"UTAH SCIENCE" is a quarterly publication devoted primarily to Experiment Station research in agriculture and related areas. Published by the Utah Agricultural Experiment Station, Utah State University, Logan, Utah 84322-4845.

This publication will be sent free on request in the United States, and to libraries and other public institutions elsewhere. Subscriptions mailed to individuals in other countries cost $10.00 annually. Please include a mailing label from a recent issue of "UTAH SCIENCE" with any request for change of address.

To avoid overuse of technical terms, sometimes trade names of products or equipment are used. No endorsement of specific products or firms named is intended, nor is criticism implied of those not mentioned.

Articles and information appearing in "UTAH SCIENCE" become public property upon publication. They may be reprinted provided that no endorsement of a specific commercial product or firm is stated or implied in so doing. Please credit the authors, Utah State University, and "UTAH SCIENCE.

Equal Opportunity in employment and education is an essential priority for Utah State University, and one to which the University is deeply committed. In accordance with established laws, discrimination based on race, color, religion, national origin, gender, age, disability, or veteran's status is prohibited for employees in all aspects of employment and for students in academic programs and activities. Utah State University is dedicated to providing a healthy equal opportunity climate and an environment free from discrimination and harassment.
CONTENTS

2  PESTICIDES REVISITED
  What if two common pesticides were banned by the EPA? A special committee of USU experts responds.

10  TREES ON THE MOVE
  Using scalpels and giant mechanical spades, crews move several grown trees to the new Utah Botanical Center.

12  A WORD WITH DR. LAMB
  More than 45 years after he began helping to build the ground floor of the country’s dairy research effort, Robert Lamb retires.

14  HOMES ON THE RANGE
  Wildlife, livestock, plants and humans are all thriving at the Cedar Mountain research project.

18  OBLIGING SCIENCE
  F.E. Busby has come back to USU after 20 years as a dean and with a new appreciation of research’s obligation to the public good.

20  THE FARM AS HABITAT
  A Berryman Institute survey finds that many farmers are thinking twice about trying to increase wildlife around their property.

DEPARTMENTS

8  HOTLINE
18  RECENT GRANTS
24  EDITOR’S FOOTNOTE

A Publication of the Utah Agricultural Experiment Station at Utah State University. Volume 59  Number 2  Winter/Spring 1999
PESTICIDES REVISITED

A year-long truce in the debate over pesticide use and food safety ended this fall with a new call for public comment on proposed changes to key pesticide science policies that will guide implementation of the new food safety law.

One of the first organizations to weigh in locally was the Utah Farm Bureau Federation in the form of a request to USU scientists to address the federation’s concern that two commonly used families of pesticides might be banned by EPA as part of implementing the Food Quality Protection Act (FQPA).

A 31-page response by five committees comprised of 20 USU scientists supported the Farm Bureau’s assertion that a comprehensive ban on organophosphate and carbamate pesticides would have deleterious to disastrous effects on Utah agriculture.

A pesticide ban “would be certain to significantly disrupt domestic food production and availability,” the report states, noting that prohibiting use of the chemicals now would appear to violate wording of the act itself. The law states that exemptions are to be allowed when loss of certain pesticides would prohibit production of an adequate, wholesome and economical food supply.

Although the EPA has not announced that it plans an outright ban, the agency made it clear shortly after the FQPA was passed in August 1996 that organophosphates and carbamates, which have been in use since the 1950s, would be among the first pesticides reassessed under a new safety standard being developed as part of the new law.

The USU report also notes that a pesticide ban might compromise state efforts to control vectors for human disease, such as mosquito-borne encephalitis. The higher cost of organic fruits and vegetables that would result from a comprehensive pesticide ban would further reduce intake of fruits and vegetables, especially among low-income residents. Reducing fruit consumption has been shown to decrease quality of health.

The USU review panels, citing the inadequacy of toxicological data related to the susceptibility of infants and children and other information gaps on the effects of chemical residues, concluded that the EPA will likely not entirely ban the two pesticide chemical families, at least not in the near future, but likely will restrict or modify their use.

Because the timeline for implementation of portions of the FQPA is so short—this August—and because so little is known about the biochemical effects of the pesticides, the report advises the Farm Bureau to closely monitor EPA efforts to develop a screening program. Doing so helps ensure that any new standards will be based on sound scientific evidence, not on the assumption that they are harming biochemical mechanisms in humans, the report states.

The report also advises the Farm Bureau to develop its own consumer education program that will counter an EPA-produced consumer brochure on the health effects of pesticides that some scientists and food producers consider to be biased.

The report further suggests that USU, the Farm Bureau and perhaps the EPA develop a research partnership to monitor pesticide residue levels on produce in grocery stores throughout Utah.
“We anticipate that the combination of data for pesticide use and actual residue levels on ready-to-eat foods will clearly show that the exposure risk to consumers is substantially lower than the maximum allowable,” the report states. “This knowledge will, in turn, facilitate consumer education efforts and help to ensure that EPA sets tolerance limits that are based on actual exposure risks.”

