupy less than one acre, but published soil surveys typically do not map areas smaller than one acre.

Even though oats are not a typical crop in the North Platte River Valley, they were planted on the entire irrigated acreage in the spring of 2003 because of their sensitivity to the kind of soil variability that also directly impacts yield variability. The yield map obtained from the yield monitor data identifies areas of high and low yield potential (Figure 1). The map produced from the electrical conductivity data (Figure 2) is much more detailed than a standard soil survey. This information was used to propose appropriate sites for plot studies and field scale studies as well as for an enhanced irrigation system at SAREC. A yield map was also produced for the dryland winter wheat acreage that was harvested in 2003. This data will assist researchers in designing appropriate plot designs for their experiments.

Soil electrical conductivity results are also being correlated with important soil properties such as soil texture, which directly affects

Modern tools *(continued)*

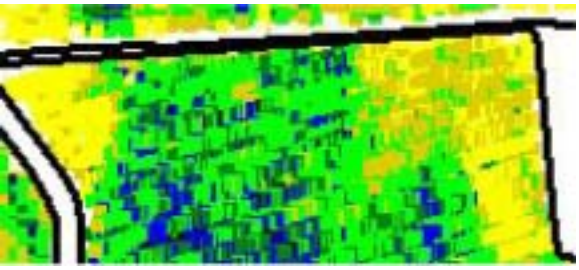


Figure 1. This shows a map of oat yields on 22 acres at SAREC in 2003. Yellow, green, and blue areas indicate below average, average, and above average yields, respectively.

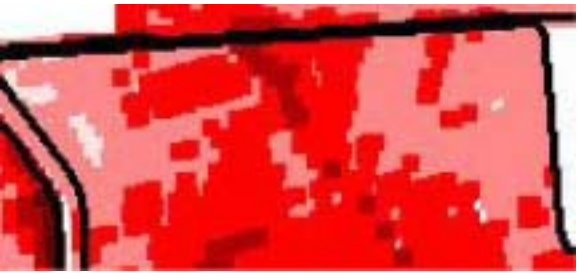


Figure 2. This is a soil electrical conductivity map (0 to 3 feet) for the same area. Darker areas indicate higher clay content and water-holding capacity and correspond to higher yields shown in Figure 1. Light-colored areas indicate sandy and gravelly soils.

water-holding capacity — an important property in both irrigated and dryland soils. Through a cooperative agreement with the U.S. Department of Agriculture's Agricultural Research Service in Ft. Collins, Colorado, the irrigated land and 200 acres of the dryland area of SAREC have been mapped with a Veris® 3100 Soil EC Mapping System. This system transmits an electrical signal through the soil to simultaneously measure conductivity from 0 to 1 foot deep and from 0 to 3 feet deep. Soil samples to a depth of 3 feet have also been taken in a grid pattern every 2.5 acres and analyzed for texture, paste saturation percentage, pH, electrical conductivity, and nutrient status.

A Geographic Information Systems (GIS) computer program is being used to combine and analyze the relationship between yields, electrical conductivity, and other soil properties. In the future, GIS will be used to track and coordinate research studies as well as maintain a detailed history of field use.

These new technological developments have provided the Agricultural Experiment Station with an exciting set of tools with which to plan and manage SAREC. Understanding and documenting the status of the soil resource prior to initiating research offers a unique opportunity to quantify improved production from new experimental practices being developed. The combination of yield and soil electrical conductivity maps and detailed soil sampling and analysis means that much more will be known about the soils at SAREC before research begins than during the establishment of any previous Wyoming research and extension center.

Dave Claypool, Research Associate II, Department of Plant Sciences

Hamid Farahani, Agricultural Engineer, Water Management Research Unit, USDA-ARS

Kelli Belden, Research Associate II, Department of Renewable Resources

Larry Munn, Professor, Department of Renewable Resources

Tracking ecological answers through isotopes

How do plants, animals, and microbes respond to environmental change? How are important elements cycled within the biosphere?

Answers to such questions can be found by tracing subtle differences in isotope ratios present in the environment.

The knowledge gleaned can help policymakers and land managers forecast and prepare for changes in Wyoming's natural ecosystems, which provide clean water, forage for livestock and wildlife, and benefits for humans.

"Tracking an element through the use of isotopes is like tagging wildlife to see where it moves," explains Associate Professor David Williams, director of the University of Wyoming Stable Isotope Facility. "It is the same idea, but we take advantage of the natural variation in ecological systems to do the work."

Here, he says, is how it happens: The key elements of life (carbon, hydrogen, oxygen, and nitrogen) are distinguished by the number of protons in their nucleus. But within each element, the number of neutrons and hence the atomic mass varies, giving rise to different isotopes of that element.

Isotopes of the same element sometimes behave differently in physical and biological systems, often separating between source and product in chemical reactions. But more importantly, the isotopic composition of different substances can be measured and used as a tracer for that element.

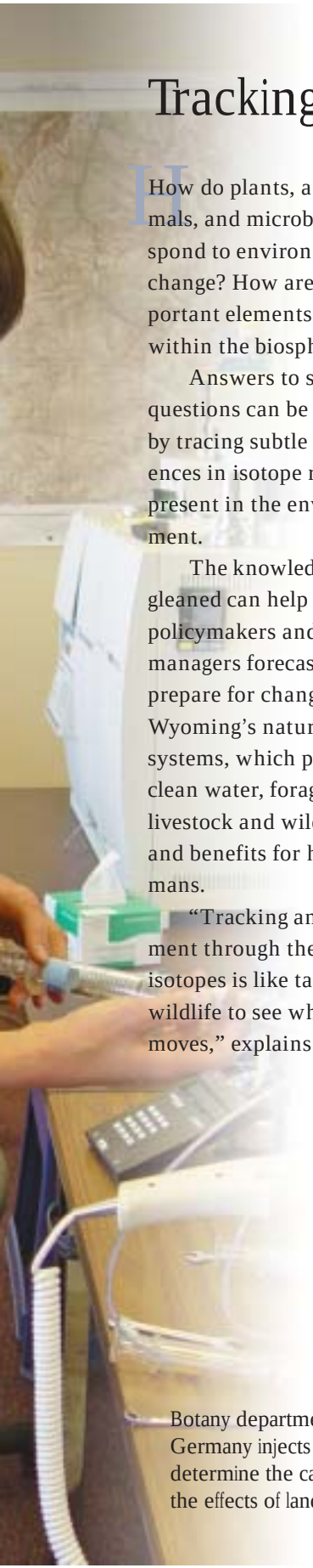
"We can take a substance that has hydrogen in it, for example, and trace that element through different biological processes," says Williams, a physiological ecologist with joint appointments in the departments of renewable resources and botany.

"By measuring the ratio of the less common to more common isotope in the hydrogen, we can follow the element as it moves through natural systems," he adds.

