OREGON'S AGRICULTURAL
PROGRESS
Spring/Summer 1990

WHAT DOES THIS HAVE TO DO WITH FARMING?

THE EDITOR'S NOTE

Let me tell you a bunny tale.

Leo the Lop, named before we determined her gender, was a gray fur ball with floppy ears the day our daughter lured my wife and me into a pet shop and conned us into rabbit ranching. The first years with Leo were tough, at least on Mom and Dad. We felt guilty whenever we looked out at her crude hutch with chicken wire sides and saw her hopping back and forth aimlessly. But if we let her out, she scrambled through the backyard's wire fence.

The little fur ball grew into a strapping Belgian doe. We put in a wooden fence and let her run free. We enjoyed watching her hop by on seemingly crucial errands, then stop six feet away and munch grass. She liked digging burrows near the roots of prized shrubs. But her greatest joy was tunneling out. I have oddly fond memories of frantic after-work searches in the neighborhood, and beyond.

One sunny day in the early fall we had a visitor from down the block. Sammie, a white male rabbit about half Leo's size, tunneled *into* our yard, and he wasn't looking for carrots. The herd soon included Louie and Howie, females named, like their mother, before their gender was determined.

For a while, motherhood kept Leo in the yard where we wanted her. But after she weaned Louie and Howie she tunneled out and headed for Sammie's place. Because of a trip to the veterinarian, carrots now were his greatest pleasure. Still, Leo was smitten. She followed him everywhere. We didn't have the heart to make her come home, and neither did Sammie's owners. In a few weeks, Louie tunneled under the fence and moved to Sammie's, too. Then little Howie followed.

They came back to see us occasionally, and ate our bribes. But Sammie seemed to have a hypnotic grasp. Or maybe it was just that there wasn't a fence around his yard. Anyway, we accepted the arrangement, enjoying their visits and reciprocating fairly often.

Quite a few neighbors laughed at their antics. Then Louie turned reckless. She couldn't shake a taste for some flowers that were an across-the-street neighbor's joy. More than once, we caught her and put her in the chicken wire hutch to cool off. Finally we faced the inevitable, deciding Howie should go along to keep her company on a farm near Alsea, Oregon, where they'd run free with ducks, geese, peacocks and other pets. The day they left was very sad.

Last week, Leo and Sammie discovered the same irresistible flowers. Now the two of them are in the chicken wire hutch in our backyard, hopping back and forth aimlessly.

The experience with our reckless rabbits has made me think about natural resource problems. One family's pets can be another's pests. Things that do good also can do harm. Fingerpointing probably is inevitable sometimes. Our best response—the only constructive option, really—is to work together to fix the problem and move forward, though that may not be easy or painless.

This issue includes an article about STEEP, an anti-soil erosion research and extension project on Northwest agricultural lands, and an article that profiles restoration work on Oregon rangeland. Both articles say something about constructive responses, about working together and moving forward.

Andy Duncan

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Cover: A starfish. The state's newest marine branch agricultural experiment station is on the Oregon Coast. See story, page 20. (Photo by Tom Gentle)

Private funds, provided by the Agricultural Research Foundation, are used to pay for color reproduction in *Oregon's Agricultural Progress*.

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You've heard horror stories about soil erosion in agriculture. Have you heard about STEEP, the cooperative research effort that's helping Northwest farmers fight back?

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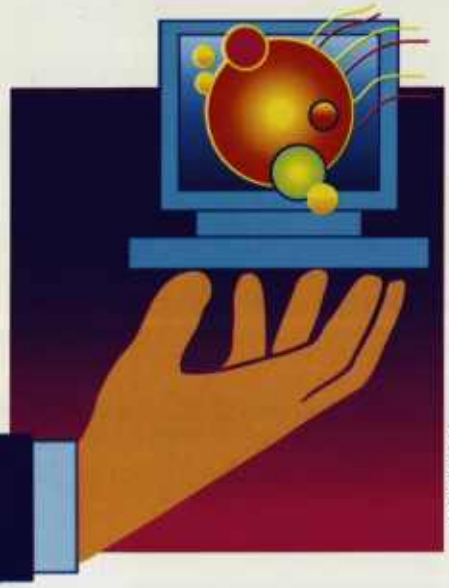
Thanks to Lloyd Martin, the North Willamette Agricultural Research and Extension Center has the atmosphere of a family owned berry farm.

THEIR DATA BASE IS REALLY TINY

Think of the computer data base Larry Moore and Joe Hanus are setting up as a brokerage-type service that scientists the world over can use in plant-related microbiological research. The data base listing of "stock cultures" will help the researchers get information about microbes that interest them.



TOM WEEKS

"There are thousands of scientists who research tiny, obscure microorganisms that are important to the well-being of plants, animals and the environment," explained Moore, a plant pathologist in OSU's botany and plant pathology department.

The international Microbial Germplasm Database that Moore and Hanus, a senior research assistant in the same department, are developing will help those scientists exchange information about bacteria, fungi, nematodes, viruses and even pieces of DNA used in genetic engineering.

The information could be extremely important when, for example, a disease problem arises.

"It's hard to predict which organisms or genes will be valuable in the future. You never know what might come in handy," said Hanus.

Besides being important in agriculture and the fermentation of food and other industrial processes, microbes play a role in medicine and environmental cleanup efforts, Moore says, noting that "our microscopic resources are greatly underappreciated."

Moore and Hanus note that some microbial collections contain unique resources and protecting and keeping inventories of these collections conserves biological diversity, a paramount concern the world over.

"The living organisms may exist nowhere else except in one collection, maintained by one scientist who has an intimate knowledge and feel for his or her collection," said Moore. For example, an organism may have originated in an area of the Amazon rain forest that no longer exists, he said.

Funds to start the Microbial Germplasm Database came from the U.S. Department of Agriculture's Cooperative State Research Service.

DINERS DIGGING NEW POTATOES

Potatoes aren't what they used to be in Oregon's Klamath Basin.

Discriminating consumers are paying a pretty price for specialty varieties and Klamath Basin growers are taking notice, says Ken Rykbost, superintendent of OSU's Klamath Agricultural Experiment Station at Klamath Falls.

Until a few years ago, russet-skinned, foil-wrapped baked potatoes were the standard fare in even the best restaurants. Now, according to Rykbost, baby red-skinned or other less common potatoes are featured side dishes.

No longer is the good old Russet Burbank potato planted without a second thought. Tubers with names like Yukon Gold, Sangre and Norkotah are getting consideration. "Potato growers are a little more willing to try something new," said Rykbost.

He and fellow agronomists at the University of California's Tulelake Field Station, just across the border, have produced a special publication called "Potato Varieties–An Introduction to Variety Characteristics, Management and Performance in the Klamath Basin." The goal is to take some of the mystery out of the new varieties. The publication is based on years of field trials at the Klamath and Tulelake stations and includes information on 18 potato varieties.

Rykbost said he believes the publication will be helpful to potato growers through the West. Copies, which cost $2 for postage and handling, are available by writing the University of California's Tulelake Field Station, P.O. Box 447, Tulelake, CA 96134.

Potatoes are the leading cash crop in the Klamath Basin, according to Rykbost. About 85 percent of the potatoes are grown for fresh market and the rest for seed. In recent years, annual cash sales have ranged from $30 to $75 million.

DAVE KING

In Oregon's Klamath Basin, Russet Burbank potatoes like these have competition from specialty varieties gaining popularity with consumers.

HER TOMATOES ARE FLYING HIGH

Like a lot of U.S. students, Denise Horton has been doing some pretty far out research.

This spring the OSU senior, who's majoring in crop science, grew tomatoes from seeds that spent almost six years in space.

"Before I planted them, it was kind of exciting carrying seeds from space around in my backpack," said Horton, who did the research under the supervision of Experiment Station scientist Rodger Danielson, manager of the OSU Seed Laboratory.

Students around the country conducted research on similar seeds as part of a National Aeronautics and Space Administration (NASA) project intended to promote interest in space among students from grade school to college age.

More than 12 million tomato seeds, including Horton's, were among 57 experiments on NASA's Long Duration Exposure Facility (LDEF) satellite put in orbit in April of 1984 by astronauts on the space shuttle Challenger. The ill-fated Challenger mission of 1986 was scheduled to retrieve the 11-ton satellite, which finally returned to earth January 20, 1990, aboard the space shuttle Columbia.

NASA distributed packets of the tomato seeds that were aboard the satellite, and Earth-bound tomato seeds grown in the same field, to students and asked them to check the germination rates and search for mutations caused by long-term exposure to cosmic radiation.

The germination rate of space and Earth-bound seeds planted at the OSU lab was the same, about 83 percent, according to Danielson.

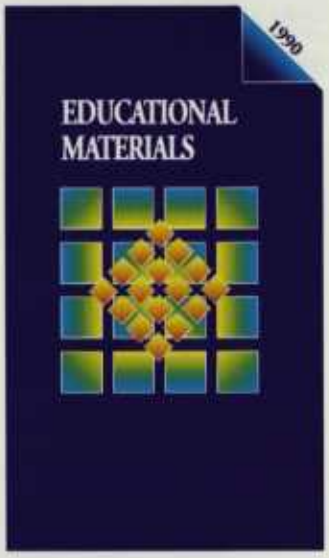
Both space and Earth-bound seeds appeared to lack vigor, he said, adding that "this is probably due to the age of the seed rather than their exposure to space elements."

Although NASA says the main purpose of the project was to increase interest in space, the agency points out that the pink grapefruit we see in the grocery store is a mutation created by irradiating white grapefruit seed.

"Denise has expressed interest in using seeds from the fruit to grow additional generations and see what turns up," said Danielson. The researcher sees another possibility. "Maybe this is a little step toward gardening in space," he said.

BOB ROST

Student researcher Denise Horton with tomato seeds that spent almost six years in space. Horton plans to continue searching for mutations.



THE LIST JUST GOT BIGGER

It's been called the "Publications List" for more years than most people remember. But there's a new name for the catalog of publications the Oregon State University Extension Service and Agricultural Experiment Station publish.

From now on, ask for the "Educational Materials List," says Evelyn Liss, publications coordinator in OSU's agricultural communications department.

The change reflects the changing contents of the publications many Oregon households keep on file, Liss notes. Although it still contains about 1,500 different titles of OSU Extension Service and Experiment Station publications, the new list includes computer software programs and educational videotapes that may be purchased.

The "Educational Materials List" is available from county offices of the OSU Extension Service or may be obtained at no charge from Publications Orders, Agricultural Communications, OSU, Administrative Services A422, Corvallis, OR 97331-2119.

CAN WHEATS BEAT FUNGUS ATTACK?

Oregon growers regularly face the problem of disease-resistant wheat varieties becoming susceptible to new strains of the disease.

Chris Mundt is experimenting with a method of planting he hopes will lead the fungi that cause wheat rust disease astray while saving wheat growers money, increasing their yields and helping the environment.

"Instead of growing fields of wheat with only one strain with only one type of resistance bred into it, we grow fields with two or more resistant strains," said the OSU plant pathologist. A single disease can't attack all the plants because of their genetic differences, said Mundt.

"Essentially what you are doing is slowing the rate of a development of an epidemic in your wheat fields," said Mundt, explaining that it takes plant breeders up to 12 years to develop new disease-resistant strains of wheat.

When there is a disease outbreak, "either the farmers suffer a great loss or they have to spray a fungicide, which is very expensive and also environmentally costly, because it can contaminate ground and surface waters," said Mundt.

Mundt believes the research will contribute to the Low Input Sustainable Agriculture (LISA) project underway in Oregon. "Potentially, this is a way of being able to maintain high yields and reduce disease with reduced chemical inputs," he said.

The researcher is mixing and planting grain varieties to learn how they perform compared to traditional one-variety plantings.

"I have found an average decrease of disease severity of about 60 percent and as high as 80 to 90 percent, as compared with the amount of disease found in pure stands," he said.