In Utah, a ban or serious restriction of the pesticides would affect all animal and crop producers in the state. Fruit production would be the most seriously affected, according to the report. A ban would essentially put the small-acreage fruit growers out of business, with 75 percent of fruit production acreage immediately lost and the quality of fruit substantially decreased in the remaining acreage.

Utah ranks second nationwide in sour cherry production. Loss of the two families of chemicals would make commercial production of cherries impossible, according to the report, which notes there are no other chemicals in use in Utah to effectively control the cherry fruit fly.

A ban or severely restricted use would add to the already significant urbanization of orchards in the state, according to the report. Loss of effective pest control could drive many fruit producers out of business, shifting Utah consumers to more reliance on imported fruit and force a number of producers to surrender their farmland to development.

Without the insecticide used to control codling moths, Utah’s commercial apples and most of the pears would be wormy, the report notes, adding that the residue left in the exit holes by codling moth larvae in wormy fruit would pose a great health risk for E. coli contamination. (Wormy apples are not used in cider production because of E. coli risk.)

Of the fruit growers that responded to a 1996 survey, 65.6 percent were part-time farmers, that is they received the major portion of their income from off-farm sources. Those growers represented 8 percent of the fruit acreage; only 25 percent of those surveyed produced more than 30 acres of tree fruit.

Loss of traditional insecticides would require growers to learn new technologies to stay in production. Part-time growers would be less likely to put in the time to learn new technologies and would probably find it more cost-effective to stop production, the report states.

Though in use now for 40 years, organophosphates and carbamates include many of the most toxic chemicals used on crops. All are toxic to the nervous system, and too much inhibits enzymes that play a vital role in the transmission of nerve signals.

There are currently 14 different federal acts regulating the use of pesticides. It is the job of the EPA to decide both risks and benefits of the pesticide. It determines potential risks to the health
of animals and humans and if it will harm the environment. It also assesses the benefits to society and the economy. If the EPA decides that the benefits of the pesticide outweigh the risks, the pesticide is registered and used in the United States.

According to the USU report, banning pesticides from fruits and vegetables in the diet to lower the possible exposure to pesticides will raise the contamination of pests that invade produce. In addition, the amount of risk reduction or increase is nearly impossible to determine.

People are more likely to accept natural risk, such as living on an earthquake fault or in a flood zone, but resist man-made risks such as fluoride in a public water supply.

"Such is the case with our food supply," the report states. "Many people take the quality of the food for granted, not realizing that agriculture improvements, including the prudent use of pesticides, have made the low-cost, often pristine food supply possible."

The public is indeed schizophrenic about food. On one hand, consumers will pay top dollar for the perfect unblemished, perfectly trimmed and hand-wrapped produce found in up-scale grocery stores that can't be produced on a mass scale without pesticides. On the other hand, some consumers are afraid that "putting poisons" on food is a hazard to their health and they are calling for a total ban on all pesticide use.

By nature, most pesticides create some risk of harm to humans, animals or the environment because they are designed to kill or otherwise adversely affect living organisms. At the same time, pesticides are useful to society because of their ability to selectively kill potential disease-causing organisms and control insects, weeds, and other pests.

Additionally, all food contains natural pesticides to protect themselves, and some of these naturally occurring substances pose a greater risk to health compared to pesticides. (See Utah Science, Vol. 58, No. 4, pp 20.)

The United States represents a third of the world's market for pesticides, with 1.1 billion pounds of active ingredients used each year. There are 21,000 pesticide products, and 860 active ingredients. In 1993, $8.5 billion were spent on pesticides in the United States.

Pesticides are not just used by farmers. The EPA reports that 69 million out of 94 million homeowners in the United States use pesticides in various forms:

- cockroach sprays and baits
- insect repellents,
- mouse and rat poisons,
- flea and tick sprays and pet collars
- kitchen, laundry and bath disinfectants and sanitizers
- products that kill mold and mildew
- some lawn and garden products such as weed killers
- some swimming pool chemicals.
Princeton University estimates that without pesticides, food crop losses to insects and other pests would total $15 billion per year in the United States.

The FQPA requires the government for the first time to consider the total risk posed to humans when they are exposed to any and all pesticides that have a common mode of toxic action and a similar type of effect. Prior to 1996, the government determined a separate, “safe” level of exposure for each of the dozens of registered pesticides found in food, but did not regulate as a group chemicals that can produce similar health problems.

All 9,700 limits on pesticides in food must be re-evaluated under the new health-based standard by 2006, with a third completed by August of this year and two-thirds by August 2002. FQPA requires EPA to re-evaluate the most hazardous pesticides first.

The act goes much farther than previous laws in specifying that foods should be “safe” for everyone, especially for infants, young children and pregnant women. The FQPA establishes a single health-based standard for both processed and raw foods, and defines “safety” as “a reasonable certainty of no harm” to public health.

In November, the EPA released a plan to receive public comments during the coming year on nine key technical issues raised by the laws. They range from how to statistically analyze human exposure to pesticides to how to deal with chemical residues on food that might be dangerous but are not measurable with existing equipment.

Industry representatives serving on an EPA advisory panel successfully pushed for the chance to comment on what they see as an overly strict interpretation of the policies that will shape enforcement of the law.