"In trying to figure out something like where plants are obtaining their water, we can use a dye, but that's not a good tracer. The isotope composition of the water, though, is the perfect tracer for the movement of that substance. Further changes in the isotope composition can show what processes are relevant in transporting water in and out of the ecosystem," Williams says.

The isotope facility, located in the College of Agriculture, is equipped with state-of-the-art isotope ratio mass spectrometers that can measure the faint differences in isotope ratios present in soils, plants, animals, water, and the atmosphere.

Established in 1998, the laboratory, which is managed by research scientist Mark Larson, is used for analyzing samples collected by researchers. The work includes scrutinizing, for example, carbon and nitrogen isotopes, the composition of organic matter, hydrogen isotopes in water, and the isotope composition of carbon dioxide and atmospheric samples.



Botany department post-doctoral researcher Luitgard Schwendenmann of Germany injects gas collected from soil in Panama into a mass spectrometer to determine the carbon isotope ratio being respired. The information will help track the effects of land use change on the global carbon cycle.

Enrico Yepez, a doctoral student from the University of Arizona who is assisting in the isotope lab, loads a sample of ground grass into a tin capsule to be heated. It will react with oxygen to form carbon dioxide from the organic material sample that will be analyzed in a mass spectrometer.

Associate Professor David Williams, director of the isotope lab, introduces a sample into a mass spectrometer.

"We have a mission to serve the analytical needs of the UW community for this type of work," Williams says. "We have a number of important collaborators on campus, but there are probably others in different fields and research organizations that could benefit. It would be great if they know we are here." The laboratory's Web site (www.uwyo. edu/dgw/IsotopeLab.htm), he adds, is currently being renovated.

Important agricultural and ecological issues at the organism or ecosystem level can be tackled with the help of isotope research.

"We can find out the origin of water that gets into our ground water system and what water plants are using — whether they are taking up ground water or rainfall or snow melt," Williams explains. "We can piece together the way water moves through our natural systems to understand how our water resources are being used and recharged. Isotopes can help us understand those pathways."

It is also possible to use the isotopes in plant tissues to determine the effects of water stress during drought and during different parts of a growing season.

Another example of how isotopes can answer key questions is in pollution studies involving the analysis of agricultural fertilizers. "Also, people have used isotopes of nitrogen in soils to understand the contribution of nitrogen-fixing plants to the buildup of that element in soil organic matter," he notes. "Nitrogen fixed from the atmosphere has a different isotope composition than nitrogen that comes from other sources. We can use the isotopes to say something about how important the nitrogen fixers in a crop or natural rangeland system really are."

By studying isotopes in animal tissues, researchers can find out where migrating animals find their food resources and what they are eating.

Williams says he hopes researchers throughout the UW community and its collaborators will continue to take advantage of the tools offered by the Wyoming Stable Isotope Facility and to expand the use of isotopes in their projects.

"Not only does the laboratory give more hands-on opportunities for our people to gain experience, but it is also a sign of an advancing research program in agriculture and ecology to have one of these facilities here."

Vicki Hamende, Senior Editor and Writer, Office of Agricultural Communications and Technology

Roundup Ready® alfalfa: Good, bad, or ugly

For centuries humans have been selecting, sowing, and harvesting seeds that grow food products that will sustain them. Global food demand has increased the need for improved crops. Biotechnology has made it possible to make more nutritious, better tasting foods with higher yield potential while reducing pesticide usage. Crops produced through biotechnology have become a significant component of the U.S. harvest. Biotechnology crops currently being produced commercially in the U.S. include soybeans, corn, canola, cotton, tomatoes, potatoes, and squash.

Biotechnology has made it possible to transfer one or a few desirable genes, thereby allowing scientists to develop crops with specific beneficial traits. Rather than spending 10 to 12 years breeding plants in the traditional manner, mixing thousands of genes to improve a crop plant allows modern crop breeders to select a specific genetic trait from any living organism and move it into the genetic code of the plant using biotechnology techniques.

However, the transition from traditional breeding to biotechnology has raised several issues of consumer concern such as public versus private-sector control of patents for genes, pollen transfer to non-biotechnology crops, antibiotic resistance in humans and livestock, and an increased buildup of resistant pest populations. The existing body of scientific evidence leads to the conclusion that there are no increased adverse health or environmental risks associated with the use of biotechnology in food production. Furthermore, the higher degree of regulation for biotechnology-derived food products ensures that they are less likely to lead to adverse effects on consumers than the new conventionally derived foods.

The biotechnology revolution isn't leaving alfalfa growers behind. Monsanto and Forage Genetics entered an exclusive agreement in 1998 to develop Roundup Ready® alfalfa that has state-of-the-art pest resistance, forage yield potential, winter hardiness, and forage quality. New varieties will not be commercially available before the spring of 2005. University of Wyoming researchers began working with Roundup Ready® alfalfa more than two years ago. Utilizing both furrow and sprinkler irrigation, the work has been closely monitored by several federal agencies including the U.S. Department of Agriculture's Animal and Plant Health Inspection Service and the Environmental Protection Agency. The objective of the initial research was to evaluate the influence of application rate and timing on weed control and seedling alfalfa response to

Table 1. Roundup Ready® alfalfa responses to several herbicide treatments the year of establishment are shown. Values presented are averaged over 2002 and 2003 results.

Herbicide[1]	Rate	Timing of application	Alfalfa		
			Injury	Stand reduction	Yield
	Oz./acre		%	%	Tons/acre
Roundup + AMS	26	Cotyledon	0	0	4.3
Roundup + AMS	52	Cotyledon	0	0	4.3
Roundup + AMS	26	Cotyledon + 3 wk	0	0	4.4
Roundup + AMS	26	2-LF	0	0	4.3
Roundup + AMS	52	2-LF	0	0	4.3
Roundup + AMS	26	2-LF + 3 wk	0	0	4.3
Roundup + AMS	26	4-LF	0	0	4.0
Roundup + AMS	52	4-LF	0	0	4.0
Pursuit + Select + NIS + AMS	4 + 8	2-LF	3	0	3.5
Raptor + NIS + AMS	4	2-LF	1	0	3.6
Weedy check	---	—	0	0	2.1

[1]The Roundup formulation used was Ultra-Max, AMS = spray grade ammonium sulfate at 1.7 pounds per acre, and NIS = X-77, a non-ionic surfactant at 0.25% V/V.

Roundup Ready® seedling alfalfa grows in a UW research plot.

Table 2. Weed control results in Roundup Ready® alfalfa with several herbicide treatments applied the year of establishment are shown. Values presented are averaged over 2002 and 2003 results.