Mundt has found other advantages. Mixing varieties increases yield and provides yield stability, even when disease is not a factor, he believes.

Official recommendations for mixtures of club wheats will be made this fall and for other wheats over the next few years, according to the researcher.

DAVE KING

Plant pathologist Chris Mundt hopes mixing varieties, instead of planting a single variety as in this field, will help farmers reduce damage from wheat rust disease.

NEW BERRIES

Waldo and Summit, new berry varieties released by the Agricultural Experiment Station and the Washington State University Agricultural Research Center, are available for commercial and home garden use.

DAVE KING

Raspberries are popular with Oregon's home gardeners.

Waldo is a blackberry variety featuring thornless canes easy to handle and work around. It's resistant to cane and leaf spots and has growth characteristics similar to Evergreen variety blackberries.

The berries are large and firm with an attractive color, good flavor and long shelf life. They begin to ripen four to seven days later than the popular Marion blackberry variety.

Summit is a new red raspberry with strong resistance to foliage and root diseases and the ability to survive in heavy soils. Summit yields well, producing firm berries with full flavor and pleasing color. The berries are reported to be suitable for fresh marketing and shipping.

For more information about Waldo and Summit, contact F. J. Lawrence of the U.S. Department of Agriculture's Agricultural Research Service, National Clonal Germplasm Repository, 33447 Peoria Road, Corvallis, OR 97333. For a list of nurseries that offer the varieties, contact the OSU Department of Horticulture, Corvallis, OR 97331. Neither OSU nor WSU has plants for sale.

OREGON HAS ANOTHER NUT

After 18 years of research, Agricultural Experiment Station scientists have developed a hazelnut they say has advantages over the state's most popular variety, which was introduced before the turn of the century.

"Willamette, the variety we've released, is aimed at the really high quality hazelnut kernel market—chocolate bars and that sort of thing. It has nut yields comparable to or slightly higher than Barcelona, and it has higher yields of good kernels and fewer defects," said Shawn

DAVE KING

Plant breeder Shawn Mehlenbacher with the promising Willamette hazelnut variety (right) and Barcelona, the state's most widely grown hazelnut.

Mehlenbacher, a plant breeder in OSU's horticulture department.

About 80 percent of the hazelnut trees in Oregon are Barcelona, a European variety introduced to the Pacific Northwest in 1895. Oregon produces about 98 percent of the U.S. hazelnut crop and about 3 percent of the world crop. Leading producers are Turkey, Italy and Spain.

About half of Oregon's hazelnuts are cracked and sold for use in baking and candy making. The rest are sold in the shell in the months before Christmas.

"Growers aren't going to yank out their old trees just to put in Willamette," said Mehlenbacher. "But we expect significant new plantings in the next few years. This is the state's first opportunity to get into the high-quality kernel market. Barcelona's nuts are not right for that."

"Nuts of Willamette are smaller than Barcelona's and have thinner shells, an advantage in processing," said Mehlenbacher. He added that Willamette's nuts have an attractive color and the round, plump kernels have good flavor and texture and are easily blanched for uses such as baking and candy making.

"But Willamette's not completely free-husking, which means some of the nuts don't fall to the ground at maturity, and some of the nuts fall in the husk. These are problems that growers and processors are going to have deal with," he said.

The new tree is susceptible to eastern filbert blight, a fungal disease causing serious problems for Oregon's $45-million-a-year hazelnut industry. Researchers are continuing to work on producing a hazelnut variety that has desirable characteristics and is resistant to the disease.

Mehlenbacher noted that the Experiment Station recently released four new hazelnut pollinizer varieties with high resistance to eastern filbert blight. The trees are intended as substitutes for the variety Daviana, widely used since 1920 to pollinize Barcelona trees. Daviana is highly susceptible to eastern filbert blight.

Developing a hazelnut variety can takes 16 to 20 years, Mehlenbacher noted. Willamette is the first variety released from an OSU breeding program that started in 1969.

Now-retired plant breeder Maxine Thompson made the crosses that resulted in Willamette in 1973. Mehlenbacher and researcher Anita Miller did the final evaluation work on the hazelnut variety.

OSU has released the variety to the public by making it available to commercial nurseries. Mehlenbacher has a list of nurseries that have Willamette trees.

TWO LUMPS AND ARTIFICIAL FRUIT?

When it comes to strawberry yogurt, Americans like a sweet, artificial fruit flavor better than the real thing, an OSU study suggests.

Debbie Barnes, a graduate student in the Department of Food Science and Technology, reported the findings recently at the annual meeting of the U.S. Institute of Food Technologists.

Barnes, who conducted the study under the supervision of Experiment Station food scientist Mina McDaniel, used a 182-member consumer panel, ranging from 10-year-olds to senior citizens, and an 11-member panel of people trained in describing the sensory characteristics of foods, to rate 14 commercial brands of pre-stirred strawberry yogurt.

The tasters preferred yogurt that was sweet with a "jammy, artificial strawberry flavor" and had the flavor of "cooked milk," said Barnes. Panelists disliked yogurt brands that had characteristics of plain yogurt, such as sourness, astringency and acetaldehyde, a product of fermentation, she said. They also disliked the bitterness in some commercial brands.

The OSU researcher noted that the panelists associated the jammy, artificial strawberry flavor in some yogurts with a "desirable, fruity character." They associated real fresh strawberry flavor with sourness and astringency, characteristics they didn't particularly like.

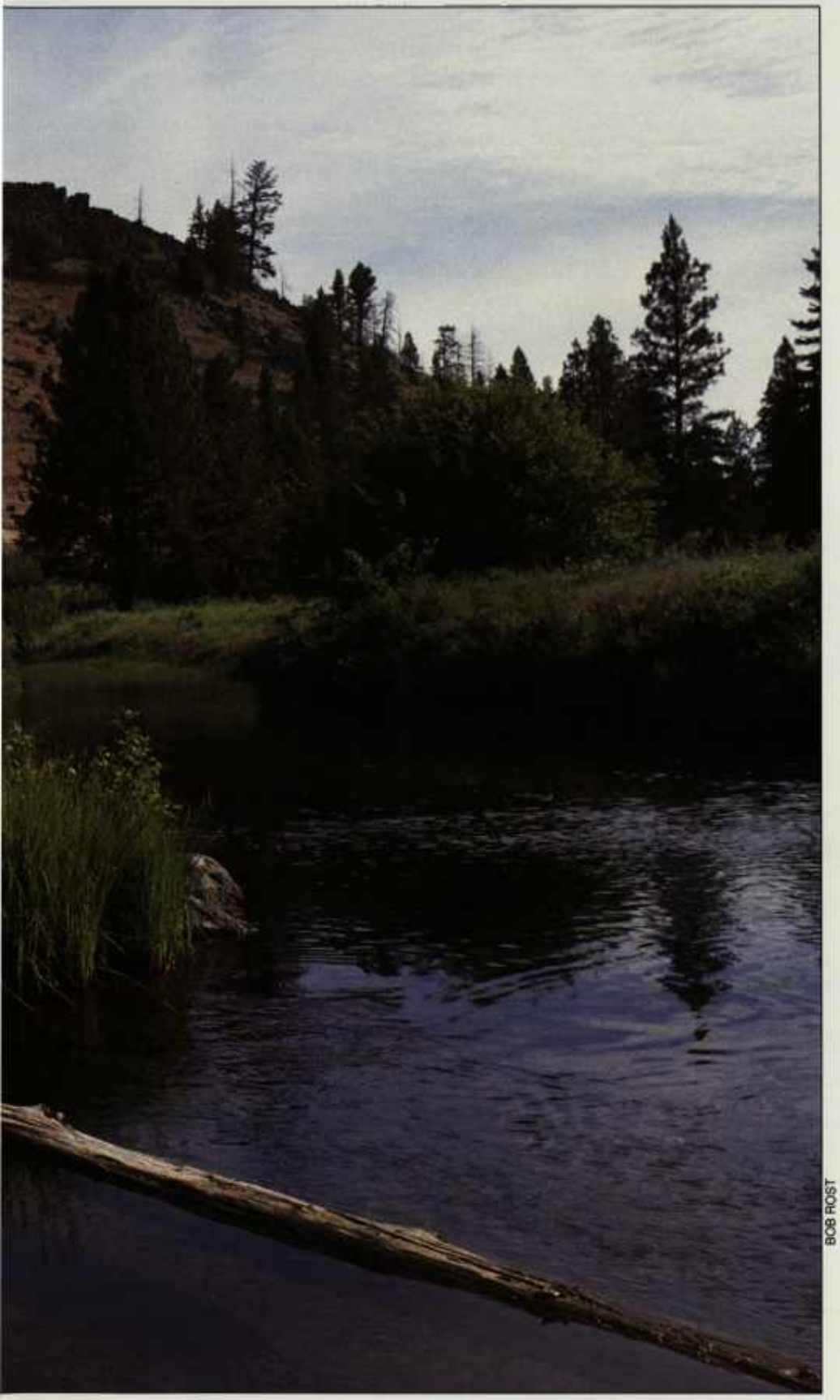
Strawberries used in food processing are an important Oregon crop.

TOM GENTLE

Tasters in an OSU study preferred sweet yogurt and chose an artificial fruit flavor over the real thing.

COMEBACK AT QUARTZ CREEK

BY JOSH KAHAN



BOB ROST

Oregon...a state carpeted with forests, wild rivers and snow-capped mountains. Her beautiful coast and magnificent waterfalls are world renowned. Yet the majority of Oregon's land mass consists of rangeland, a semi-arid, often strikingly beautiful region primarily east of the Cascades. Although sparsely inhabited, Oregon's rangelands are rich in natural resources, including grasslands, forests and wildlife.

When settlers first arrived in the state via the Oregon trail, many passed through these rangelands but chose to settle in the more temperate Willamette Valley. The majority of those who decided to live in eastern Oregon maintained their livelihood by raising cattle and sheep.

Early accounts of these ranges depict vast grasslands covered with Idaho fescue, Great Basin wild rye or blue bunch wheatgrass. Today, however, one sees a totally different vegetation pattern in eastern Oregon. In areas once dominated by these native bunchgrasses, juniper and sagebrush now reign. Decades of overgrazing and suppression of natural fires have created an entirely altered ecosystem. The consequences of this shift in vegetation include less forage for livestock and wildlife, an increase in soil erosion, and a decrease in water quality in lakes and streams. The rangelands of eastern and southwestern Oregon have become ecologically degraded.

However, there are ranchers, biologists and Extension agents dedicated to the rehabilitation of these rangelands. Although involved in different projects, all remain committed to a more productive and ecologically stable Oregon rangeland. The article on the following pages examines some of their activities.

Tribal Council member Jacob Frank surrounded by lush vegetation at the confluence of Quartz and Beaver Creeks on the Warm Springs Indian Reservation. Frank helped launch rehabilitation work on a degraded stretch of Quartz Creek upstream.

The Restoration of Quartz Creek

Several years ago, Quartz Creek on the Warm Springs Indian Reservation in central Oregon was in trouble, channeling increasingly warm, silt-laden water that caused problems for fish on downstream. Each rainfall brought more topsoil into the creek, reducing the productivity of the hillsides and damaging aquatic life. Few livestock and wildlife were seen in the area due to lack of sufficient forage along the banks of the creek.

Yet today, Quartz Creek runs cleaner and cooler, fish populations downstream are recovering, wildlife numbers are increasing, and herbage production for livestock has increased.

What caused the improvement of this watershed system?

Quite simply, "people recognized some things needed to be done and did them," says Ross Racine, agricultural/range coordinator for the Warm Springs reservation. Racine, who has lived on the reservation since 1986, points out that others deserve credit for the restoration, which started before he arrived.

BOB ROST

Warm Springs agricultural/range coordinator Ross Racine on a new stone check dam. The dam was built to slow waterflow and keep erosion sediments from moving downstream in Quartz Creek.