Some environmentalist groups say some companies are just trying to slow things down. The risk of subtle adverse effects on the developing nervous system in children, which might show up later in life such as learning difficulties or behavioral problems, is a central concern for groups who are calling on the federal government to set the new safety standards for the pesticides. JT

MORE INFO

Ralph Whitesides (435) 797-2259
ralphw@ext.usu.edu
In 1995, 10,615 samples (10,133 surveillance and 482 compliance) were analyzed under regulatory monitoring. Of these, 5198 were domestic and 5411 were imports.

In 1995, no violative residues were found in nearly 99% of all domestic surveillance samples (the same percentage as in the past several years).

Overall, no violative residues were found in nearly 97% of the import surveillance samples (97% in 1993 and 96% in 1994).

<table>
<thead>
<tr>
<th>COMMODITY</th>
<th>number of samples analyzed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DOMESTIC</td>
</tr>
<tr>
<td>apples</td>
<td>9</td>
</tr>
<tr>
<td>bananas</td>
<td>2</td>
</tr>
<tr>
<td>cherries</td>
<td>25</td>
</tr>
<tr>
<td>corn</td>
<td>10</td>
</tr>
<tr>
<td>grapefruit</td>
<td>8</td>
</tr>
<tr>
<td>grapes</td>
<td>5</td>
</tr>
<tr>
<td>olives</td>
<td>-</td>
</tr>
<tr>
<td>oranges</td>
<td>20</td>
</tr>
<tr>
<td>pears</td>
<td>6</td>
</tr>
<tr>
<td>plums</td>
<td>7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>92</td>
</tr>
</tbody>
</table>

Without pesticides, how much additional farmland would be needed to maintain present production?

The major reasons for using pesticides in modern farming are: improve the health of people around the world; enable producers to earn an equitable living for their families by enabling them to increase crop yields.

How much pesticides help depends on the geographic location of the farm/ranch, the crops, the moisture, the cultivating techniques and the pesticides available for their use.

On average, fields of tomatoes can be increased 17 percent, whereas yields of apples, pears and strawberries that are not very pest-resistant can be increased by about 78 percent with pesticides.

The newspaper Barron's estimates that the yield deficit without pesticides would require additional farmland the equivalent of Minnesota, Iowa, Missouri, Arkansas, South Dakota, Nebraska, Oklahoma and Louisiana to maintain present production.

That estimate does not include the additional environmental problems or costs of increased use of fossil fuel that would be required for planting, harvesting and transportation.

The costs of using pesticides must be included in the cost-benefit equation. Costs such as accidental animal poisonings from contaminated feed, honey-bee and wildlife losses and pollution.
The most widely used index of pesticide toxicity is the reference dose, or RfD. The RfD is an exposure level expressed in milligrams of chemical per kilogram of body weight of the exposed individuals per day, estimated to pose no appreciable risk of adverse effect in people. Most chemicals have an RfD for acute effects, and some may have one for chronic effects as well.

Toxicologists calculate an RfD by first determining the lowest level of exposure to a chemical that produced an adverse effect in a well-designed animal study, usually involving laboratory mice. The next exposure level below that—the highest dose that produced no observable, statistically significant adverse effect in the animals exposed—is called the No Observable Adverse Effect Level, or NOAEL.

The NOAEL is typically divided by a “safety factor” ranging from 10 to 1,000, depending on the extent and quality of available data to produce the RfD, the estimated safe daily dose for humans.

In other words, the doses allowed on farms are from 10 to 1,000 times less potent than the dose that showed no observable adverse effects in the lab.
Weed scientists at USU are two years away from achieving the first-ever complete eradication of a noxious weed in the United States, and in the process will save alfalfa growers nationwide the headache of a goatsrue infestation.

Jack Evans, a professor in USU’s Plants, Soils and Biometeorology Department, says goatsrue appears to be capable of infesting the major irrigated forage alfalfa regions of the country and costing farmers millions of dollars.

By October 2001, the purple blossom plant should be completely eliminated from 38,000 acres in northern Utah that 16 years ago was about 95 percent infested.

The plant, which was imported in 1890 as a possible livestock feed, spread rapidly but never took hold with herbivores, who completely avoided it. It is a legume similar to alfalfa but nearly three times larger.

Evans says goatsrue’s initial spread was along ditches, canals and other waterways, where some infestations remain. He says workers will spend the next two summers hand pulling weeds from those remaining areas.

---

Goatsrue, *Galega officinalis* L., a member of the Pea family, was intentionally introduced from the Middle East as a potential livestock forage but was found to be unpalatable and highly toxic.

---

*More info*

Jack Evans  
jevans@mendel.usu.edu  
(435) 797-2242
GRAIN MAY ADD TO HIGHER E-COLI LEVELS IN CATTLE

Despite stringent new food safety standards, the number and virulence of Escherichia coli O157:H7 continue to increase. Research by the USDA is indicating an underlying reason for the increase is diet changes among beef cattle.

Researchers at Cornell University found that E. coli counts were 300 times higher in the fecal samples from grain-fed cattle than in samples from hay-fed cattle. When the samples sat for an hour in acid similar to that in the human stomach, virtually all E. coli in the hay-fed group were destroyed while 80 percent in the grain group survived.