Herbicide[1]	Rate	Timing of application	Weed Control		Weed yield
			Grass	Brdlf	
	Oz./acre		%	%	Tons/acre
Roundup + AMS	26	Cotyledon	94	91	0.2
Roundup + AMS	52	Cotyledon	95	100	0.1
Roundup + AMS	26	Cotyledon + 3 wk	100	93	0.0
Roundup + AMS	26	2-LF	97	97	0.05
Roundup + AMS	52	2-LF	98	99	0.02
Roundup + AMS	26	2-LF + 3 wk	100	100	0.0
Roundup + AMS	26	4-LF	100	99	0.01
Roundup + AMS	52	4-LF	100	99	0.01
Pursuit + Select + NIS + AMS	4 + 8	2-LF	96	80	0.65
Raptor + NIS + AMS	4	2-LF	86	84	0.7
Weedy check	---	—	0	0	4.5

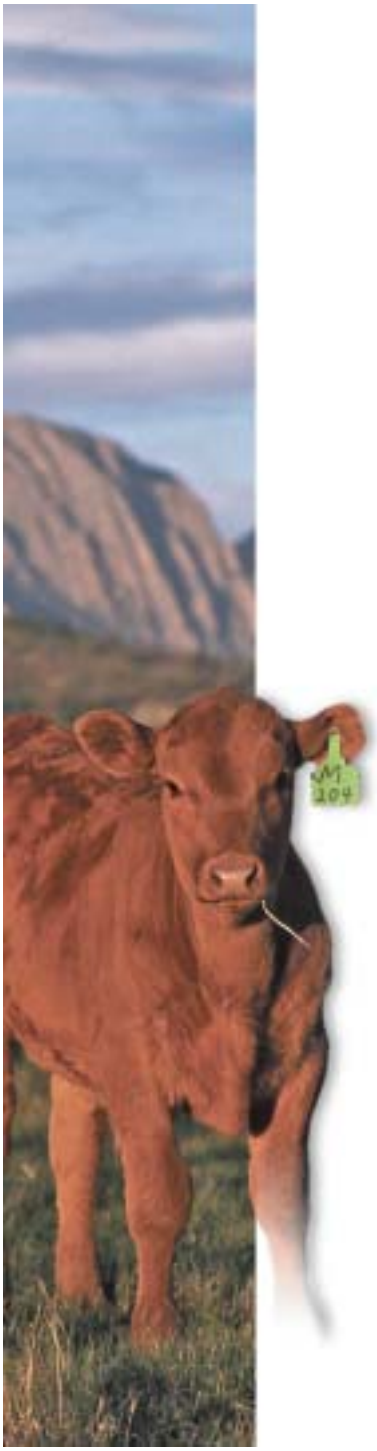
[1]The Roundup formulation used was Ultra-Max, AMS = spray grade ammonium sulfate at 1.7 pounds per acre, and NIS = X-77, a non-ionic surfactant at 0.25% V/V.

Roundup and to compare these results with several commercial standards.

Roundup Ready® alfalfa tolerance to Roundup has been excellent regardless of application timing or rate (Table 1). Weed control with Roundup in seedling alfalfa has been influenced by application timing but not rate (Table 2). Roundup applications at the cotyledon or two-leaf stage of alfalfa have required follow-up applications for complete weed control, whereas Roundup applications at the four-leaf timing have not. Weed control has been better with Roundup than with conventional treatments (Table 2). Alfalfa yields were highest in Roundup plots where weeds were removed at the two-leaf stage or earlier and follow-up applications did not increase alfalfa yields even though weed control was improved. Alfalfa yields were 0.4 to 0.8 tons per acre higher in Roundup-treated plots compared to conventionally treated plots (Table 1), and yield increases were closely related to improved weed control and reduced weed growth (Table 2). One of the concerns expressed by alfalfa seed growers in the northern part of Wyoming regarding Roundup Ready® alfalfa is pollen movement to non-transgenic alfalfa. Data thus far indicates that pollen movement can be significantly reduced using spatial isolation of 1,000 feet in combination with non-fallow cropping.

Stephen Miller, Professor, Department of Plant Sciences

Craig Alford, Temporary Associate Research Scientist, Department of Plant Sciences



Beef: It's more than what's for dinner

It may be called a "shortcourse," but a program offered annually by the Department of Animal Science about beef cattle jampacks a tall order of information ranging from how to raise 'em, how to rate 'em, and how to cook 'em.

The Wyobeef Shortcourse, dubbed "From Gate to Plate," provides three days of intensive, hands-on training designed to give producers a better understanding of the beef industry and of the important role cow-calf operators play in the state's economy.

Close to 170 students have completed the January course since it began in 1998. Attendees in addition to producers have included Cooperative Extension Service (CES) educators, state agency employees, range managers, spouses, veterinarians, agricultural industry personnel, and leaders from the Wyoming Stock Growers Association (WSGA).

The meat lab, livestock center, and classroom teaching facilities of the animal science department in the College of Agriculture provide the setting, and funding comes from the Wyoming Beef Council and registration fees. Other key players involved in presenting the course are the Wyoming Business Council, CES, and WSGA.

Industry experts from the U.S. Department of Agriculture Consumer Health Services, the Wyoming Department of Agriculture inspection service, retailers, beef packing plants, and feedlots as well as University of Wyoming faculty and staff members and graduate and undergraduate students donate their time to enhance the training.

During the three-day period, attendees evaluate live cattle, observe beef harvest procedures, assess beef carcasses for quality and yield grade, discuss proper food safety, watch beef carcasses being fabricated into individual retail cuts, and participate in taste panel exercises.

In addition, industry leaders present information on herd management, herd health, feedlots, cattle marketing opportunities, packing industry issues related to harvest procedures, retail challenges, and consumer issues.

CES Educator Dallas Mount of Platte County, a student in the January 2004 Wyobeef Shortcourse, said he enrolled so that he would be able to "talk the talk" with his constituents, particularly the ones who sell their beef to consumers in Wheatland and surrounding towns and the ones who buy it.

After learning about the sensory characteristics of beef, shortcourse attendee Larry Dobrenz of Gillette tastes pieces of meat to rank them for tenderness, juiciness, and flavor.

Graduate student Keith Underwood passes samples of cooked beef from the Department of Animal Science kitchen to a waiting taste tester on the other side.

"It's important to be able to tell people what quality and yield grade an animal is and how many pounds of retail-ready meat they will get out of a carcass," Mount noted.

A feed salesman and former meat inspector enrolled in the same session said the course "helps me and helps the producer" in the development of feed rations to raise leaner animals.

A visit to one session of the shortcourse revealed intense, hairnetted students walking among thousands of pounds of beef carcasses, notebooks in hand, grading them and predicting their yield based on characteristics such as texture, color, marbling, age, and fat thickness.

Instructors assisted students in the use of official USDA marbling photograph kits prepared by the National Cattlemen's Beef Association to help determine marbling scores of slight, small, modest, moderate, slightly abundant, and moderately abundant. The kits also included a reference chart for beef carcass grading standards.

While official graders have just four seconds to evaluate carcasses to determine their yield, shortcourse participants were allowed a bit longer to work their way through evaluation forms that considered live weight, dressing percentage, 12th rib fat, different stages of yield grade, hot carcass weight, the ribeye area, maturity, marbling, and kidney, pelvic, and heart fat.