BOB ROST

Racine in a deep gully created by erosion along Quartz Creek. On the left are the remains of a log dam built by the Civilian Conservation Corps in the 1930s, part of an unsuccessful attempt to tame the creek's spring runoff and curb erosion.

The history of Quartz Creek holds valuable lessons for Oregonians in other rangeland areas. Once, the creek flowed through land that yielded native food plants, meadow grasses and grains in abundance. But in the 1930s and '40s, changes in government farming programs, and industrialization on the reservation, reduced agricultural activities. Areas once cultivated were abandoned, with no vegetative cover to hold the soil in place. Factors like overgrazing, logging practices in the upper watershed, and subtle shifts in climatic patterns also contributed to changes in Quartz Creek and the land surrounding it.

The streambank wore down. Overhanging banks that provided shade, keeping the water cool, disappeared. The loss of vegetation allowed rainwater to run unobstructed into the stream instead of soaking in. Increasingly, the rainwater carried soil with it. By the late 1930s, gullies had formed.

Quartz Creek feeds into Beaver Creek, one of the major streams on the reservation used by ocean-going fish such as salmon and steelhead. Beaver Creek, in turn, feeds into the Warm Springs River. Sediment and warm water from Quartz Creek were debilitating the fish in Beaver Creek and at a hatchery on the Warm Springs River.

In the late '30s, the Civilian Conservation Corps built rubble dams and log-frame structures filled with rock to create pools. The hope was that the topsoil from the streamside erosion would settle out of the water in the pools, at least solving the sediment problem downstream. But the structures weren't adequately maintained, and even if they had been, there was no plan for proper management of the area's vegetation.

In 1984, the Confederated Tribes of the Warm Springs Reservation allocated money and labor to rehabilitate the watershed. They constructed 13 rock dam-type structures, sometimes called check dams, in the Quartz Creek drainage. They also filled the gullies with cut juniper trees to block runoff water and trap silt before it entered the creek. Concurrently, the tribes began a vegetation management program to re-establish healthy plant communities that would increase soil stability on the banks. The first step included reseeding denuded slopes.

The rehabilitation project was a cooperative effort initiated by Jacob Frank, a member of the Tribal Council, Deepak Seghal, tribal watermaster, Clint Jacks, an agent in the Jefferson County office of the OSU Extension Service, and others. Later, the tribes implemented an integrated resource management plan for all resources on the reservation, including livestock, fisheries and adjacent forests. The plan considers how a decision about one resource will affect the others.

"It's hard to believe we're talking about the same creek," says John Buckhouse, an Agricultural Experiment Station and Extension Service range scientist who worked with the Tribal

Council and Jacks on initiating the resource management plan. "You don't need a lot of scientific data to be convinced that there has been a definite improvement here."

Quartz Creek provides evidence that with proper management of an ecosystem, successful livestock production can be compatible with a sustained population of native vegetation, fish and wildlife.

Fire on the Mountain

When settlers first came to what is now the John Day Fossil Beds National Monument in central Oregon, they discovered an area rich in fossilized remains of the plants and animals that inhabited the area millions of years ago. They also found a vast expanse of bunchgrass prairie providing ample forage for livestock. Within a few years, cattle ranching became one of the largest money-making endeavors in the area.

Today, native bunchgrass species like Idaho fescue and Great Basin wild rye no longer dominate the vegetation composition of these rangelands. Juniper and sagebrush have invaded with a vengeance. Although overgrazing is largely considered the cause of this dramatic shift in vegetation, some range scientists are convinced another factor played a key role: the suppression of fire.

"Fire was a dominant ecological process in eastern Oregon," claims J. Boone Kauffman, a fire ecologist in OSU's rangeland resources department. According to Kauffman, who does research through the Agricultural Experiment Station, natural fires occurred on a regular basis before settlement in the 1850s. "In a given area, fire occurred here as frequently as once every 10 years," Kauffman explains. "Re-occurring fire not only prevented the establishment of juniper and sagebrush, but enhanced the habitats of native grasses and forbs, promoting frequent germination."

However, during the last 130 years of livestock grazing, fire has been suppressed due to the notion that it is a destructive force. In addition, the overgrazing of livestock has significantly reduced the amount of fine fuels (forbs and grasses) necessary for range fires.

Three years ago, Kauffman began a project examining the ecological effects of fire on juniper/sagebrush dominated rangeland within the Fossil Beds National Monument. Researchers burned several hundred acres, with fires strategically set with hand-held drip torches. The goal was to restore the area to a pristine grassland.

ANDY DUNCAN

An experimental fire started by OSU researchers to kill undesirable plants and promote the growth of desirable grasses.

Today native bunchgrasses like bluebunch wheat grass and Idaho fescue, and many native forbs, dominate the burned areas. There has been a decrease of more than 90 percent in sagebrush and juniper. Apparently, fire in these experimental plots helped restore the natural ecological processes of the plant communities.

Kauffman feels ranchers also could use fire to increase the grazing potential of rangelands. "We've done prescribed burning on rangelands near Prineville, Bend and the Steens and all sites have

BOONE KAUFFMAN

BOONE KAUFFMAN

Top: A dead cottonwood tree and unproductive, sagebrush-covered rangeland near eastern Oregon's John Day River. Above: Grass-covered rangeland the second year after an experimental fire cleared the area of sagebrush and other undesirable plants.

displayed an increase in net forage productivity," he notes.

Ranchers Doc and Connie Hatfield of Brothers, Oregon, have been successfully burning their rangelands for 12 years. "We burn anywhere from 160 to 800 acres a year depending on the weather," explains Doc Hatfield.

The best conditions for burning include the right combination of temperature and relative humidity, with wind substantial enough for the fire to carry.

Hatfield stresses the importance of having enough fine fuels such as grasses to burn the sagebrush. "We try not to graze an area too heavily before we burn," the rancher explains. The careful planning and patience apparently have paid off. "Fire really improves the grazing potential of an area," says Hatfield. "And the cost is negligible compared to clearing the sage and juniper with Caterpillars."

He emphasizes that the primary motivation behind burning his ranch lands is not an economic one. "Burning is a sound ecological practice," he claims. "It's been a part of this environment for thousands of years. Burning usually results in a mosaic vegetation pattern which is good for wildlife. Also, grasses tend to hold the runoff of winter snowmelt better than juniper. The additional water improves the low-lying meadow areas tremendously."

Boone Kauffman isn't surprised by the results obtained on the Hatfields' ranch. "Fire is a big piece of the puzzle in eastern Oregon," he states. "Without it, the picture is just not complete."

"Something's Wrong Here"

When Ron Mobley began working for the Jackson County Extension office in 1981, he noticed something was terribly wrong with the grazing lands in the area. Native forbs and grasses that once extensively inhabited the foothills were almost non-existent. Instead, introduced plants such as medusa's head, ripgut brome and yellow star-thistle were dominating these southwestern Oregon rangelands.

"These exotic species are extremely undesirable for both livestock and wildlife," Mobley explains. "They are unpalatable, can cause severe mouth damage to animals, and may in some cases be toxic." According to Mobley, the non-native plants are tenacious competitors and have effectively replaced palatable natives such as Idaho fescue, junegrass and California oatgrass.

Livestock have been in the region since the 1850s. Mobley believes the native plants were severely overgrazed by livestock in the early settlement period. This, coupled with fire suppression, allowed the exotic plant species to invade.

"Natural re-occurring fires stimulated the reproductive cycle of the native plants and prevented the establishment of non-native plants," Mobley explains.

"Once these exotics get their foot in the door they are extremely hard to get rid of," he continues. "Unlike the native plant species, which tend to be perennial, many of the introduced species are aggressive annuals."

These annuals are tough competitors because they tend to grow rapidly, produce a great many seeds, and can germinate under a wide variety of conditions. "We knew it would be awfully difficult re-establishing stands of native grasses in areas heavily infested with exotic annuals," says Mobley.

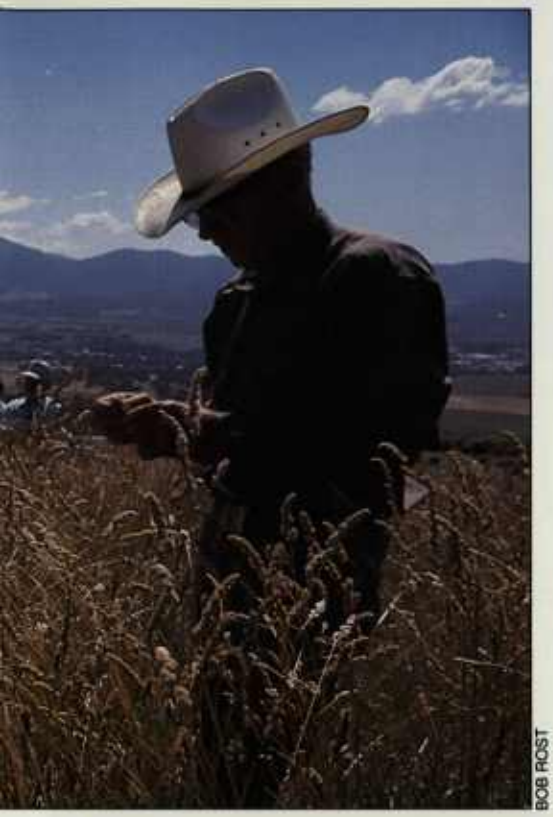
Although the situation appeared bleak, a research program was started to re-establish palatable grasses in degraded grazing areas. Initiated by OSU's rangeland resources department and the Extension Service, it soon became a cooperative effort with the Soil Conservation Service and Bureau of Land Management. Later, private landowners became involved.

BOB ROST

Range scientist Doug Johnson with medusa's head, a weed that's invaded southern Oregon rangeland.

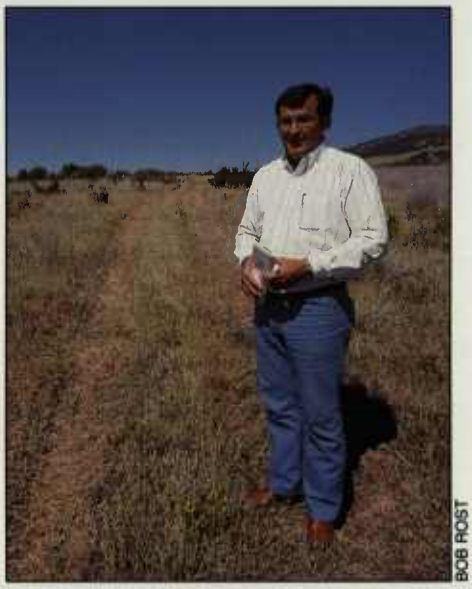
In the first stage of the project, hundreds of varieties of palatable grasses were planted to see which responded best to the diverse climate of southwestern Oregon.

Several of the grasses that displayed the best potential for growth were native perennials. But there was no commercial



BOB ROST

Ranchers and land managers, on a tour sponsored by OSU researchers and extension agents, look over Palestine orchard grass, a nutritious forage planted near Phoenix south of Medford. Invading weeds cover the surrounding land.



BOB ROST

Jackson County extention agent and researcher Ron Mobley in a field of yellow star-thistle, another weed invader.

source of the seed. Thus the second stage of the project required collection of a large amount of seed from native grasses in the area. OSU rangeland resources graduate student Mike Borman, who spent three years on the project, found himself crawling around the Medford area on his hands and knees looking for plants and seed.

"We spent several weeks collecting Idaho fescue, junegrass and California oatgrass," Borman admits. "It wasn't much fun but we felt it was important." Borman believed that because these species are native to the area, they would be ideal for re-establishment.

After propagation in a greenhouse, seedlings were transplanted at a study site near Medford. Dense stands of exotic weeds surrounded the transplant sites. "We wanted to see which species competed best with the star-thistle and medusa's head," Borman explains.

After three years of research and analysis, it appeared that Idaho fescue and Berber orchard grass (an introduced species) had the best potential. "Once established, these plants appear to be able to out-compete the weeds quite well," concludes Borman.