According to the research, the digestive tract of cattle have a hard time breaking down the starch in grain, which can pass undigested into a cow's intestines and trigger a fermentation process the bacteria can grow well under.

Additional research shows that by switching cattle from grain to hay five days prior to slaughter virtually eliminated the E. coli most harmful to humans.

USU AG DEAN APPOINTED TO CHAIRMAN OF BOARD

Rodney Brown, Dean of USU's College of Agriculture, has been appointed chairman of the Board on Agriculture, one of the governing bodies of the 200-member National Association of State Universities and Land Grant Colleges. The association is represented in all 50 states and provides a national forum for discussion and development of policies that affect higher education and the public interest.

CLIMATE CENTER DIRECTOR ELECTED

Donald T. Jensen, director of the Utah Climate Center and a professor in USU's Department of Plants Soils and Biometerology, has been elected a fellow with the Cooperative Institute for Regional Prediction.

The Institute fosters a broad program of research aimed at improving weather and climate prediction in regions of complex terrain, with emphasis placed on weather and climate issues of the Colorado River Basin and other parts of the West.
The yearly display of trees changing their leaves from shades of green to a fluttering patchwork of crimson, orange and gold against a background of evergreens is cause to stop, gaze and admire.

This past November, trees that were once home at USU’s Botanical Garden received more double takes than admiring glances. A change of season this past year meant a change of location for several trees that were literally moved from Farmington to Kaysville, the site of the new Utah Botanical Center.

Using a specialized truck, garden staffers, volunteers and professional tree movers transplanted selected trees to the new site just east of I-15 near the Kaysville ponds. They now stand like sentinels, conspicuously tall amid 94 unplanted acres that wait to be transformed during the next few years into gardens, paths, picnic areas, greenhouses, classrooms and research plots.

Over the course of several days last fall, the garden’s staff watched as the branches of trees they had been preparing for two years were tied up and the roots and surrounding dirt dug by the moving truck’s huge shovel blades.

Debbie Amundson, Extension Horticulturalist and assistant director of the garden, explained that roots as well as branches of the chosen trees were carefully pruned over the past two years. Cutting some of the larger roots caused fibrous, hairlike roots to sprout, providing the trees with more feeder roots that are an important support system once they’re moved.

Unearthing the trees suddenly would have been a life-threatening shock to their systems, said Anne Palo, a USU landscape architect who helped coordinate the tree moving project.

Although it was painful to see some beautiful trees and plants left behind, it was logistically and financially impossible to move all of them, she said.

“It costs thousands of dollars to move the large trees, and we can use that money to buy several smaller ones,” Palo said. “We have chosen to move important collections, unusual trees and some that are very slow-growing. There aren’t any that are really considered rare, but some that would take 30 or 40 years to reach this size. And there are trees at the garden that are hard to find now, although the varieties may have been common 20 years ago.”

Among the trees moved was a California incense cedar, a hazelnut, some of the garden’s beech collection and the dwarf conifer collection.

Some trees simply could not be moved because their size made it physically too difficult and the price too high to warrant the risk of moving them. Rather than leave them to be torn up during the U.S. 89 expansion, which prompted the garden’s move, the trees were harvested and will re-appear at the new Botanical Center as benches, exposed support beams and other pieces of garden infrastructure.

Bill Varga, Extension Horticulture Specialist and director of the Botanical Garden, had planted and cared for many of the trees and watched them being moved with a mixture of excitement and worry.

“They are going to need to be staked and carefully tended for the next few years,” Varga said. “We got a look at the roots we pruned and it appears that
First you dig a hole...

they've developed good fibrous roots that will help them get re-established. But that's one of the tough things in this business, you can't see right away if the things you've done are working.

There is plenty of work to be done at the Botanical Center site, some that will be immediately visible and some that will take time to bloom. Project Director Dave Anderson said the next projects at the site include more planting in the working gardens, grading soil, installing footpaths and fishing spots around the ponds, and building a greenhouse and offices.

While all that work goes on around them, the trees will continue adjusting to their new home. And once the color of their foliage changes again, they'll have survived their first year and will surely deserve the admiring looks of the people who've cared for them and from visitors who don't realize they are looking at the Botanical Center's leafy immigrant ancestors.

by Lynnette F. Harris
UAES Information Office

MORE INFO

Dave Anderson
danderson@wpo.hass.usu.edu
(435) 797-1984

Ann Palo
annep@wpo.hass.usu.edu
(435) 797-0568

The Utah Agricultural Experiment Station 11
His surname might have predestined him to make agriculture his chosen field, but it is dairy science, not sheep, that has occupied Dr. Robert Lamb's time the past 45 years.

Dr. Lamb, who has been associated with the UAES one way or another since he was a student in the late 1940s, retired in December as head of the Animal, Dairy and Veterinary Sciences Department at USU, a position he has held since 1990.

He was on the ground floor of the dairy research at the university and nationally, even before there was a ground floor. While working on his Ph.D. at Michigan State University, he helped devise the first genetics collating method in dairy cattle that became the basis for much of the computerized mapping that is underway today.

"I remember spending hours and hours with punch cards doing a job that most any computer could do in minutes today," Dr. Lamb says. "But it gave me literally a feel, I guess you could say, for the science behind the science and statistics."