In another room and session, eager eaters armed with newly gained knowledge about beef tenderness and beef cookery inhabited small booths to conduct taste tests on the tenderness, juiciness, and flavor of pieces of meat.

Bite-sized samples in individual containers were passed to them through small openings. The tasters were asked to munch a cracker and then drink diluted apple juice followed by water before biting into each

carefully broiled tidbit of hopefully succulent beef.

With the aid of sensory evaluation score sheets, the panel ranked piece after piece of seemingly mouth-watering meat using a scale of one to eight to determine toughness versus tenderness, dryness versus juiciness, and a lack of fed-beef flavor versus an abundance of fed-beef flavor.

On the other side of the small openings, graduate students worked energetically in the kitchen to make sure that the slices of meat from different animals were carefully organized, prepared, and delivered through the designated slots so that the integrity of the sampling would be preserved.

This much-anticipated activity brought the shortcourse participants' learning full circle. First they observed the live cattle, then they evaluated the carcasses after the animals were harvested, and finally they watched the cattle being fabricated into pound after pound of saleable cuts.

"You are an elite group as a result of this training," Associate Professor Warrie Means told the tasters, who were still smacking their lips, "because not many producers are afforded the opportunity to evaluate live cattle, watch them being harvested, and evaluate their carcasses a day later."

He added, "It is also rare to be able to taste steaks from carcasses that were quality and yield graded the day before."

CES Beef Cattle Specialist Steve Paisley, the chief organizer of the Wyobeef Shortcourse, sees the program as becoming more and more important for producers involved in an industry that is undergoing dramatic changes.

"Retailer consolidation, changing cattle marketing strategies, and health-conscious public perceptions are quickly transforming how cattle are produced and marketed," Paisley notes.

"To remain competitive, Wyoming beef cattle producers need to better understand the interrelatedness of all segments of the industry and how beef management decisions and herd health practices can have long-term impacts on the quality and safety of the beef they produce," he adds.

"If beef producers are exposed to important issues and concerns of other segments of the industry, they may be more willing to make management and marketing changes in their own operations, improving their chances of capturing additional value in the cattle that they produce," Paisley says.

He hopes to develop advanced sessions that will be available to graduates of the first program. The real success of the Wyobeef Shortcourse, Paisley adds, "is encouraging producers to manage and market their cattle more successfully and to take a more active role in the beef industry."

Vicki Hamende, Senior Editor and Writer

Office of Agricultural Communications and Technology

Wyobeef Shortcourse participants Steve Jones and Carol Jones of Thermopolis try their skills at evaluating a beef carcass. Looking on is Neils Hansen of Rawlins.

Healthy lifestyles to achieve healthy weight:

In *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity*, former Surgeon General Dr. David Satcher shared his perspective on how to effectively tackle the critical health issues facing America as well as many other countries worldwide:

"The challenge is to create a multifaceted public health approach capable of delivering long-term reductions in the prevalence of overweight and obesity. This approach should focus on health rather than appearance and empower both individuals and communities to address barriers, reduce stigmatization, and move forward in addressing overweight and obesity in a positive and proactive fashion."

This is, in fact, the approach of Wellness IN the Rockies (WIN the Rockies), a community-based research, intervention, and outreach project in Wyoming, Montana, and Idaho. This project provides a unique and progressive alternative to the prevailing approach to obesity intervention. Instead of focusing on having people achieve a specific body size, shape, or weight, WIN the Rockies employs a health-centered approach for people to achieve a healthy weight by developing healthy and enjoyable lifestyles related to food/physical activity/body image. The project team views a health-centered (versus a weight-centered) orientation to well-being as critical to the ultimate goal of reversing the rising tide of obesity.

UW-based team members include Shelley Hill, Betty Holmes, Michael Liebman, Linda Melcher, Sylvia Moore, Suzanne Pelican, Kim Puls, Kathy Tatman, Fred Vanden Heede, and Mary Kay Wardlaw.

WIN the Rockies involves six rural communities in Wyoming, Montana, and Idaho and is a collaborative effort among the three states' land-grant universities. The University of Wyoming is the lead institution, and the project is administered jointly by the College of Agriculture and the College of Health Sciences. Each state has a demonstrator and a comparator community. In Wyoming, Powell is the demonstrator and Torrington the comparator. The project's community coordinators work with Cooperative Extension Service educators, teachers, health care professionals, business owners, and other leaders to initiate interventions related to food/physical activity/body image in schools and other community settings.

Examples include "WIN Kids" lessons and activities, the "A New You: Health for Every Body" curriculum for adults, mass media campaigns, train-the-trainer workshops, walking programs, educational videos, competitive community grants, and the use of the physicians' healthy lifestyle prescription tool.

Joseph Jen, the U.S. Department of Agriculture under secretary for research, education, and economics, talks with Mary Kay Wardlaw, WIN the Rockies project education specialist, during a visit to UW to find out more about the project.

A progressive, community-based project

The flexibility of project materials encourages local selection and adaptation. For example, the "WIN Kids Fun Days" curriculum offers more than 40 different hands-on activities that can be used in various settings for youths 8 years old and older. Step-counter walking programs in one community are primarily work-site based while other communities are promoting family walking or improving pedestrian safety at intersections.

WIN the Rockies is achieving its goal of integrating research with extension and education beyond the project communities. For example, most of the intervention materials are accessible online at www.uwyo.edu/wintherockies, and the development of many of these has been summarized and shared at state and national professional meetings. The University of Idaho Cooperative Extension Service is considering the adoption of the lessons as the state's 4-H food and nutrition curriculum. WIN the Rockies is listed as a resource in *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity*. Joseph Jen, U.S. Department of Agriculture under secretary for research, education, and economics, visited the project in 2003, and the project director/co-principal investigator made a presentation at USDA's 2004 Outlook Conference in Washington, D.C.

WIN the Rockies is gathering quantitative research results through community-wide cross-sectional surveys and assessments of adult and student cohorts. Qualitative research includes collecting narratives (or life stories) from adults, creating and using a community portrait tool, and developing community case studies of the project.

WIN the Rockies has been supported by an award through USDA's Initiative for Future Agriculture and Food Systems Competitive Grants Program. The project team is seeking funds to extend its activities to other areas and to continue helping communities sustain the programs that are working for them.

Figure 1. Sample of quantitative results

Individuals with a high body mass index (BMI)[1] were more likely to do the following:

- order super-sized portions
- drink sweetened beverages such as soft drinks/soda pop
- eat while doing other activities
- watch television

Compared to men, women

- were less likely to order super-sized portions when given the opportunity
- indicated that foods eaten at dinner were prepared at home more of the time
- were more likely to be dissatisfied with their body

Body dissatisfaction

- among men was associated with a lower frequency of physical activity
- among both men and women was a significant predictor of self-consciousness, keeping respondents from participating in physical activity

[1]*BMI is a standard calculation commonly used to categorize individuals as being underweight, normal weight, overweight, or obese.*

Figure 2. Sample of qualitative results

"When I would go to my grandma's house as a child, the rule was you finished what she put on your plate. And I've noticed since that I feel *guilty* when I don't eat everything that's on my plate. Even now I feel like I need to finish *everything* . . . whether I'm hungry for it or not."