The next stage of the project required the seeding of larger plots of rangeland with seed taken from experimental plants displaying the best competitive characteristics. Before the plots were seeded, they were exposed to various treatments such as fire and herbicide application.

"The results were pretty surprising," says Doug Johnson, an assistant range professor at OSU who directs the restoration project. "It appears that if the exotic plants are disturbed before seeding takes place, the desirable species have a much better chance of survival."

According to Johnson, a dose of the herbicide Picloram discourages the growth of the exotics long enough for the desirable species to become successfully established. "We're not advocating extensive herbicide use," Johnson emphasizes. "But it's important to give the desirable plants a head start if you want to increase forage production."

The result of the experiments is a tremendous increase in forage production. "We've recorded 500–2,000 pounds of forage per acre up here," Johnson states. "We had no idea how productive these rangelands could be."

He believes these results may provide incentive for ranchers to restore their rangelands. "Based on the limited research, there seems to be a definite return of investment." The OSU professor also feels restoring rangelands can provide other benefits besides those relating to grazing. "Re-establishing perennial grasses can provide a longer grazing period for wildlife," Johnson says. "Also, because perennials stay green longer than annuals, they pose less catastrophic fire hazard and provide greater erosion control throughout the year."

Although still in the experimental stage, the restoration of southwestern Oregon rangeland is promising. With more than 250,000 acres of degraded rangeland in Jackson County alone, there is tremendous potential for improved forage productivity, as well as a restored and stabilized ecosystem.

The Outlook

Other rangeland reclamation projects are underway in various parts of Oregon. Early results in those appear promising, too:

- Lee Eddleman and Kathy Ramsey of OSU's rangeland resource department have studied the chemical influence of decomposing juniper slash (cut trees) on the germination and growth of native grasses. Apparently, if juniper slash is concentrated, a reduction of grass growth can occur. On the other hand, scattering the slash may improve the micro-environment, allowing increased growth of grasses.
- OSU range scientists Richard Miller and Paul Doescher have analyzed the physiologic characteristics of plants such as sagebrush and juniper. Their research will increase the understanding of why these plants out-compete native perennial grass such as Idaho fescue.
- Scientists in OSU's fisheries and wildlife department are studying the habitat requirements of creatures such as mule deer and sage grouse. Information gathered from their research may enable land managers to better identify sites requiring restoration or stabilization.

Although severely impacted by humans, Oregon's rangelands remain rich in beauty and natural resources. Projects aimed at restoring these areas provide hope that the degradation can be reversed. In a state that is rich in natural resources, it is encouraging to know that with proper management, disturbed areas can be reclaimed for future generations.

Free-lance writer Josh Kahan recently received a master's degree in range science from OSU's Department of Rangeland Resources.

WHAT MAKES WILLIE RUN?

OSU researchers had to start with the basics to help state vets treat the growing number of his kind

Willie had been sick for three weeks and was getting worse when he went in the hospital. The doctors suspected the problem was a perforated ulcer or, possibly, a trichobeazoar (hairball). After tests and X-rays, they decided exploratory surgery was his best chance to get back to being a healthy llama.

That's right, llama. Doctors at OSU's Veterinary Teaching Hospital have been treating patients like Willie for more than five years.

With more than 6,000 of the 35,000–40,000 llamas in the United States, Oregon is one of the leading llama-producing states. The growing population has spurred a search in OSU's College of Veterinary Medicine for more knowledge of this strange and curious animal, a new kind of patient for most of the state's veterinarians.

Curiosity and economics sparked the effort, which includes research partially supported by the Agricultural Experiment Station.

Distant relatives of the camel, llamas are native to the Andes Mountain region on the eastern coast of South America, where there are thought to be 10 to 15 million used as pack animals and for food and wool production. In the United States they've become popular as pets, as well as pack animals and sources of wool.

How popular?

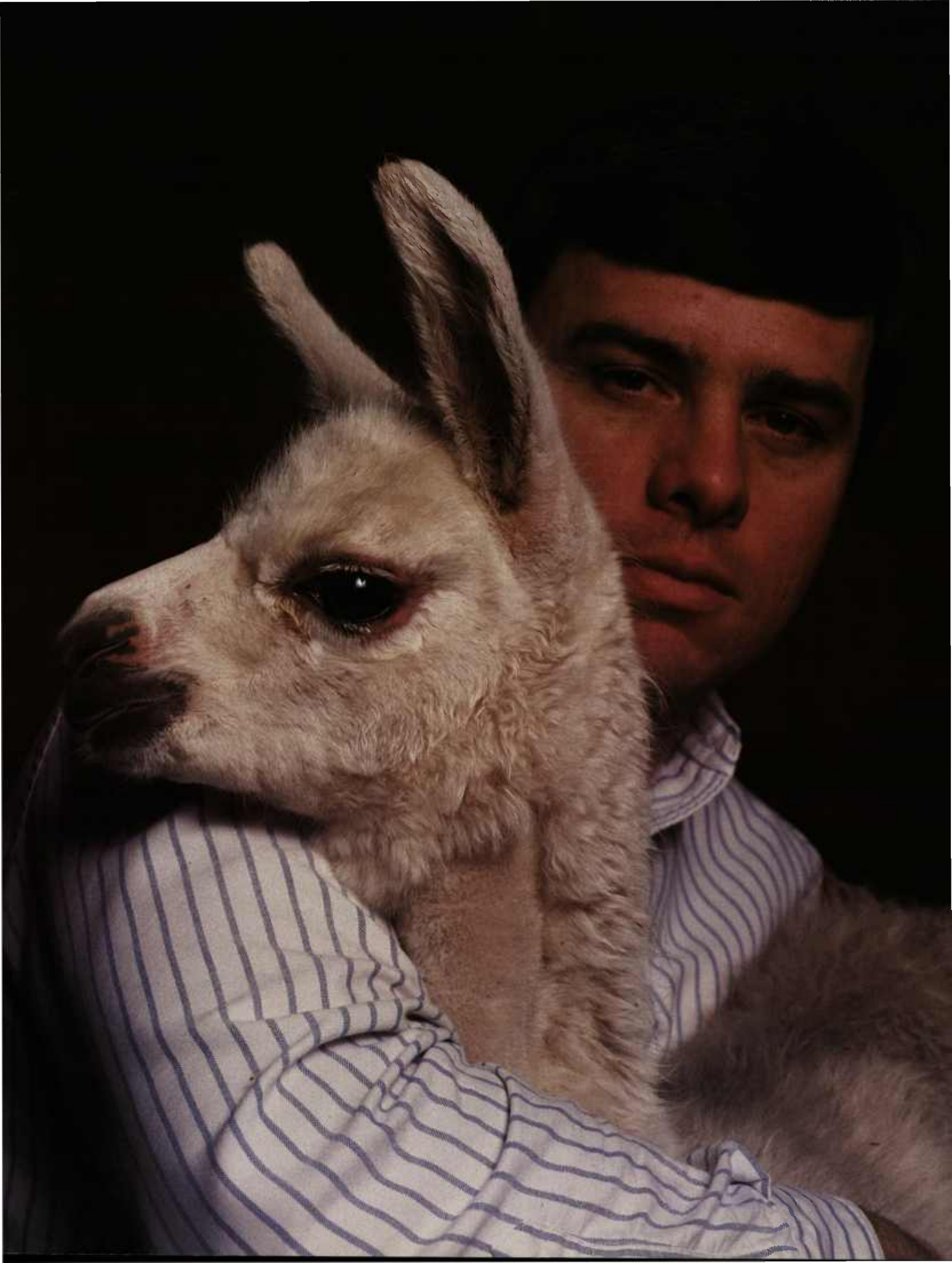
Some call llamas America's "yuppie pet." They often are sold at auctions that attract well-heeled crowds. Among animals with almost identical conformation, or structure, certain color combinations can boost the bidding by the price tag of a nice down payment on a new Porsche. An average-quality female llama that can breed is worth from $12,000 to $15,000 and a high-quality female from $25,000 to $40,000. A top female recently sold for $175,000. The price range for males is even wider, with pet- and pack-quality animals selling for $500 to $1,500, while top males have sold for more than $150,000.

Studies show Oregon's llamas are worth at least $20 million a year to the state economy, according to Tim Deboodt, chair

BY LAURA AMITON

LYNN KETCHUM

Right: OSU veterinary scientist Brad Smith and friend.



of the Crook County office of the OSU Extension Service. Extension agents in central Oregon assist llama owners by conducting workshops on the animals' care and management.

A top female recently sold for $175,000.

The state's highest concentration is in the Bend-Redmond-Sisters region. The first llamas arrived there in the early 1960s. Llamas have spread into the Willamette Valley, southern Oregon, and a few into eastern Oregon, apparently thriving in the state's varied climates.

One reason the creatures have become popular in the United States is their disposition. Though characteristically reserved, "they are neat, intelligent animals that have a great curiosity," observes a Willamette Valley llama owner.

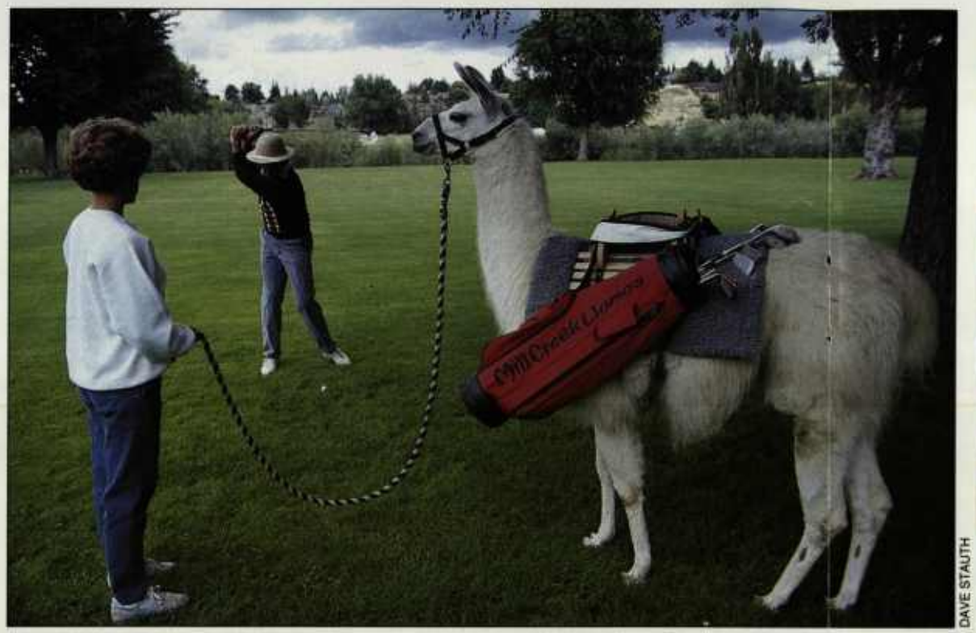
South American veterinarians rarely work with llamas, says one U.S. veterinary scientist. "The fundamental attitude is different," he said. "If an animal doesn't perform, it ends up in the stew pot."

OSU, Colorado State University and the University of California at Davis are the veterinary teaching hospitals with the leading llama research programs. Breeders from all over the western United States bring valuable animals to OSU.

"My involvement started when someone came up to me in the hallway and asked what I knew about llamas. Nothing, I had to admit," says Brad Smith, an OSU veterinary scientist active in the llama research effort. With the help of a herd of 29 animals that live on the campus, which Smith oversees, veterinary students are learning to handle llamas properly, doing exams and routine chores such as collecting blood samples.

Veterinary professors like Smith, and graduate students, do the research. They describe llamas as looking like they were "built by committee," meaning they share characteristics with several other animals.

"The llama has a gastrointestinal tract similar to that of the cow, a placenta like



DAVE STAUTH

LYNN KETCHUM

LYNN KETCHUM

OSU's 29-animal campus llama herd is invaluable to researchers and veterinary students.