He left East Lansing in 1961 and became an assistant professor in the Department of Dairy Science at USU. He developed an active research program and taught courses in dairy cattle breeds, genetics and milk secretion.

"A lot of students were living in Army barracks, and there wasn't even a third of the buildings that are here now," he says.

Three years later he began a 26-year association with Agricultural Research Service arm of the USDA. He was first a Husbandman then a research animal scientist, and from 1973 to 1990 was research leader in dairy for the ARS.

He was made acting head of the USU Animal, Dairy and Veterinary Sciences Department in 1988, a post he held jointly with his ARS duties.

Dr. Lamb has been a regular contributor to the flow of information about his field. Over the years, he has published 54 refereed journal articles, 80 abstracts and 46 articles in the popular press.

"I wouldn't call that prolific, but I have never lost that initial interest that first caught me all those years ago; I can still lose myself in it from time to time."

He has also kept close association with students, past and present. He has an open-door policy for any student, and was for years tapped to give the introductory animal science courses.

"Dr. Lamb in one way or another has helped produce untold gallons of milk through his teaching and research," says Rodney Brown, Dean of the USU College of Agriculture. "This is not just someone retiring, this is an era coming to an end."

Dr. Lamb says the bulk of his post-retirement time will be spent enjoying the husbandry of another kind. "I'm going to get to know my grandkids as well as I can."

He says although he has seen science bring milk and cattle production to a level never before seen in history, there is still much more to be learned. "The easy stuff has already been taken care of. But the more we have found out, the more we realize that
there is a lot more to find out. In genetics, for example, we’ve really only scratched the surface on its possibilities. And food production in all forms, especially when predictions of tremendous population growth well into the next century, will be even more important than ever.”

This past year, Dr. Lamb received the Nicholas and Mary Katherine Leone Leadership Award in recognition of his administrative skill. He also received the Special Service Award from the Utah Farm Bureau Federation for his contribution to Utah agriculture.

An informal reception was held for Dr. Lamb on Dec. 18. JT

---

**DR. HEALEY TAKES OVER AS ADVS DEPARTMENT HEAD**

The vacancy in Animal, Dairy and Veterinary Science created by Dr. Robert Lamb’s retirement will be filled by veterinarian and parasitologist Mark C. Healey, the department’s assistant director since December 1990.

Healey, who was awarded tenure at USU in 1986 and who was an acting associate director of the Experiment Station last year, has been on campus since 1981 when he was appointed a research assistant professor. He has a joint appointment with the biology department. He was also acting ADVS head for five months in 1994.

Healey holds two patents; one for bacterial extract vaccines issued in 1991, the second, issued last year, for a method he developed to control Cryptosporidium infections with protease inhibitors.

He received a doctorate in veterinary medicine at Mississippi State University in 1981. He has a Ph.D. from Purdue University (1976). He earned both his bachelor’s and master’s degrees at the University of Utah.
Despites developing into a showpiece for how to manage rangeland during the past 19 years, the Cedar Mountain Research Project's true value is yet to come.

So say researchers and beneficiaries who are proposing that the project be continued beyond its original 20-year phase so that nestlesome problems in the western United States, such as aspen displacement by conifers and the interaction between wildlife and livestock, could be further investigated.

The project, begun in 1980, has already shown that a combination of cattle and sheep grazing can optimize production for both animal species and improve range conditions at the same time.

On 3,000-acres located just east of Cedar City, the project has also demonstrated that varied interests of agriculture, wildlife, state and local political leaders, scientists, state and federal agencies along with the Farm Bureau Federation can be successfully coordinated.

Lee Wood, the project’s on-site manager, recently told the Farm Bureau News that the project has
shown that cattle and sheep graze better together. "We've even been able to show that we can produce more pounds of red meat per acre because of the fact that our stocking rate can be higher with cattle and sheep together."

Wood also said that the project's size and the fact that so many parties are working together make it an invaluable asset to rangeland studies.

Some estimate that more than 50 percent of Utah's aspen stands have been replaced by conifers during the past 200 years. Conifers displace much more water and are generally viewed as a sign of degrading ecosystem by experts.

Researchers say with the project and personnel already in place, the displacement of aspen could easily be added as another area of investigation.

Another question project coordinators would like to answer is the effect of a 10-fold increase in elk since the 1960s—to 65,000 today compared to 6,500 in the 1960s.

Wood said casual observation has shown cattle and elk grazing and bedding down together.
The Legislature in March appropriated $200,000 per year in ongoing funds to help underwrite research at Cedar Mountain. "We were quite hopeful that we'd get some funding in this year's legislative session," said Ken Olson, assistant professor of animal science at USU. During the past few years, funding has been extremely tight and at the point where the project needed a major infusion of new money, Olson said.

Olson, who has helped coordinate a funding initiative the past year, said financial goals included obtaining a one-time infusion of money that would be used to upgrade the project's infrastructure, as well as a recurring amount that lasts until the project shuts down.

Rep. Tom Hatch said the project provides the "potential to do some really unique research" that benefits people across the West.