Female, early 20s

"When I was growing up, dinner time was family time. And at my house now, it's not. It's crazy. I even wonder sometimes why we have a dining room with a table in it."

Male, 30 to 40

"I do try to get exercise because I think that's the only way you're going to stay healthy. We have to always work hard to stay healthy. That's an ongoing thing. Anything worth having is worth working at."

Female in her 40s

"People aren't happy with their bodies. 'I should be shorter. I should be thinner. I should be broader in the shoulders. I should have more or less hair. I shouldn't have to shave so often.' That's disgusting. Why can't people be people?"

Male, late 50s

Suzanne Pelican, Food/Nutrition Specialist, Cooperative Extension Service

Sylvia Moore, Director, Division of Medical Education and Public Health, College of Health Sciences

Reclaimed

Jonathan Anderson, left, collects soil samples from one of the coal mine reclamation areas where research is being conducted. On the right is Lachlan Ingram, a post-doctoral research associate in the Department of Renewable Resources.

Being able to put more carbon into the soil and less into the atmosphere is considered an environmental necessity in the fight against greenhouse gases and global warming.

Researchers in the College of Agriculture's Department of Renewable Resources are investigating ways to increase the amount of organic carbon accumulation in soils through progressive surface coal mine reclamation management practices.

Information obtained from their studies may provide reclamationists with effective strategies for building soil carbon and organic nutrients in addition to making significant contributions to the current scientific understanding of the dynamics of disturbed soils.

> "We're definitely seeing some differences in the effects of management practices on the carbon levels in soil. That's good news for the environment."

"The upshot of this work is that it will enable us to recommend management practices to increase carbon storage in these reclaimed lands," says Assistant Professor Peter Stahl, the principal investigator of a three-year federal grant funded by the Abandoned Mine Land Program.

"It's a way for coal companies to show that they are helping to solve environmental problems by putting more carbon into the soil," Stahl adds.

One of the main objectives of the research project is to examine the influence of a number of coal mine management practices such as grazing, mulching, seed mixing, and the handling of topsoil on organic matter storage and soil fertility.

Other goals are to investigate the mechanisms by which organic matter and nutrients build up in surface mine reclaimed soils and to evaluate the potential of these soils to accumulate organic matter, organic nutrients, and to sequester carbon.

"Our early work has shown that in some mine soils we definitely do see carbon levels increasing after the reclamation of these disturbed lands," Stahl says. "It's good for the atmosphere, but it's really good for soils. The more organic matter in soil, the better the fertility, water-holding capacity, erosion resistance, and structural properties."

Graduate student Jonathan Anderson, who is earning a master's degree in soil science, has been assisting Stahl and other collaborators with the research. He has spent the past few summers "doing marathon soil collecting" at coal mines in the Powder River and Green River basins. "We also do extensive vegetation sampling to complement it," Anderson explains.

He is now conducting laboratory work to process "hundreds and hundreds" of samples. "Keeping track of them, making sure they are analyzed, and organizing

soils may help reduce carbon in the atmosphere

the data is quite a challenge," the graduate student adds. "What do the numbers mean? That's what we're trying to determine now."

Both Anderson and Stahl praise the cooperation the research team has received from mining companies. "They have been really great about finding appropriate research sites where we can make good, meaningful comparisons of the management techniques," Anderson says. "They met with us ahead of time and have assisted us when we are there. They have also provided long-term records that have been very helpful."

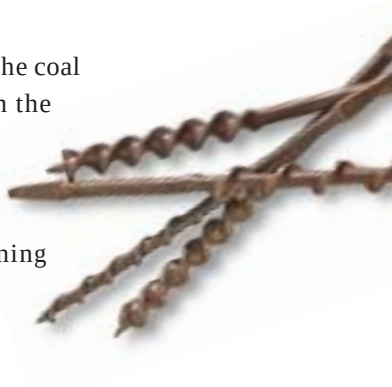
Anderson explains that much of the land in question was formerly leased by producers or was considered national grassland. "The mining companies have the responsibility of reclaiming the land to the point that it is sustainable and that it can resume its pre-mining use for domestic livestock grazing and wildlife habitat," he says.

"Over time many properties of the soil change, and management practices may be affecting the overall quality of that soil and its carbon accumulation," Anderson says. "At the end of the three years, we will make recommendations to these companies."

That point will come in 2005. Meanwhile, progress reports are being produced yearly to update the reclamationists on what has been discovered so far. "We have to collect and analyze a lot more data before we'll be ready to write a final report," Stahl says.

Helping with the project are other faculty members, post-doctoral researchers, agency representatives, and graduates and undergraduates. Anderson praises Stahl for providing opportunities for University of Wyoming students. "He really makes a big effort to incorporate undergrads into the research projects. It makes a big difference when you go to graduate school if you have had undergraduate research experience," Anderson says.

Stahl points out that the research has nationwide importance. Wyoming accounts for more than half the coal surface mined in the United States and sells it to several other states. "Coal mining is an important industry, and there are significant amounts of land affected by this," he says.



"The preliminary results have been encouraging," Stahl adds. "We're definitely seeing some differences in the effects of management practices on the carbon levels in soil. That's good news for the environment."

Vicki Hamende, Senior Editor and Writer

Office of Agricultural Communications and Technology

Graduate student Jonathan Anderson, left, and sophomore geology major Amy Friese separate soil samples into pieces through a process of particulate organic matter fractionation to analyze the accumulation of organic carbon.

Kelli Sutphin, who has a degree in microbiology, prepares to analyze soil samples in an organic carbon analyzer that examines characteristics like microbial biomass.

Sire selection: Transmitting desirable characteristics

Producing lambs with desirable carcasses is one of the goals of the Mountain States Lamb Cooperative.

The Mountain States Lamb Cooperative was formed to provide its producers with the ability to control the entire cycle from breeding to marketing of retail cuts to provide a high-quality, desirable product for consumers.

Identifying meat sires that produce the most desirable carcasses for consumers is an ultimate goal of the Mountain States Lamb Cooperative. The cooperative was formed to provide its producers with the ability to control the entire cycle from breeding to marketing of retail cuts to provide a high-quality, desirable product for consumers. This approach requires that group members be able to identify sires needed to produce lambs with desirable carcass characteristics.

University of Wyoming animal science faculty members Gary Moss, Robert Stobart, and Warrie Means in cooperation with the Wyoming Wool Growers Association and Mountain States Lamb Cooperative have initiated a program to determine the ability of rams identified as superior in standardized performance tests to transmit their desirable characteristics to their offspring.

This cooperative project was initiated to identify sires with the genetic background necessary to produce lambs that meet the desired objectives of the cooperative's marketing plan. Initially, meat-type sires were brought to the University of Wyoming College of Agriculture livestock center where they were fed together for a 60-day period. Data such as average daily gain, loin-eye size, and the amount of back fat were recorded and entered into a selection index.