Far left: Some call llamas America's "yuppie pet." Left: A young llama in an animal petting zoo set up for Corvallis youngsters.

that of a horse, and they're induced ovulators (ovulate when they mate) like rabbits, ferrets, cats and several other animals," says Smith. "This anatomical hodge-podge makes veterinary research more difficult than with some other animals."

These dwarf llamas can be half normal size.

OSU research includes a wide range of topics, such as the animals' nutritional needs and the diseases and parasites that attack them. "But our main focuses are internal medicine and reproductive problems," says Smith.

The researchers didn't have much data to help them get started.

"Our knowledge is far more extensive now than it was five years ago," says Smith. "We've made very significant advances in our understanding of basic llama medicine. But we're still asking questions that were answered 20 years ago in other large animal species."

They began with the most basic question: What is a normal llama?

"Really very mundane things," says Smith. "How much should a seven-month-old animal weigh? How much of various components is normal in their blood? How do female llamas' ovaries function? What are normal hormone changes during pregnancy? What should a normal radiograph [X-ray] of a llama's stomach look like?"

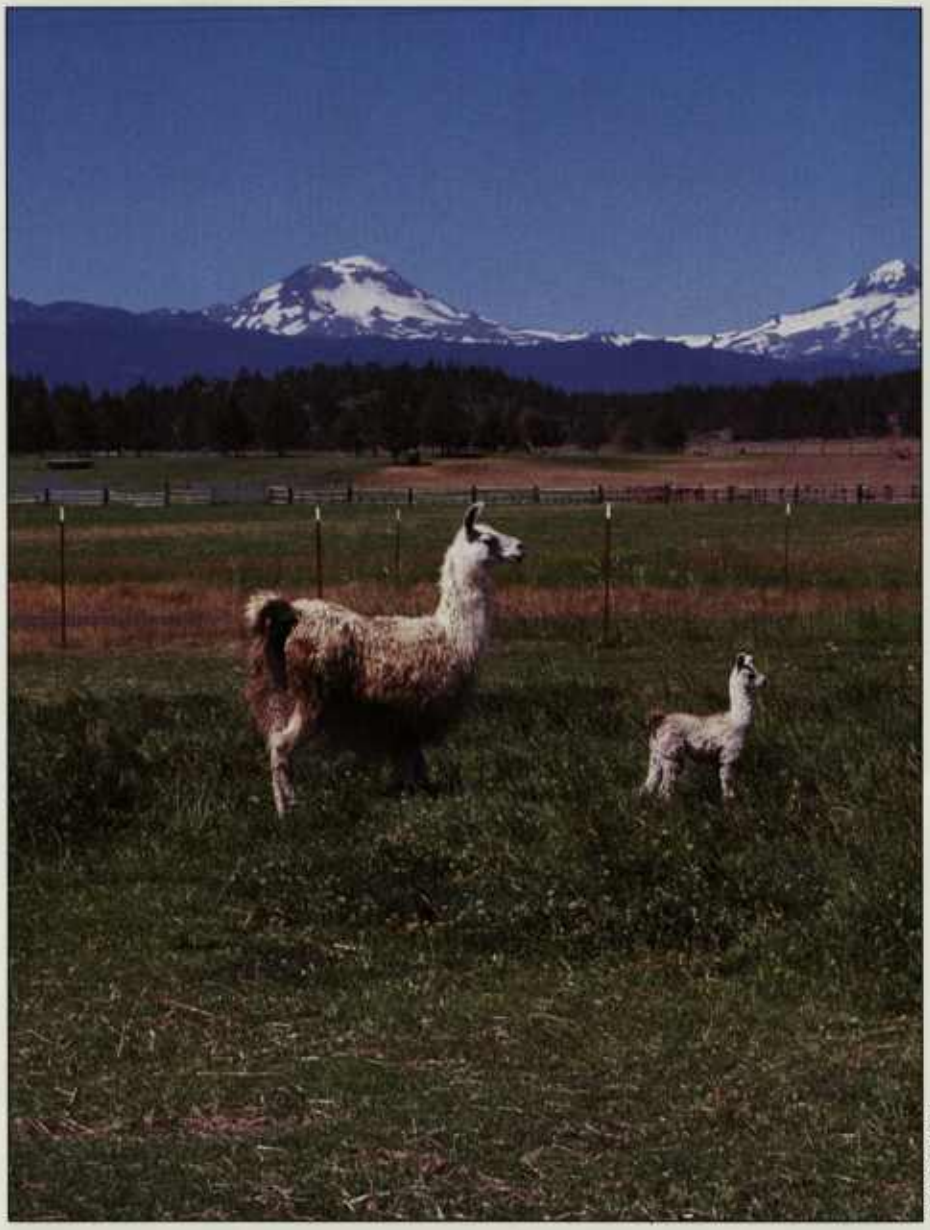
Not having this kind of information is a problem for veterinarians in Oregon and other states with llamas.

"A while back," "recalls Smith, "we had a little cria [baby llama] that wasn't passing any manure. Dr. Watrous [an OSU colleague] came into the clinic to give him an oral barium test [the test allows veterinarians to trace materials moving through the digestive system]. Then we realized we really didn't know just how fast food is supposed to go through their intestines."

A sample of OSU llama research topics:

- Surgery techniques, led by Mike Huber.
- Bone development problems and dwarfism, led by Barbara Watrous.
- Parasites that afflict the animal, led by Lora Rickard and Gary Zimmerman.
- Thyroid, adrenal, ovary and testes functions, led by Smith.
- The llama's anatomy, led by Karen Timm.
- Viruses that infect llamas, led by Don Mattson and Becky Pruitt.
- How toxic plants such as tansy ragwort affect the animal, led by Erwin Pearson.
- Nutritional needs of healthy llamas, led by Smith.
- Nutritional needs of sick llamas, including intravenous feeding, led by Benjamin Darien.
- The affect on llamas of acute blood loss, led by Pam Reed.
- Studies of various aspects of llama reproduction, led by Smith and others.
- Normal serum protein patterns in the blood of llamas, led by Donna Mulrooney.

They walk right over and look at the coyote.



BRAD SMITH

Oregon's highest concentration of llamas is in the Bend-Redmond-Sisters area in central Oregon. The first llamas arrived there in the early 1960s.

Almost all areas of llama research provides valuable information to veterinarians who treat the animals. Consider the blood serum protein research listed above. "We used to say, well, maybe it's similar to a cow's [a llama's blood serum protein level], says Smith. "Now we have a point of reference. The findings have been published for use by vets in Oregon and other parts of the country."

Barbara Watrous, head of radiology at the OSU veterinary research hospital, and radiology colleagues, are gathering an enormous amount of information on what a llama should look like when you peek inside with X-rays and other diagnostic tools.

Some problems show up repeatedly.

Watrous, Smith and others are studying megaesophagus, or dilation of the esophagus, a condition that makes it hard for the animals to keep food down.

Researchers at the OSU hospital see a number of llamas suffering from dwarfism and crooked front legs. When grown, these dwarf llamas can be half normal size. "We suspect iron deficiency may be one cause among many," says Watrous.

"What's surprising," she says, "is that some of the owners don't even know it. They bring their animals in when they're young because of the crooked legs and we diagnose dwarfism. They don't know how big the animals should be."

The researchers are exploring the possibility of a thyroid problem, which is related to dwarfism in humans, horses, dogs and other mammals. They're also looking for a genetic link to rickets, a bone problem in human children. Veterinary scientists at OSU and elsewhere have developed surgical methods of slowing or speeding bone growth to even up the crooked legs.

Problems with what's called "failure to thrive," and weight loss, often show up in Oregon's llamas, as well as those in other states.

"Their hairy coats can hide weight loss," notes Watrous.

Other common problems are urinary tract ruptures (in males), tooth abscesses, broken bones, obesity, choanal atresia (a blockage of the nasal passage that hampers breathing), and "dismature" births. This is when llamas are born not fully developed, but after a full-term pregnancy.

A big question, according to Smith, is "why do we see so many fertility problems?" One reason could be tied to money.

"Some animals out there should be culled but owners breed them anyway," he says. "Part of the problem is that they're so valuable. If I've got $15,000 invested in a female llama that has a genetic defect, it can be a difficult decision to cull her from the herd."

Embryo transplanting could provide a "neat, functional solution," Smith contends. He is studying the procedure along with Agricultural Experiment Station animal scientist Fred Menino and others. It involves removing embryos from superior females and implanting them in surrogate mothers.

LYNN KETCHUM

Above: Wayne Shull, chair of OSU's Deschutes County Extension Service Office, watches a 4-H Club member's creative approach to a challenging cleaning job. Below: Veterinary doctoral student Pam Reed is studying how llamas react to acute blood loss.

LYNN KETCHUM

"We're working on methods of embryo collection and are probably a couple years away from doing transplants," says Smith. "But this way owners will be able to have all their females reproducing while upgrading the gene pool."

The enthusiastic Smith sees llama popularity continuing and the uses of llamas multiplying.

"They're similar to goats. They seem to be happy eating blackberries, poison ivy and similar plants," he says, explaining that he and OSU agricultural economist Fred Obermiller plan to experiment with raising llamas for wool and forage control on the eastern Oregon range.

For several years, sheep growers have experimented with llamas as guards against predators such as coyotes.

"They take a youngster at weaning age [4 to 5 months], usually the ugliest-looking male llama they have, and move it out with a herd of sheep," Smith explains. "The llama bonds and identifies as part of the herd." Llamas, usually six feet tall and 400–425 pounds when mature, usually don't fight with coyotes. "But they're curious. They walk right over and look at the coyote," says Smith. "While they are really very calm animals, their size can be intimidating."

A stroll through the large-animal stalls of OSU's veterinary teaching hospital backs up Smith's optimism about the llama's future.

"They're becoming a significant part of our clinic load," he notes. "They're second behind horses in terms of numbers. One day last week we had 10 of them in here. We've started a continuing education program and are starting to get some excellent llama vets in the state."

All this attention to llama medicine should be comforting to Willie, who came through his exploratory surgery successfully and is home after the removal of a pesky hairball blocking the third compartment of his rumen. It also should be comforting to Oregon's llama owners. After all, the furry creature in the pasture may be worth more than the fancy car in the driveway.

Laura Amiton is a recent graduate of OSU's Department of Journalism.