"Obviously, the implications are most applicable the closer you are to the study site," Olson said. "But it's going to fit most of the other forests as well [because] the aspen die-off issue and the elk issue are problems throughout the state."

Although researchers will do new studies, they will continue to study the scenarios they have faced previously, Olson said. "Different species with different dietary preferences eat different things," Olson said. "If you've got all sheep and they eat just the things they like, they eat those things to death.

"They eventually die off and what's left is what the sheep didn't care for," he continued. "But if you put a balance of animals out there with different dietary preferences so that you balance the grazing on all these different plant species, it helps maintain the diversity of the plant community."
In addition, Olson said both plant and animal species work cooperatively.

"By maintaining a balance of species of animals, you maintain the plant species balance," he said.

Although both animals and plant species supposedly benefit equally from each other, Olson said the plant community reacted more strongly than the animal community.

"The effect we saw on animal performance wasn't as strong as we had expected, but it was there," he said. "We definitely saw it with the sheep, where mixing them improved sheep performance; with cattle it really didn't matter if they were mixed with sheep or not."

But the integration of animal species doesn't only benefit the animals and plants. Olson said it benefits humans as well.

"If we don't maintain the ecosystem, and allow its degradation, which changes the plant composition and decreases the protection of the soil, then you get soil erosion," he said. "When you lose soil, you lose productivity, and pretty soon we no longer have the ability to sustain productivity on sites.

"The net benefit is reduced productivity in terms of using a site to produce animals to produce products for human consumption," he continued. "But the long-term effect is we don't have an immediate loss, but a forever loss because of soil loss."

Planning at Cedar Mountain was on hold until researchers found out the Legislature will award the grant. They will now broaden involvement in the project.

"I would assume we're going to have a larger group of people," Olson said. "We're obviously going to have to have wildlife biologists involved because we're adding this wildlife component."
**Recent Grants and Contracts**

**Steven Aust**, Chemistry and Biochemistry, has received an NIH grant to investigate the role of iron in toxicities and pathologies.

**Nedra Christensen**, Nutrition and Food Sciences, has a grant from Primary Children’s Medical Center to study the effect of fortified milk on bones of cystic fibrosis patients.

**Tilak Dhimani**, Animal Dairy & Veterinary Sciences, has a state Department of Agriculture grant to determine why the milk from grazing cows has more conjugated linoleic acid, an essential fatty acid, than confined cows.

**Janis Boetiging**, Plants, Soils and Biometeorology, is studying three-dimensional modeling of molecules and minerals in soils with the University of Minnesota.

**Layne Coppock**, Rangeland Resources, is involved with a federal/multi-university grant to help improve risk management on east African rangelands.

**Reed Holyoak**, Animal, Dairy & Veterinary Sciences, has a USDA grant to determine the efficacy of embryo transfer and artificial insemination.

**Brent Miller**, Family and Human Development, has a joint U.S. Health and Human Services and NIH grant to study the well-being of adopted adolescents.

**Noelle Cockett**, Animal Dairy and Veterinary Sciences, has a USDA grant to investigate cloning of the ovine Callipyge gene.

**Paul Johnson**, Plants, Soils and Biometeorology, is evaluating golf course putting green and fairway grasses for the National Turfgrass Association.

**Mark Healey**, Animal, Dairy and Veterinary Sciences, has a state Department of Agriculture grant to study a parasite that causes chronic and/or life-threatening diarrhea in animals and humans.

**E. “Fee” Busby**, who has spent the past 20 years away from USU farming the territory between agricultural development and science technology, has grown an appreciation for the obligation facing ag research in the next 20 years.

Key to meeting future obligations is for researchers to become more visible reference and service contacts for the public, says Busby, the former USU Extension Service specialist who in July returned to USU to become dean of the College of Natural Resources.

One of the best ways to be more visible, Busby says, might be for researchers to play more of a role in helping Salt Lake City metropolitan area residents grapple with population growth problems.

That doesn’t mean taking “for” or “against” positions on issues, he says. It means helping the public and elected officials focus on problems such as clean water, fish and wildlife and open space, he says.

The college is a natural resource for that, he says. “Agriculture and range management, though they’ve made mistakes along the way, know how to help produce clean water and how to keep soil from blowing away and how to show a stewardship for the land that goes further than fence post to fence post. Clearly we could be a powerful decision support tool, but we’re often not viewed as an asset.”

There are costs to many human endeavors and government policy-making. “I believe that anytime universities shy away from pointing out those costs or providing options, we’re not doing our job. If we don’t do that, who will?”
Busby left USU in 1979 to head the University of Wyoming's Department of Rangeland Management. He directed the Cooperative Extension Service for four years then worked for Winrock International Institute for Agricultural Development. He was also on contract assignment in Washington, D.C., as deputy chief for science and technology for the USDA's Natural Resources Conservation Service.

He says his stint in Washington taught him that the agricultural industry is a complicated, world-wide conglomeration of competing interests that aren't well understood in the United States.

The world market for grain, for example, is essentially driven by traders who set the price and turn farmers into contract growers.

"We in the ag research institutions need to understand the complexities of that system," he says. "Generally we don't. We continue to push technology and production and in the process create a kind of terrible treadmill for ourselves."