To evaluate the ability of the rams to transmit their desirable traits, the top five indexing rams (one ram per producer) were placed with 16 whiteface ewes at the UW Archer Research and Extension Center in Cheyenne. Lambing data was collected, and at weaning the lambs were weighed and subsequently placed in a commercial feedlot. Lambs remained on feed until they reached an average of 140 pounds and were then taken to the Swift and Company plant in Greeley, Colorado, for processing. After slaughter, information about hot carcass weight, 12th-rib fat thickness, rib eye development at the 12th rib, and 12th-rib body wall thickness was gathered. In addition to standard carcass information, weights of the major wholesale cuts were also obtained.

Ten untrimmed legs from each sire group were brought back to the

Sires that produce the most desirable carcasses for consumers are being tested at the Archer Research and Extension Center to see if their traits can be passed on to lambs.

to lambs

Department of Animal Science meat laboratory to determine the percentage of their fat, lean, and bone to provide an estimation of carcass fat, lean, and bone. The carcasses were evaluated with the Lamb Vision System, a new technology designed to predict lean meat yield. In addition, an image of the loin eye was taken with a cold cam, and the image was measured to provide loin eye size. Data was also collected from a group of contemporary lambs to provide comparative information.

All the information collected will be analyzed and used to evaluate how accurately the selection index predicts the growth traits of rams and the carcass traits of their progeny. This information is essential for the selection of rams that produce offspring with desirable market traits.

Robert Stobart, Associate Professor, Department of Animal Science

Professor Robert Stobart uses the OptiReader™ device to collect sheep identification data at the UW Archer Research and Extension Center.

Who's who? Retinal identification can tell

Alliances within the sheep industry are being formed to enhance the industry's ability to compete on a global scale.

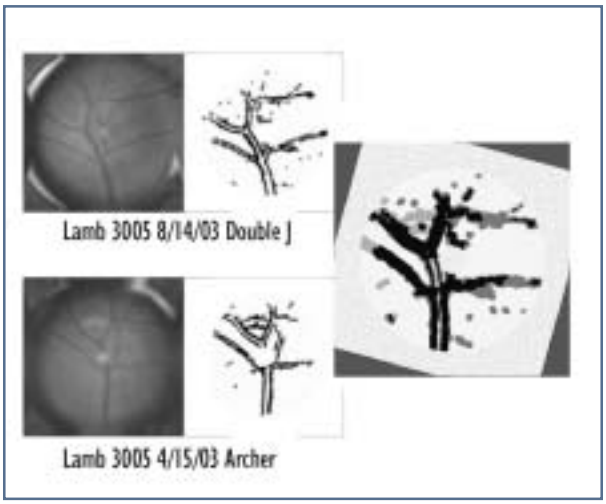
University of Wyoming animal science faculty members Gary Moss and Robert Stobart, in cooperation with the Wyoming Wool Growers Association and Mountain States Lamb Cooperative, have embarked on a study to determine the ability of rams identified as superior in standardized performance tests to transmit their desirable characteristics to their offspring. The study is funded in part by the U. S. Department of Agriculture National Sheep Industry Improvement Center.

For differential compensation to be paid for product quality, a reliable identification method must be developed to identify animals throughout their productive life. Common methods of identification such as ear tags or paint brands are often lost, become unreadable, and can create confusion when animals from different producers are combined.

However, the retinal vascular pattern of individual animals is unique, present at birth, and does not change throughout an animal's lifetime. Optibrand, a company based in Fort Collins, Colorado, has developed a method of identification that is based on the uniqueness of an animal's retinal vascular pattern. The hand-held OptiReader™ device captures and stores the image of each animal's retina on a removable memory card. The OptiReader™ is a combination hand-held computer and ocular fundus digital video camera. The computer contains a Global Positioning System satellite receiver board and antenna. The global position along with a satellite set time-date stamp are encrypted and become part of each image record.

Moss and Stobart, in collaboration with Jack Whittier at Colorado State University, incorporated the identification technology offered by the Optibrand system into their study to determine the applicability of

the device and associated software to the identification of sheep throughout their life cycle. To evaluate this new technology, the retinas of all lambs born to selected sires at the College of Agriculture's Archer Research and Extension Center were scanned at birth. Their retinal images along with associated identification information were stored. In addition, all lambs received their traditional ear identification tags coded for their year of birth and breed and cross-referenced to their dam's identification. The consistency of identification by the traditional ear tags and the Optibrand system will be evaluated by retinal images acquired at weaning, when the animals leave the feedlot, and following exsanguinations at a slaughter plant.



Actual images recorded from the same animal at two different dates and locations are shown on the far left. A computerized image is generated identifying the branching pattern of the retinal vasculature in the center images. Computerized matching of the branching pattern, on the right, confirms the identity of the animal at the two locations.

The data from the retinal images is being processed, and the final outcome of the reliability of the retinal scans has yet to be determined. Moss, however, believes the technology offered by Optibrand is a promising system for positive identification. As the speed of image acquisition improves and issues of data-base management are resolved, adoption throughout the industry may be likely. At this time the technology is practical as a means for positive identification of show animals and superior sires.

The increased efficiency of the acquisition of images that occurred throughout the study have left Moss and Stobart confident that as the public and industry demand that animals be positively identified and traced throughout their lifetime, the Optibrand system will offer a viable enhancement to existing methodologies.

Brenda Alexander, Temporary Research Scientist, Department of Animal Science

"Humanized" caterpillars could be used to produce human medicines

Could a lowly insect hold the key to reducing the cost of pharmaceuticals? Professor Don Jarvis is a believer.

"The next time you need a drug or vaccine, it might come from a caterpillar," he predicts. "That's almost unbelievably weird!"

Maybe not. A virologist with the Department of Molecular Biology, Jarvis is part of a three-way team using a hefty $2.6 million U.S. Department of Commerce grant to try to genetically reprogram caterpillars to produce mammalian proteins that can be used as medicines or vaccines to treat or prevent various human diseases.

This approach, he says, would provide an alternative source of these proteins, currently unavailable or being manufactured in other systems, at a much lower cost.

"From a manufacturing standpoint, producing medicinal proteins using our approach is advantageous because we can grow caterpillars in a relatively small factory at an extremely low cost," Jarvis says.

The critters are simply infected with an insect virus that induces them to produce recombinant proteins and then squeezed through a mesh screen so that those proteins can be efficiently and inexpensively extracted for subsequent purification and pharmaceutical use. That's the idea, anyway.

Making and testing the genes that will be injected into caterpillar embryos are part of the research duties of Bob Harrison, left, a post-doctoral scientist, and Jennifer Oiler, a technician assistant.

Jarvis has been researching viruses that kill insects for nearly two decades and helped construct transgenic insect cell lines with "humanized" glycoprotein production pathways. "This work extended previous efforts by others in the field, which originally enabled us to use insect viruses to introduce genes encoding useful proteins into insect cells," he explains.