THE SEA AND THE

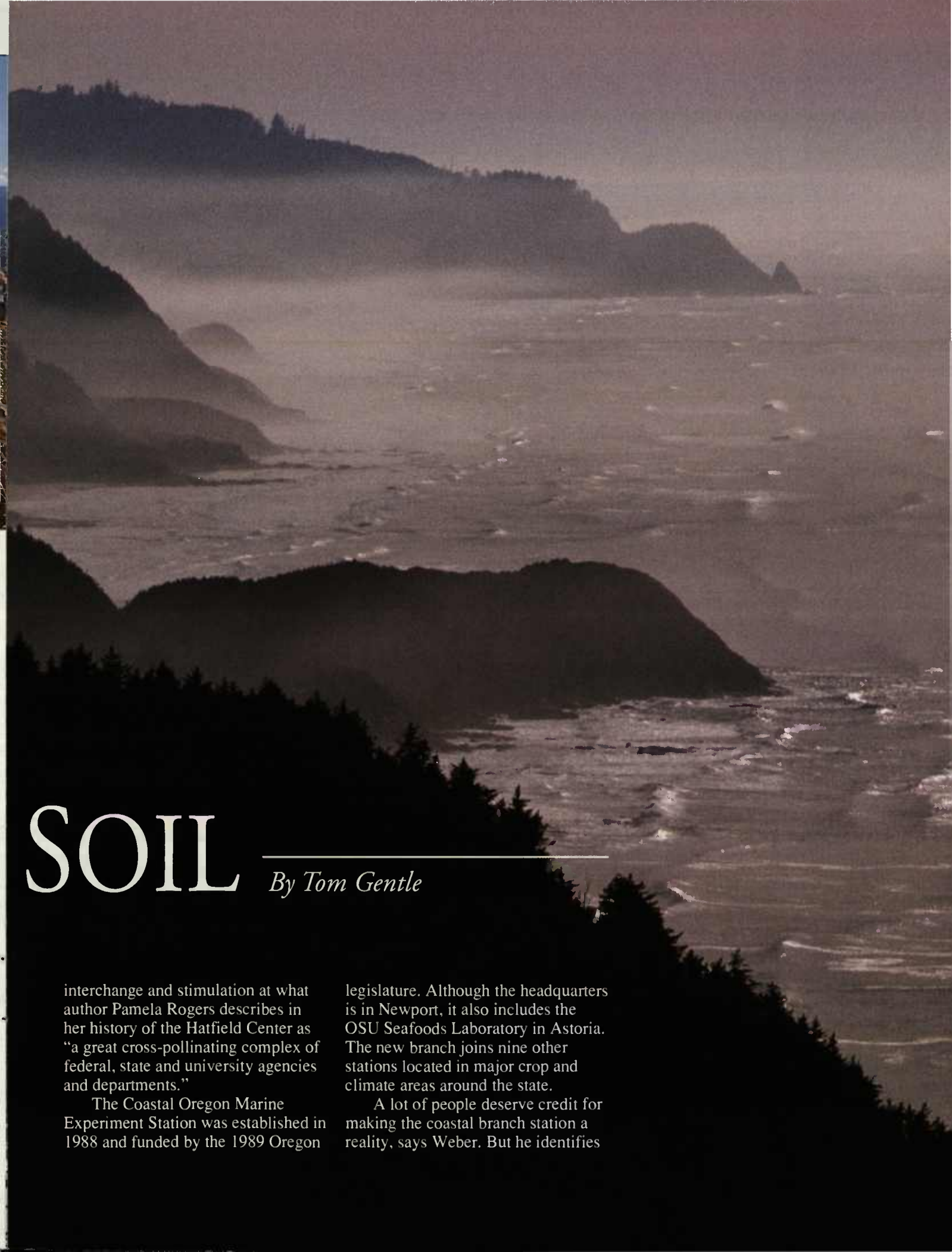
The newest branch experiment station is by the Pacific Ocean

Lavern Weber wears two hats these days. One as director of the OSU Hatfield Marine Science Center in Newport. The other as head of the newest branch of the OSU Agricultural Experiment Station.

But that doesn't mean he divides his time between the sea and the soil. Rather, he's in charge of a group of researchers who focus their efforts on commercial fishing and seafood processing.

"Experiment Station research seeks to increase the quantity, quality, safety, and marketability of food. On the coast that means fish, just as in eastern Oregon it primarily means cattle and wheat," Weber said.

So don't expect exotic recipes for beef bouillabaisse or experimental crops along the banks of Yaquina Bay. The new station fits right in with the existing marine research activities at the Hatfield Center. And it contributes significantly to the scientific



SOIL

By Tom Gentle

interchange and stimulation at what author Pamela Rogers describes in her history of the Hatfield Center as "a great cross-pollinating complex of federal, state and university agencies and departments."

The Coastal Oregon Marine Experiment Station was established in 1988 and funded by the 1989 Oregon legislature. Although the headquarters is in Newport, it also includes the OSU Seafoods Laboratory in Astoria. The new branch joins nine other stations located in major crop and climate areas around the state.

A lot of people deserve credit for making the coastal branch station a reality, says Weber. But he identifies

two in particular. Leaders in the commercial fishing industry led a grass roots effort in support of the station. And coastal Senator John Brenneman was instrumental in getting the idea approved by the state legislature.

Don't expect... beef bouillabaise.

Many people are puzzled when they first hear about the coastal branch station. "What," they ask, "is an agricultural research unit doing at a place devoted to studying the ocean?" It's a question Weber hears often. His reply, accompanied with a wry smile, is another question. "Isn't it strange it didn't happen sooner?"

The Hatfield Marine Science Center celebrates its 25th anniversary this summer. Comparing that to the relatively brief life of the new branch station lends support to the notion that the coastal station has been a long time coming.

Why wasn't it established years ago? There isn't a simple explanation. Various agriculture groups in Oregon have a long history of banding together to promote their common interests. The fishing industry, in comparison, began to organize relatively recently. For example, only three of Oregon's 26 agricultural commodity commissions deal with fishing. Many of the traditional commodity groups date back to the 1940s and 1950s. With the exception of the Oregon Trawl Commission, founded in 1963, the fishery commodity groups, dating from the late 1970s, are new kids on the block.

Weber thinks it simply took the various players—the fishing industry, state government, and the university—a long time to sort out their goals.

Not that OSU has neglected fisheries and seafood research until now. But it has been scattered among a number of departments and colleges on the OSU campus in Corvallis. The new branch station, says Weber, has brought these research activities together. As a result, he expects the research will be better coordinated and more responsive to industry problems.

Having the branch station researchers physically housed on the coast is a key advantage, he maintains, and will enhance cooperation and coordination between OSU and the seafood industry.

TOM GENTLE

TOM GENTLE

TOM GENTLE

Top: Commercial fishing boats at Newport. Left: Hauling in a halibut. Above: Tidepool creatures.

"Living and working on the coast will give the researchers direct contact with coastal people and issues. And I think their research will be more relevant because they don't have to look to an academic department 55 miles away in Corvallis for guidance or assignments," Weber said.

Initial plans call for ten research positions, three food scientists at the OSU Seafoods Laboratory in Astoria and the remainder in Newport. The positions at the Hatfield Marine Science Center include a marine economist, a microbiologist, five fisheries and wildlife scientists and a marine mammalogist.

Some of the positions are new and will be filled by people hired from outside the university. Others are existing positions at OSU that have been reassigned to the Coastal Oregon Marine Experiment Station from various academic departments.

Gil Sylvia occupies one of the new positions. A marine economist and marketing expert, Sylvia was the first new person assigned to the branch station. His research will look at such issues as the economic efficiency of different segments of the fishing industry, consumer seafood preferences, and potential new markets for fish.

Chris Langdon, a shellfish aquaculture expert, conducted research through the OSU Department of Fisheries and Wildlife before joining the new branch station. He's already trying to develop a commercially acceptable pelleted feed that will lower the cost of algae feed. He's also investigating the suminoe oyster as a new aquaculture species.

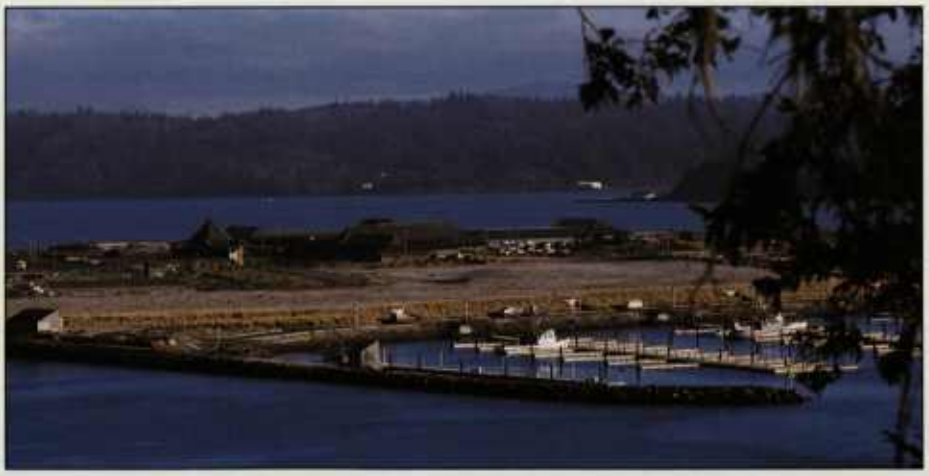
Bill McNeil, another longtime OSU faculty member and internationally acclaimed pioneer in salmon aquaculture, is investigating the development of polyculture systems—that is, growing other crops, such as seaweed, along with salmon.

Viruses, bacteria and parasites in fish get the attention of Bob Olson. Jim Lannan will continue to devote attention to problems connected with fish culture and genetics. And Dave Sampson, a marine fisheries expert, will conduct research on fish populations.

Three researchers recently began working through the coastal branch station: Michael Morrissey, a food scientist, and Lewis Richardson, a chemist, both at the OSU Seafoods Laboratory; and Paul Reno, a microbiologist, in Newport.

JIM LARISON

Lavern Weber



OSU's Hatfield Marine Science Center at Newport is the headquarters for the Coastal Oregon Marine Experiment Station. The OSU Seafoods Laboratory in Astoria also is part of the station.

The fishing industry... began to organize relatively recently.

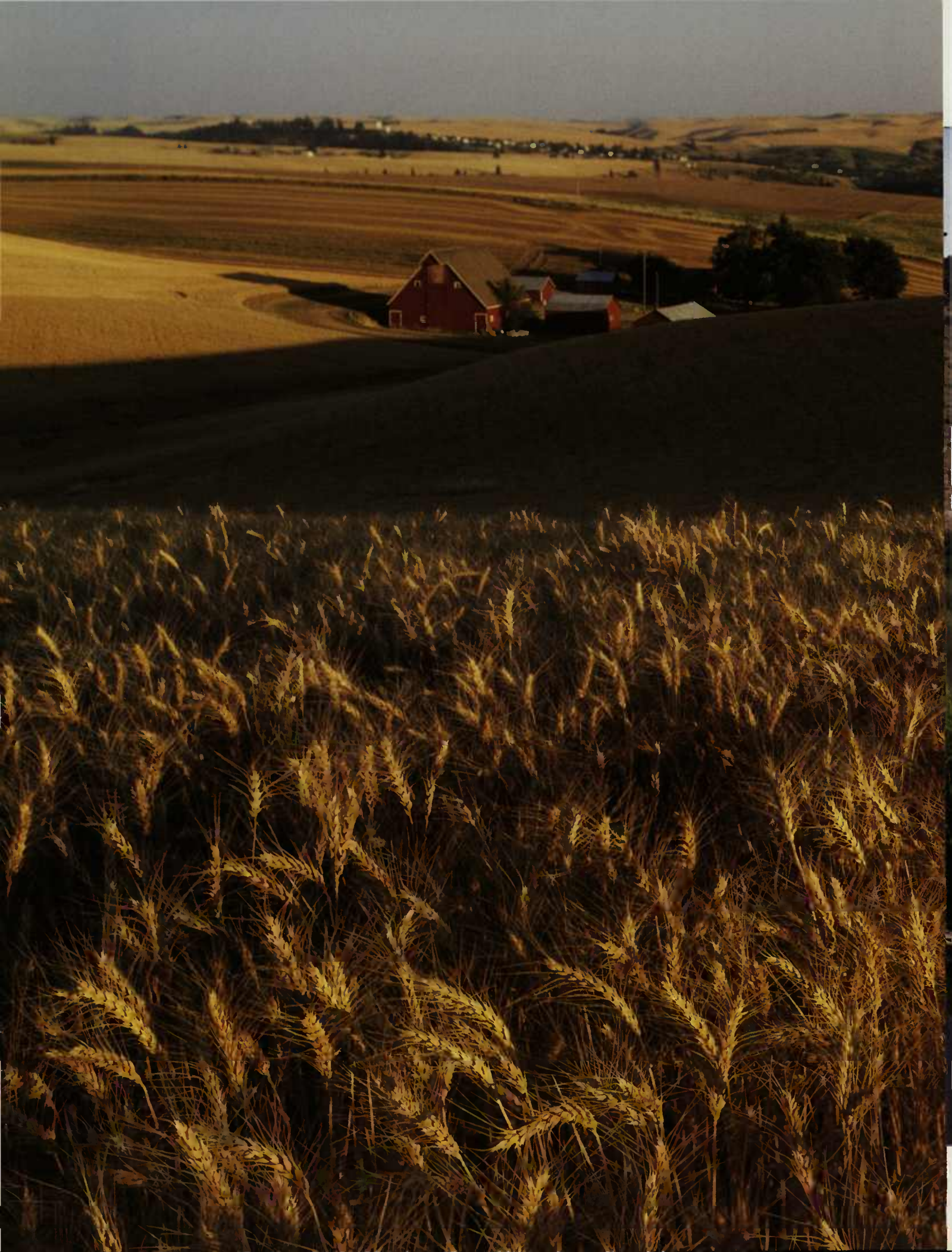
Chief among the many amenities available to the staff of the coastal branch station is the Hatfield Center's new 21,000 square foot library, which was dedicated in July. With a collection of 25,000 volumes and 310 research journal subscriptions, it is the leading marine station library in the United States.