The view from Washington also revealed to Busby what he considers to be a lot of conflict over the management of natural resources in the West. The land uses are competing, and public and private land mingle like nowhere else in the country.

He says he hopes his college and his colleagues in science research will play a leadership role in helping sort out the conflicts and create a clear vision for the next century.

"If we are to have the positive effect on resources that we want, my college and others must actively share knowledge with decision makers as well as with peers," he says. "We must help those involved in the conflict use their experience, knowledge and passion to create ideas."

If Busby has an overriding philosophy about his approach to the land and its uses, he says it would be a sentiment attributed to Chief Seattle: "We have not inherited the earth from our forefathers, only borrowed it from our grandchildren." JT
Although most farmers and ranchers in the country try to manage wildlife on their property, most sustain property damage greater than $500 each year, and some are losing their interest in enhancing wildlife populations because of it.

According to new findings by the Jack Berryman Institute at USU, 24 percent of farmers and ranchers surveyed around the country report they are reluctant to provide habitat for wildlife, and 38 percent said they would oppose the creation of a wildlife sanctuary near their property because of property damage caused by wildlife.

The 1,400 farmers and ranchers surveyed said problems were caused most often by deer (listed by 53 percent of all survey respondents) raccoons, (25 percent), coyotes, (24 percent) and ground hogs (21 percent). Regional differences were found in wildlife enhancement practices, hunter access, and the species causing problems, but not in the extent of wildlife damage, according to the survey.

Michael R. Conover, Fisheries and Wildlife professor, director of the Berryman Institute, and survey coordinator, reported that 80 percent of respondents experienced wildlife damage on their property in the prior year, and 53 percent of those said the damage exceeded their tolerance.

The range of loss was from less than $100 (reported by 23 percent of respondents) to more than $10,000 (3 percent).

More than half the respondents said they received more than $500 in property damage, despite spending a mean of 43.6 hours and $1,002 in the prior year trying to solve or prevent wildlife damage.

Most respondents had diversified operations: 73 percent raise field crops, 55 percent livestock, 17 percent timber, 13 percent vegetables, 8 percent fruits. The size of their farms and ranches averaged 897 hectares.
Management efforts by farmers and ranchers include providing cover for wildlife near fields, providing a water source, leaving crop residue in the field, leaving a portion of the crop unharvested, or providing salt licks.

Conover reported in 1997 that perceptions of high levels of wildlife damage can reduce a farmer’s tolerance of the species responsible. But it was unclear until this latest examination whether wildlife damage on a national level is extensive enough to influence perception of the nation’s agricultural producers about wildlife and diminish their willingness to manage their lands to enhance wildlife populations.

It may seem counter-productive for farmers to be spending time and money to enhance wildlife habitat and to reduce wildlife damage at the same time, Conover says.

“One reason for this apparent paradox is that many farmers enjoy having abundant wildlife on their property but do not like the damage caused by the animals,” he says. “Hence, they take steps to try to accomplish both objectives.”

An example is a farmer who simultaneously manages for a trophy deer and to keep them out of his soybean field.

People’s attitudes about wildlife are also species-specific—they like some species and dislike others, according to Conover’s research reported last year.

For example, sunflower growers in North Dakota spent resources trying to protect their crop from blackbirds by both harassing the birds and by using herbicides to open up marshes so that blackbirds will not roost in them. Many of the same growers spend time trying to increase pheasant populations on their property because they enjoy hunting them.
Wildlife damage is widespread across the United States, Conover says. However, western agricultural producers spent more time and money trying to solve or prevent wildlife damage problems than those in other region. Northeastern producers spent the least time and money.

Deer, ground hogs, and raccoon problems were most common in the Northeast; deer and beaver problems in the Southeast; deer, coyote, raccoon, prairie dog, and blackbird problems in the Great Plains; and deer, European starling, blackbird and coyote problems in the West.

Farmers who allowed hunting were more likely to have wildlife damage, to consider their damage unacceptable and to report annual losses greater than $500 than farmers who prohibited hunting.

"Apparently, farmers experiencing wildlife damage are more likely to allow hunting in an effort to reduce wildlife damage," Conover reports. "Many wildlife managers try to persuade farmers to allow hunting on their property by arguing that hunting would reduce wildlife damage. My findings indicate that this strategy is successful."

Considering that only 5 percent of the respondents reported that they charge hunters a fee, the high value respondents placed on wildlife apparently resulted from the aesthetics and enjoyment wildlife provide rather than from direct financial benefits, Conover says.

The figures represent perceived losses, Conover says. That is, their relationship to actual losses is unclear and probably depends in part on the conspicuousness of the damage. For example, farmers overestimate sandhill crane damage to grain fields because the damage occurs along the field's edge where it is most obvious.
Similarly, red-winged blackbird damage to corn is typically overestimated because damaged corn ears are shredded, making them conspicuous.

However, farmers underestimated the magnitude of losses caused by geese or deer grazing in rye fields.

Although the relationship between perceived and actual levels of wildlife damage is unclear, a farmer’s perceptions are important because as Conover’s results indicate, they influence his or her attitudes about wildlife.