It turned out that the infected insect cells could produce large quantities of these proteins, but they were unable to add the proper carbohydrate side chains to glycosylate them. As a result, Jarvis and former UW graduate students Jason Hollister and Jared Aumiller began introducing human genes into insect cell lines, thus producing structurally authentic or "humanized" glycoprotein products.

That led Chesapeake PERL, Inc., (C-PERL), a start-up company being incubated at the University of Maryland and focusing on the use of insect virus-infected caterpillars for pharmaceutical protein production, to approach him about applying a similar genetic engineering process to the worms.

A more sophisticated genetic transformation was needed to create transgenic caterpillars as compared to simple insect cells growing in the laboratory. So Jarvis called on colleague Malcolm Fraser, a professor at

the University of Notre Dame, for help. Fraser had developed a transposable genetic element or "jumping gene" that could be used to insert new genes into the DNAs of caterpillars and other insects.

"Our job is to build and test the genes, and Fraser's job is to inject those genes into caterpillar embryos and isolate the transgenic offspring," Jarvis explains.

"The genes we make will have easily visualized markers that will modify the color of their eyes. Thus any offspring arising from embryos injected with our DNAs will be easy to identify. Once the transgenic caterpillars are made, assuming they can be made, they should have totally different biochemical pathways involved in protein glycosylation which will allow them to produce glycoproteins the way we do," he says.

Shades of Frankenstein?

"Agriculture has changed so dramatically as a result of the impact of molecular biology that we can now take advantage of an agricultural system like insects and use that point of view to tackle major biomedical issues."

Don Jarvis

"The notion that we can humanize this pathway is really out there," Jarvis admits. "If we totally genetically reprogram this basic biochemical pathway in caterpillars, their own glycoproteins will have human-like carbohydrate side chains and they will be freaks of nature that might not be able to develop properly, survive, or reproduce."

If the first attempts to produce transgenic caterpillars fail for any of these reasons, a back-up plan will be used to modify the human genes so that they can be turned on or off like a light switch. "We would keep the genes 'off' to allow for normal development of the transgenic caterpillars, and then when we're ready to make the protein of interest, we'll add the virus and turn the genes 'on' by adding a drug to the insects' food," he explains.

Currently, most recombinant glycoproteins are produced in mammalian cell lines such as Chinese hamster ovary cells. Why change to insect systems? "It's safer and cheaper," Jarvis says. "There is the possibility that mammalian cell lines can carry adventitious agents that can adversely affect humans."

If and when the transgenic caterpillars are successfully created, C-PERL will use them to manufacture a model glycoprotein that will be analyzed in Jarvis's laboratory. "The proof of the pudding will be to compare the structures of the glycoproteins made by the normal and transgenic insects," he says. "Then we will hopefully have

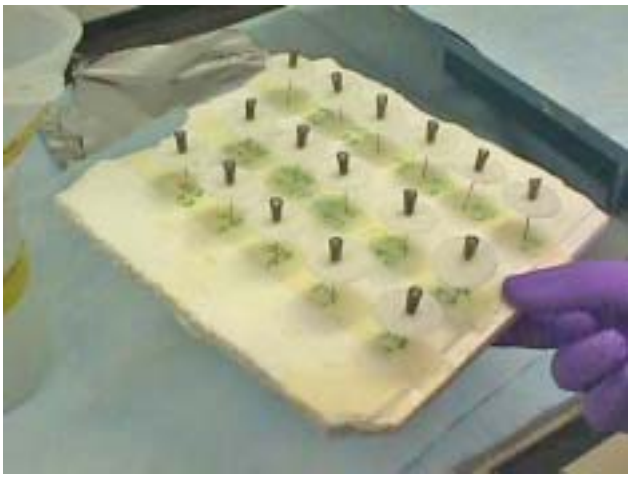
a product that can be sold to biopharmaceutical companies."

Such a scenario could be accompanied by a three-way patent that would benefit the University of Wyoming, C-PERL, and the University of Notre Dame. Consumers would also be able to purchase medication for such medical problems as hemophilia, heart attacks, and metabolic disorders more cheaply.

As an example, Jarvis points out that one recombinant protein drug currently manufactured from mammalian cells and used to treat human genetic anemias costs consumers more than $2.8 billion a year. "We could manufacture this drug in a safer system and at a lower cost, which are really strong selling points with the Food and Drug Administration."

National attention has already been drawn to the research due to the fact that the federal Advanced Technology Program funds only about 10 percent of all submitted proposals. It is the first time the University of Wyoming has received such a grant. "I am pretty proud of this award because it's such a highly competitive program," Jarvis notes.

Perhaps more important than putting UW and its collaborators on the humanized glycoprotein production map, he adds, is the fact that the research reveals a growing connection between the study of molecular biology and its applications to agriculture.



This tray contains examples of the type of assay used to measure trans-gene activity.

Analyzing glycoprotein produced in insect cells are researcher Bob Harrison, standing on the left, Professor Don Jarvis, and technician Jennifer Oiler.

"If you were in the College of Agriculture at UW 20 years ago, you were not very likely to be working on making drugs. People would typically think of the kinds of things we are doing now as happening at a medical school," Jarvis points out.

"Agriculture has changed so dramatically as a result of the impact of molecular biology that we can now take advantage of an agricultural system like insects and use that point of view to tackle major biomedical issues," he adds.

"There is a whole new arena of opportunity for students that they might not even realize when they consider entering the College of Agriculture."

Vicki Hamende, Senior Editor and Writer

Office of Agricultural Communications and Technology

What makes a teacher memorable?

"What strikes me about many of these personal stories is not just the fact that teachers were so influential but that teachers often make a difference in others' lives without really knowing it."

Jim Wangberg

"Teachers open the door; you enter by yourself," according to a Chinese proverb.

Ask anyone to recall a favorite teacher, and a story will probably be told. Ask a teacher to relay a narrative about a memorable mentor, and the door will likely open once again.

"I thought it would be nice to hear stories from our faculty members, teachers themselves, about teachers who made a difference in their lives," says Jim Wangberg, associate dean and director of the Office of Academic and Student Programs. "What strikes me about many of these personal stories is not just the fact that teachers were so influential but that teachers often make a difference in others' lives without really knowing it," he adds.

"Thus, the article is to celebrate all of the teachers who make a difference and to serve as a reminder that on any given day, at any given moment, we UW faculty members may be making a difference in a student's life."

Here are some of the stories:

"Dr. Stan Snyder was a pathology professor at Colorado State University where I was a trainee. He was – more correctly, is – a low key, understated, wise, experienced, and humane instructor. His approach was to solicit your opinion on a clinical case and carefully guide you to the correct answer. If you were slow to take the hint he would offer, he was not averse to letting you plunge down the large, black hole before throwing a rope.