A nine-member advisory council provides guidance on research needs and priorities and helps marshal political support for needed programs. The group includes three fishing industry representatives, three seafood processors, two community representatives, and one environmental representative.

The membership list of the advisory council reads like a Who's Who of the Oregon fishing industry. Barry Fisher, Newport fisherman and president of New Wave Fisheries, is the council's chair. Others members include Don Barth, vice president and district manager of U.S. Bank's Yaquina Bay Branch; Joe Easley, director of the Oregon Trawl Commission in Astoria; Jon Englund, owner of Englund Marine in Astoria; Mike Graybill, director of the South Slough Estuarine Sanctuary in Charleston; Sam Hayes, Tillamook oyster grower; Merl Johnson of Pacific Seafoods in Charleston; Tom Libby, Point Adams Packing Co. in Hammond; and Dick Severson, manager of Or Aqua in Springfield.

As with any new undertaking, it has taken a while for all the elements to fall into place. Now the staff positions are filled, research is underway, and new proposals are being considered. Perhaps it's fitting that the new coastal branch station stands poised to begin its work as the Hatfield Marine Science Center celebrates 25 years of accomplishment.

Tom Gentle is a communications specialist in OSU's Department of Agricultural Communications.



GRANT HEILMAN PHOTOGRAPHY

THE GOOD EARTH

A program nicknamed STEEP is the core of a Northwest battle to curb erosion and save the topsoil that feeds us

BY LEONARD J. CALVERT

Trying to describe STEEP is a little like trying to tell someone the plot of *Twin Peaks*, the mysterious television program that showed up on your screen this spring. Both are innovative and multilayered, with a large cast of players. But, unlike *Twin Peaks*, STEEP has been around for 15 years.

The acronym stands for "Solutions to Environmental and Economics Problems." The name is the first clue to the complexity of the project. Everyone—farmers, scientists, and ordinary citizens—agrees that soil erosion is a major problem and should be reduced or even stopped. However, solutions become more difficult when economic viability is added to the equation. It does little good to develop solutions if the cost is so high the farmer can't afford to change practices and stay in business.

Just as *Twin Peaks* contains a myriad of subplots, any of which might hold clues to solve the mystery of who killed Laura Palmer, so STEEP is made up of contributions from scientists in three states, each adding a bit of knowledge to the unified whole.

STEEP is a federally funded, regional research effort to conserve water and soil resources involving scientists from the USDA's Agricultural Research Service (ARS) and the agricultural experiment stations of Oregon State University, Washington State University, and the University of Idaho.

Left: Eastern Washington's Paulouse wheat country, and the land just across the borders of Oregon and Idaho, are key areas in the struggle against soil erosion in the Northwest.

More than 100 scientists from ARS and the three Land Grant universities work on about 60 different projects each year. The research brings scientists from such areas as plant pathology, agronomy, soils, economics, agricultural engineering, genetics and entomology together in interdisciplinary teams from all three states and the federal government.

However, such descriptions of STEEP—like calling Twin Peaks a murder mystery—mask its uniqueness. Both the TV show and STEEP are the talk of the country, albeit in different circles.

Such descriptions... mask its uniqueness.

STEEP has shown the nation how to approach a regional problem and is seen as a model program involving university and federal scientists in a partnership with producers.

How did this all begin? The Pacific Northwest wheat industry has a long record of concern and action regarding soil and water conservation. "Conservation Farmer of the Year" has long been and remains one of the major awards given each year by the Oregon Wheat Growers League.

You may remember driving through eastern Oregon's wheat country and noticing contour plowing, strip farming, terraces constructed to hold soil and water in place, and signs warning drivers of limited visibility because of dust storms. "Trashy Fallow for Conservation" was the topic of a 1955 OSU Extension Service bulletin. Farmers knew that if they didn't care for the land, it wouldn't be there to care for them.

The need to follow conserving farming methods got a big push when Congress passed the Federal Water Pollution Control Act Amendments of 1972, notes Dennis Oldenstadt, associate director of WSU's Agricultural Research Center and one of the few founders of STEEP still actively involved. The handwriting was on the wall: Change your methods to reduce erosion or you may be out of farming.

The law motivated the growers to wonder what research could do to help. The industry approached the three universities and ARS.

At the same time, it was becoming increasingly clear to producers that the traditional ways, mainly building structures such as terraces and waterways, were not the solution, adds soil scientist Benno Warkentin, head of OSU's Water Resources Institute and a member of the STEEP technical committee.

If wheat producers didn't know they had an erosion problem, they did after reading the 1974 research proposal prepared for Pacific Northwest Wheat Growers by OSU, WSU and Idaho. The proposal noted that soil erosion is "bordering on catastrophe" and that "damage to land and environment is steadily increasing in spite of past decades of conservation efforts by concerned farmers, non-farm land owners, and state and federal agencies." It estimated that 110 million tons of soil "are eroded annually, of which 30 million tons are carried to Northwest streams, rivers, lakes, and harbors."

The proposal called for a unified effort to solve the problem while paying attention to conditions and situations affecting the management of the farm business (in other words, economics).

Although conservation tillage, defined by the Soil Conservation Society of America as keeping 30 percent or more of the soil surface covered by residue or maintaining the soil surface in a way to reduce erosion to a minimum, was making a big splash in other parts of the country, the proposal noted that just borrowing a practice from another area often fails because of different environmental characteristics.

Attention must also be paid to differences, including rainfall and soil

ANDY DUNCAN

Wheat harvest in Oregon's Columbia Basin near Pendleton, where no till and minimum till planting techniques that reduce erosion are gaining popularity.

ANDY DUNCAN

OSU agronomist Floyd Bolton helped develop a drill that plants wheat through stubble from the previous year's crop, which keeps the soil more stable.

depth, within the region. After all, the proposal covered millions of acres of the Columbia Plateau and the Palouse-Nez Perce Prairies, the Columbia Basin and Snake River Plains, and the Willamette-Puget Sound valleys.

Research, the universities said, was needed in tillage and plant management, plant design, erosion and runoff prediction, pest management, and the economics of erosion control, and it should be done on a regional and interdisciplinary basis.

Two of the unique characteristics of STEEP now were in play, Oldenstadt points out. First, the idea originated with growers, not researchers. Second, the three universities and ARS were joining to work on a regional problem. Including ARS was natural because its scientists, stationed at Pullman, Washington, Pendleton, Oregon, and Kimberly, Idaho, were doing erosion-related research and were well known to growers and university scientists.

Armed with the proposal, the wheat industry went to Washington in search of funds. Enlisting the aid of their Congressional delegations, particularly Oregon Senator Mark O. Hatfield, the growers were successful in getting the money needed by the three agricultural experiment stations and ARS.

Borrowing a practice from another area often fails.

The OSU, WSU and Idaho Agricultural Experiment Stations share equally in money annually included as a line item in the budget for the USDA's Cooperative State Research Service, the USDA agency relating directly to the agricultural experiment stations. ARS funds, at first a special appropriation, are now part of the agency's base budget.

Oldenstadt gives "full credit to the growers for keeping it [STEEP] high on their priority list." Their annual work in Washington, D. C., is the third unique element of STEEP and part of the model that has made the effort successful. Or, as Oldenstadt said, "we couldn't have done it without them."

Consistent funding has enabled agricultural scientists to approach a common problem (erosion) from a variety of disciplines. STEEP provides a mechanism for researchers from many disciplines to focus their creativity in pursuit of a common goal, in partnership with industry and the federal government.

The work of Floyd Bolton, OSU agronomist, illustrates the STEEP model. A STEEP researcher since 1977, Bolton has concentrated on understanding different tillage systems, particularly no till, where crops are seeded through the stubble left after harvest of the previous crop. However, he couldn't limit his research to tillage methods. He needed to know how different crop plants would

TOM GENTLE

A creek in Morrow County turned chocolate brown by topsoil from nearby fields.

TOM GENTLE

Bird's eye view of Columbia Basin dryland grain fields. The browner areas were plowed but left unseeded, or fallow, so moisture would build up in the soil. Research has shown leaving harvest residue in such fallowed fields makes them less susceptible to erosion when they're lashed by winter rain, snow and winds and subjected to freezing and thawing.

grow under different methods and how to control weeds and diseases. This meant working with researchers from other disciplines. Among his most recent research cooperators are A. P. Appleby and D. J. Rydrych, weed scientists; Warren Kronstad, cereal breeder; and Scott Case, manager of the Moro branch of the Columbia Basin Agricultural Research Center.

The wheat industry went to Washington.

At the same time, STEEP gave him a communication channel to scientists at WSU, Idaho and in ARS and to growers at the annual STEEP review meetings. The foundation for such cooperation, Bolton believes, was laid much earlier, because the Pacific Northwest states have a history of working together.

Bolton still isn't able to recommend "a single set of tillage practices to use year-after-year to get same results." The situation is complex, the scientist notes, because of climate and the presence of weeds, plant diseases and insects. "Stirring the soil" (plowing) may or may not be necessary if these can be controlled in an economical manner.

Working with OSU cereal breeders such as Kronstad, Bolton found that environmental factors more than tillage methods affect yields. In fact, little difference in crop yields was found "if you can control weeds and establish a vigorous crop stand."

Using residues to control soil erosion became possible in the 1950s when specialized equipment, such as chisel plows, became available. However, residue covers and stubble mulch can harbor weeds and diseases that aren't a problem when conventional tillage is used. Thus, chemical controls have been an important part of minimum tillage systems.

The tillage system used must be flexible to allow growers to meet current conditions, he notes. In addition, growers will need to be sophisticated managers and users of all available tools to be successful.

Economics play a critical role in the adoption of minimum tillage systems. Although Bolton demonstrated that yields may be almost the same with no till systems as with conventional tillage, a drop of five bushels may be more of a

risk than growers who are fully extended may be willing to take.

In addition, chemical controls, particularly for grassy weeds, are more expensive than conventional tillage. This may be changing, however, because a wider array of "tools" are available. For instance atrazine was registered in 1988 for the control of cheat grass. It is only about one-third the cost of other materials. Timing and placement of fertilizer are very important in minimum tillage systems. A new computer program called Wheat Plan will allow the farmer to predict crop response to nitrogen applications.

Bolton also is working with a commercial company to produce a strip till machine which will do four operations at once. The company obtained a license two years ago to use OSU research and data. The prototype machine worked well, Bolton notes.

Bolton has three years of data suggesting that liquid fertilizers, broadcast or band sprayed, produce equal results to anhydrous ammonia injected in both conventional and minimum tillage systems. He also found that liquid fertilizer could be effectively combined with an herbicide for results equal to or better than water-herbicide mix. He sees this as a way of reducing costs while increasing efficiency. Bolton got the idea from growers who combine broadleaf herbicides with liquid fertilizer.

Taking the results from scientists like Bolton to the grower is the responsibility of the Extension component of STEEP, begun about five years ago. Don Wysocki, OSU Extension soils specialist based at the Columbia Basin Agricultural Research Center in Pendleton, conducts meetings, tours, demonstrations and writes publications as part of his outreach work. Annual cropping, conservation and

DAVE KING

Experts estimate farmers are using some kind of conservation tillage to combat erosion on more than a third of the Northwest's grain acreage.