About 40 percent of the respondents said that wildlife damage was so severe on their farm or ranch that they would oppose the creation of a wildlife sanctuary near their property, and about 26 percent said that wildlife damage reduced their willingness to provide wildlife habitat on their property.

“Considering that 45 percent of the total surface area of the United States, or 401 million hectares, is under the control of agricultural producers, perceptions of wildlife by this group are critical if America’s wildlife resources are to be maintained or enhanced.

“Wildlife damage appears to be a serious concern of many farmers and ranchers, and that perception should be of concern to wildlife managers,” he says. “Development and implementation of effective strategies to alleviate wildlife damage to agricultural producers would not only enhance the nation’s productivity and strengthen rural economies, it would also strengthen American’s wildlife legacy.”

\textbf{EVERYONE AGREES-- WILDLIFE IS VALUABLE}

One way to assess the value of a resource is to measure the amount of time and money spent to acquire or manage it, Conover says.

By this standard, the nation’s 2.1 million farmers and ranchers, who spend 120 million hours and $2.5 billion annually on wildlife management, do value wildlife.

In a similar study last year, Conover reported that U.S. urban area residents, who far outnumber agricultural producers, spend 1.6 billion hours and $5.5 billion annually to manage wildlife in and near cities.

“The United States is blessed with a valuable wildlife resource,” Conover says. “On this point, both its urban and rural citizens agree.”

\textbf{MORE INFO}

Michael Conover  
conover@cc.usu.edu  
(435) 797-2436
EDITOR’S FOOTNOTE

The most pessimistic scientists I’ve interviewed over the years have been cancer researchers. My impression is they’re just not a hopeful bunch. A protein expert at the University of Utah, who liked to use agriculture metaphors around me for some reason, said one day, “We’ve barely found the haystacks, let alone any needles.”

Not that there haven’t been several striking advances in that battle. Most recently are refinements in forecasting breast cancer risk and the promising results linked to the protein angioatin. But ultimately, odds are the disease simply has so many tillers (to use a plant science metaphor) that the biggest hope for a cure lies in not getting it.

I’ve been reminded of these cancer researchers lately by their colleagues in agriculture who lead research efforts. They don’t seem like a hopeful bunch, either. But unlike their medical science counterparts, who are daunted by their lack of finding a cure, ag researchers are daunted by having what they do perceived as a cure.

They are getting the impression that Americans think abundance is a permanent vaccine for hunger. At three conferences this fall and winter ag researchers said that those who oversee the awarding of science research grants must be saying to themselves, “Research for agriculture? We did food already.” Most Americans, who seem to follow a personal food philosophy “I eat to avoid getting hungry,” would probably agree with them.

Robert G. Zimbelman, Executive Vice President of the Federation of Animal Science Societies, says some people conclude that the ag research agenda gets widely ignored in Washington, D.C., because grocery store shelves have been full for so long that agriculture is taken for granted and because only 20 members of Congress have actual ties to a farm.

“Others portray the agricultural community as a circular firing squad,” Zimbelman said in an address to the first Intermountain Nutrition Conference in January in Salt Lake City. He said legislators see ag groups arguing about research priorities amongst themselves: formula funds versus competitive grants, plant sciences versus animal sciences, biological sciences versus social sciences, sustainable agriculture versus conventional agriculture, small farms versus integrated operations, commodity support payment versus research to be competitive.

“I don’t see such arguments among the biomedical community which received a $2 billion increase for fiscal year 1999,” Zimbelman said.

Perhaps agriculture isn’t a priority in Washington because agriculture doesn’t have a common foe. It doesn’t have a rallying point like cancer or other health maladies that biomedical researchers can “sell” in Congress. Everyone knows someone with cancer, but hardly anyone knows someone who’s hungry.

So what is left to learn about food and fiber. Here a few of the many needles still to be found:

• The combined threats to the food supply, both natural and manmade, continue to evolve and change. The next corn borer is lying in wait to take over wheat, as it did in malignant fashion this year in Arizona. The spores do what they like, and they don’t cooperate with USDA quarantines.

• Humans are booming. By 2010, there will be 300 million Americans. By 2050, there will be 8.9 billion people in the world and more than 5 million—twice the population of the entire state today—will reside along the Wasatch Front.

• The growing need for food is compounded by the fact that the number of farmers continues to decrease and the land available in the wake of housing and other development pushes farming to the fringes.

• Safety and security of the food must be increased. Plant and animal health and safety must be promoted, disease controls must be developed, genetics will continue to be manipulated where that’s beneficial, and chemical control of pests will be reduced.

• More harmony between agriculture and the environment must be found. New lower-impact grazing techniques are being studied. New ways to make wildlife and domestic animals more compatible must be developed. Water quality and quantity is a constant concern.

No single research issue facing agriculture will show up on Washington’s radar screen, and perhaps the interests of the industry are fragmented. But when legislators deal with ag research proposals, instead of looking at the 2 percent of the population that farms, they should consider the 100 percent of the population that research funding ultimately helps.
Utah Science is on line.
Check out our Web page at:
http://agx.usu.edu/agx/

*PLEASE NOTE OUR NEW WEB SITE

FEATURED RESEARCHERS

Ralph Whitesides  Ken Olson  Mike Conover

Printed on recycled paper