"His approach was carefully calibrated so that the cockier the student, the deeper the trap. If you got it right, he would acknowledge the expertise. But if you got it wrong – well, he had a cackle of a laugh that told you better than anything that it was time to hit the books. I always valued him prefacing his summation with, 'Well, I'll give you my experience, and you can take it for what it's worth.' I still use some of the tips that were offered so modestly."

— *Professor Donal O'Toole, Department of Veterinary Sciences*

"The teacher who had the most impact on me, I believe, was one of my high school math teachers – Mr. Grant. He taught the advanced math classes which were designed for college-bound students in the areas of math, science, and engineering. What made this teacher so influential was his ability to take advanced and difficult math concepts

Professor Donal O'Toole, head of the Department of Veterinary Sciences, appreciated being guided to the correct answers by a pathology professor.

and relate every one of them back to everyday life. If that meant explaining in terms of candy bars, he did, bringing them to class to demonstrate his concepts. He had the ability to make math exciting and fun, not always a view shared by many high school students.

"But beyond his ability to teach, Mr. Grant was a caring person. He supported and encouraged us as students in all our areas of interest. Not only was I interested in math and science, but I also majored in art throughout high school. Mr. Grant saw me struggling to catch the school bus with my art project one afternoon, and since he lived close by my house he offered to take my project home and bring it in to school each day for me. This simple gesture was typical of the kindness and support he showed for his students.

"Tragically, Mr. Grant was killed in an automobile accident between my junior and senior years of high school, and not being able to have him as a teacher for my final year of high school was one of the greatest disappointments of my academic career."

— Associate Professor Donna Brown, Department of Family and Consumer Sciences

"Snoozing groundhogs and slumbering marmots! Moose with brain worms and blind elk! Rocky Mountains versus suburban Washington, D.C. Fascinating subjects to a junior studying zoology at the University of Maryland. As a kid I wanted to be a vet (a common dream for kids who like animals), but my goals had changed over the years to a desire to study wildlife. It was Dr. Tom Albert, a professor in the animal science department at the University of Maryland and a pre-vet adviser, who suggested to me that all vets don't treat dogs, cats, or cows.

"Dr. Albert studied the physiology of hibernation, he did field work in the Arctic on sleeping ro-

Department of Family and Consumer Sciences Associate Professor Donna Brown helps University of Wyoming graduate Amy Copeland with a sewing pattern. Brown recalls a high school teacher who befriended her.

dents, and he helped me complete a project studying the behavior of his captive groundhogs for a zoology class. He let me know it was entirely possible to become a wildlife vet (a specialty not even recognized by the American Veterinary Medical Association) and encouraged me to meld my interest in wildlife with my old goal of becoming a vet (even though he couldn't guarantee there would ever be a job).

"It was the personal interaction with Dr. Albert and his encouragement to be a bit different that changed the direction of my life. I am sure I would be working with animals and doing research in some capacity if I hadn't met him, but I don't think I would have figured out that there was wonderful opportunity and challenge in studying diseases of wildlife."

— Professor Elizabeth Williams, Department of Veterinary Sciences

"In the spring of 1986, I had a very bad haircut. Cultural sophisticates these days might describe it as an '80s mullet,' and its only redeeming quality was that

"His compassion for the student body was outstanding, and for me his help, friendship, and guidance constantly remind me that students remain the reason universities exist."

Assistant Professor David Fay of the Department of Molecular Biology remembers the interest shown in him by an organic chemistry professor.

nearly everyone had one. That semester, to my surprise, I was doing quite well in my organic chemistry class. The professor was a pedantic and excitable little man named Georgian, whose principal distinguishing feature was his bowtie collection.

"One day after handing back our exams, he chased me down a hall and two flights of stairs to the entrance of the chemistry building. I had initially failed to hear his shrill calls of 'Young man!', and when it finally dawned on me that I was being pursued, my heart sank a bit. For what good reason would any professor chase a student out of a building? He began to make small talk. What was my name? Where was I from? Finally, when I thought he was through with me, he came to the point of our exchange. 'Why don't you get a haircut?' he asked, and promptly skipped back up the stairs into the building.

"I was perplexed. Walking back to my apartment, I happened to run into my upstairs neighbor, who was a chemistry graduate student. I recounted the event and awaited his interpretation. 'He likes you,' was the unexpected answer. That was, of course, a possibility that had not occurred to me. However, I eventually realized its truth. I was doing well in his class, and he had taken an interest in me. He had also correctly judged my haircut to be dismal. Nothing could be simpler or more flattering, really. The very idea that this erudite professor would even notice me, let alone see enough potential in me to encourage a trip to the barber, had me slightly giddy for days.

"As professors, I think it's easy for us to forget the power our words and actions can have on our students. Telling that straight-and-narrow pre-med student to get a haircut could, of all things, actually plunge him into a lifetime of academics."

— *Assistant Professor David Fay, Department of Molecular Biology*

"Dr. Carl Wiesen grew up in the woods and iron country of Michigan. A veteran of the invasion of Normandy, he became a professor of microbiology at UW and was near the end of his career when I took his basic course. Each class was packed with information, started on time, ended on time, and was organized from start to finish. Testing was thorough, and he taught each and every laboratory session.

"He encouraged me to use microbiology as a tool to conduct my master's research and followed my career as a doctoral student while I studied microbial ecology and range science. He taught me discipline, encouraged me to be patient, and made sure that I grasped the importance and consideration of other professors who were trying to help me become qualified for university life.

"Most of all he provided the example of what it would mean and demand to be a classroom teacher. He loved teaching and worked at being outstanding each day until he retired. His compassion for the student body was outstanding, and for me his help, friendship, and guidance constantly remind me that students remain the reason universities exist."

— *Professor Quentin Skinner, Department of Renewable Resources*

REFLECTIONS

is published by the
University of Wyoming
College of Agriculture.

Frank D. Galey — Dean

Jim Jacobs — Associate Dean and Director,
Agricultural Experiment Station

Kathleen Bertoncelj — Office Associate, Senior,
Agricultural Experiment Station

James K. Wangberg — Associate Dean and Director,
Office of Academic and Student Programs

Glen Whipple — Associate Dean and Director,
Cooperative Extension Service

Editor

Vicki Hamende — Senior Editor,
Office of Communications and Technology

Design and Layout

Tana Stith — Graphic Designer,
Office of Communications and Technology

Cover Photo

Orlando Hiller

Departments

Agricultural and Applied Economics: (307) 766-2386

Animal Science: (307) 766-2224

Family and Consumer Sciences: (307) 766-4145

Molecular Biology: (307) 766-3300

Plant Sciences: (307) 766-3103

Renewable Resources: (307) 766-2263

Veterinary Sciences: (307) 742-6638

Tools

Special thanks to Ed and Lillie Stith and Tore and Annabel Gram

Please visit our World Wide Web site at www.uwyo.edu/agcollege.

UNIVERSITY
OF WYOMING
College of Agriculture
Dept. 3354, 1000 E. University Ave.
Laramie, WY 82071

Nonprofit Organization
U.S. POSTAGE
PAID
University of Wyoming