WILL THE SHOW GO ON?

After enjoying a long run, STEEP is up for renewal in Congress.

The need to continue a STEEP program into the next decade is as great as ever, as scientists and producers explore ways to stop erosion and protect water quality while maintaining profitable farming operations.

STEEP 2 continues and expands the work of the last 15 years. The plan, prepared by Oregon State University, Washington State University, the University of Idaho and the USDA's Agricultural Research Service and Soil Conservation Service, was first presented to members of Congress by area wheat producers in Washington, D.C., in March.

Although rooted in the original program, STEEP 2 has important differences, points out Van Volk, associate director of the OSU Agricultural Experiment Station.

First, it expands research to emphasize water quality as well as soil erosion. Many believe water quality will be one of the important issues of the '90s, and more information is needed to assess the impact of farming practices on water quality.

Second, research will move toward looking at farming systems as a whole, including production and marketing. The goal is to obtain and integrate technical and scientific information about soils, crop plants, pests, energy and farm profitability into sustainable, whole-farm management systems.

Third, the new program expands efforts to disseminate and transfer technology from STEEP research to on-farm applications. It calls for more on-farm research. Moving research plots and field tests to the farm means greater interaction between researchers and producers, Volk points out. There will be greater Extension staff involvement.

"This is the result of a feeling by many producers that there's more knowledge from STEEP research than has been shared with them," Volk observes. "We have shared results, but perhaps not as effectively as we could."

Fourth, there's a new urgency to work related to soil erosion. Many unanswered questions remain about minimum tillage practices and how they affect production. Because of the 1985 Food Security Act, many farmers are trying conservation practices for the first time. Indeed, later this decade farms without approved conservation plans will no longer be eligible for government support programs. Management strategies and options are needed to provide future protection for the two million acres now in the Conservation Reserve Program in the three states. Concerns about sustainable agriculture, water quality, high production costs and environmental stability have placed land stewardship in a new context.

Producers will play a more direct role in determining STEEP 2 priorities.

Grower input has been sought regularly, Volk explains, but in a more informal way. Growers have been present in large numbers at the annual STEEP review meetings to hear results and make suggestions.

subtillage methods as well as minimum till plantings, fertilizer placement and rapeseed agronomics are among the practices being demonstrated. Publications include the *Pacific Northwest Conservation Tillage Handbook,* published this year.

A no till planting drill. No till grain farming can produce yields almost equal to those with conventional tillage.

BOB ROST

But has 15 years of scientific inquiry made a difference in how people farm?

Van Volk, associate director of OSU's Agricultural Experiment Station, sees stubble mulching and conservation tillage "being well accepted." Oldenstadt believes you measure progress by its impact on the countryside "and you can see it." He observes farmers instituting soil conserving practices as they become more knowledgeable.

Their observations are echoed by Roger Veseth, STEEP Extension conservation tillage specialist with Idaho and WSU, who estimated in 1987 that 36 percent of the cereal acreage in the three states in 1987 was under some type of conservation tillage as compared with only 24 percent in 1982. Mike Stoltz, OSU Extension agent in Umatilla County, believes that growers are putting many STEEP findings into practice "without being aware that they resulted from STEEP research."

Bolton emphasizes that once a consistent minimum tillage system is established, farmers will readily adopt it. The Soil Conservation Service is using STEEP information in developing farm conservation plans.

Even though 15 years may seem like a long time for a research program, Volk points out that time is a key element when addressing a long-term problem such as erosion. Scientists need time to plot trends resulting from changing management practices so growers can know what to expect.

Even though much progress has been made, there are still unanswered questions regarding new conservation tillage practices. Scientists continue to search for ways to control weeds and diseases through farming practices while reducing reliance on chemicals.

Cereal breeders are continuing their efforts to develop wheat and barley strains that thrive in trashy fields. Soil scientists are looking at how water and chemicals move through the soil.

Just as the law officers on *Twin Peaks* search for clues to solve their mystery, STEEP researchers continue to search for ways to bring soil erosion under control while allowing producers to work the land in an economical manner.

Len Calvert is a communications specialist in OSU's agricultural communications department.

TOM GENTLE

Besides threatening food production, erosion can send sediment and pesticide and fertilizer residues into waterways like the Columbia River.

LLOYD'S VISION INCLUDED A PLOW

Lloyd Martin's dream as a boy in eastern Oklahoma was to be a farmer.

"I had a vision of myself plowing the soil, growing crops and watching the sprinkler irrigation squirt water on the fields," he says. "I would have been happy doing that, and I believe I would have been successful at it."

But the vision remained only that, a ghost in some recess of his mind, plowing a field of dreams. There was no farm to inherit.

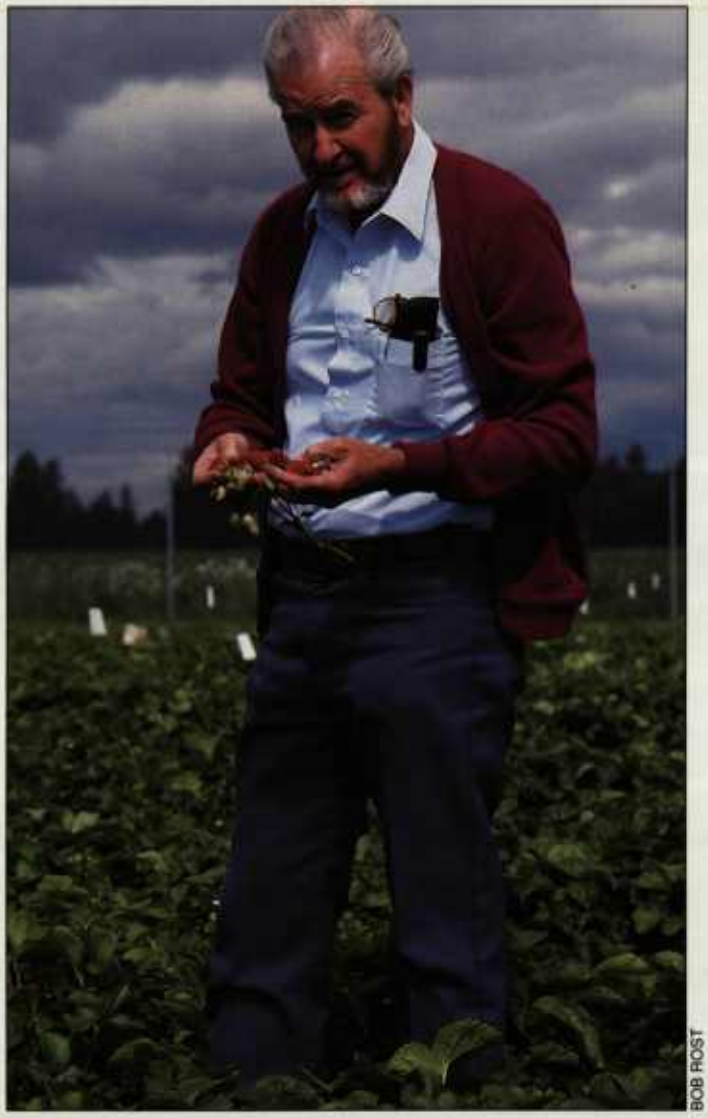
Instead, he went to Oklahoma State University to study horticulture, did a tour in the Marine Corps in Korea, and then went to Michigan State University to do graduate work in horticulture and plant nutrition. By the mid-1960s he was at OSU as an Extension horticulture specialist. A few years later, in 1970, Martin was named superintendent of OSU's North Willamette Agricultural Experiment Station near Aurora.

Asked if he likes his job of 20 years, Martin sits back and deadpans, "No, I'm just passing through." But he does like his job, and he doesn't think much about being a farmer anymore. "Too many nuisance factors," he says. Maybe part of the dream came true just the same.

His office is in the middle of 160 acres of rich Willamette Valley cropland. A look around reveals expanses of plowed soil, plots of various kinds of berries, wheat, potatoes, wine grapes, nursery crops and sprinkler irrigation pipes squirting water.

The former OSU branch experiment station now is the North Willamette Research and Extension Center, where Martin has a double role. He's the administrative head and a researcher. Berries are his research specialty, particularly strawberries. Recently, he offered this writer samples of a variety he's working on. They were the best I had ever tasted.

"I've had some opportunities to move over the years and I've looked at other jobs," says Martin. "I think that's good for people. It was for me. You go away and interview for a job and you can appreciate what you have going in Oregon. We've got some problems, but all you have to do is go back to the Midwest or East Coast and it'll make you, at least it made me, really appreciate Oregon."



BOB ROST

Lloyd Martin

In Martin's two decades at the research center there have been many changes, but nothing like what's happened in the last year. Contractors just finished an addition to the office building, adding a conference room, a large meeting room and extra offices. Additional staff are arriving, including extension agents who specialize in horticulture. The agents are transferring from offices in northern Willamette Valley counties.

Along with the changes come different expectations for the center and its staff.

"We'll be on trial here, more or less, for a few years to see if we can make this system work," Martin says, referring to extension agents working alongside researchers, serving agriculture on a regional rather than county basis. "I see the changes here as an opportunity for a closer working relationship between agricultural research and Extension staff and an opportunity for better service to commercial agriculture."

Martin manages his new responsibilities with quiet enthusiasm. Several colleagues have been at the center almost as long as he has, apparently liking his unflappable demeanor.

"My kids used to say if I was any more calm and cool, I'd be in a coma," he observes. "I'm not a very expressive person." The center seems to reflect his style. It's a busy place in a quiet sort of way. The science and education facility has the atmosphere of a family-owned berry farm or nursery.

In a recent movie called "Field of Dreams" the ghost of a famous baseball player walks out of a corn field and asks the owner if his farm is heaven. "No," he replies. "It's Iowa." Imagine the ghost of Luther Burbank, the legendary horticulturist, appearing in one of Lloyd Martin's berry patches, asking the same question.

"No, it's Oregon," Lloyd might say, handing Mr. Burbank a box of the best strawberries he'd ever seen, including those up yonder.

—Bob Rost

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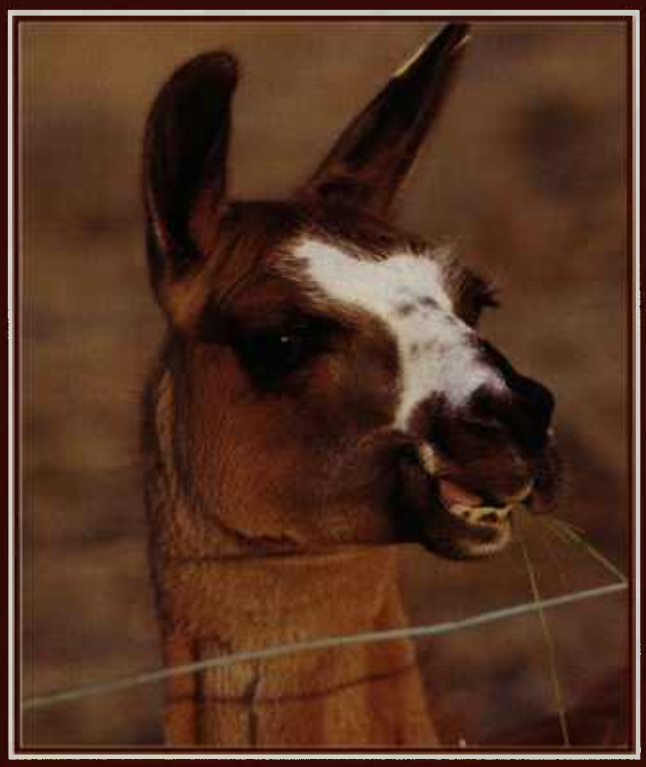

What's Up, Doc?

Mysteries of Llama Medicine.

(see page 14)