OREGON'S AGRICULTURAL PROGRESS

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Cover

The Columbian white-tailed deer inhabiting the islands and tidal flats of the Columbia River in Western Oregon are the object of OSU research that may get them off the endangered species list. Story begins on this page.

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Deer survival at stake

Survival of a small band of deer along the lower Columbia River may hinge on what Oregon State University researchers can learn about them.

The Columbian white-tailed deer, an endangered species, is one of 31 subspecies of white-tailed deer inhabiting North America but is the only one with such a limited habitat. The only place the deer are certain to exist is on the islands and tidal flats of the lower Columbia River. Another small band of white-tailed deer along the Umpqua River near Roseburg also may belong to the same sub-species, but this has not been scientifically documented.

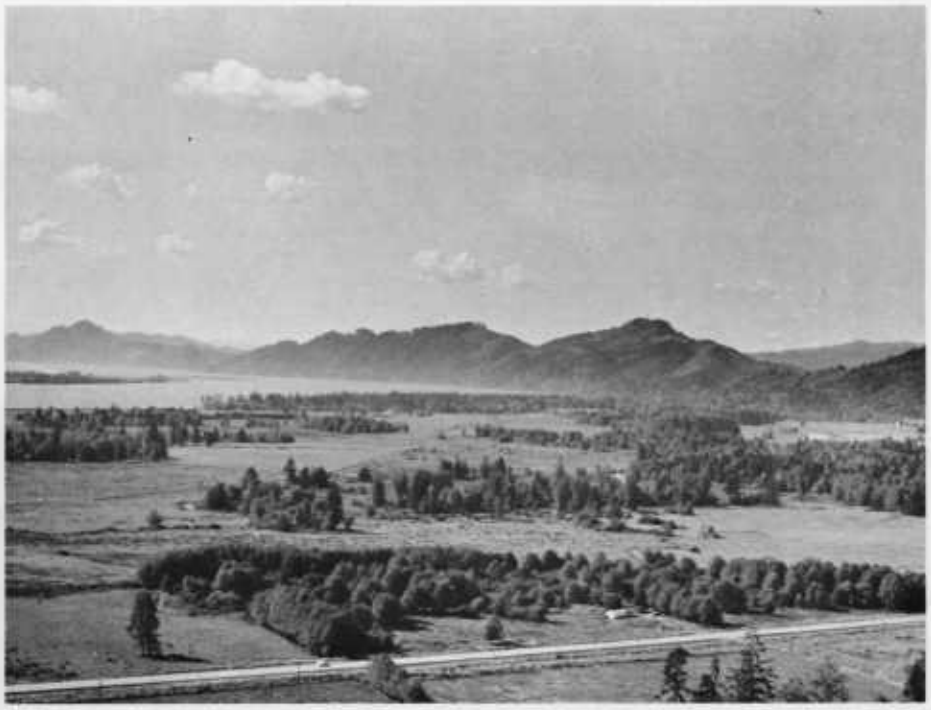
Paul A. Vohs Jr., associate professor of Fisheries and Wildlife at OSU has been directing a study supported by the Bureau of Sport Fisheries and Wildlife to learn more about the deer and its habits so it can be successfully managed and perhaps eventually removed from the endangered species list.

A one-year field study to characterize vegetation types, determine movement patterns and obtain an estimate of size of the deer population has been completed by Lowell Suring, master's degree candidate in the Department of Fisheries and Wildlife. The work was done on the Columbian White-Tailed Deer National Wildlife Refuge established in 1972 by the Bureau of Sport Fisheries and Wildlife as a sanctuary for the deer. The refuge covers approximately 2,781 acres, encompassing several Columbia River islands and part of the mainland near Cathlamet, Washington.

Land incorporated into the refuge is mostly diked and has been drained and fenced to provide improved pasture for dairy and beef cattle. The pastures are interspersed with small stands of spruce, alder and cedar and some have been invaded by thistles and rushes.

Suring has observed that the deer are primarily grazers, utilizing rush

Plastic collars help trace deer movement.



Open fields interspersed with wooded areas are preferred by the Columbian white-tailed deer.

and thistle invaded pastures more than improved pastures that offer less cover. Proximity of wooded areas also influences their grazing habits as the deer prefer open canopy wooded areas to large open fields.

Vohs and Suring estimate that the Columbian White-tailed deer population numbers around 225-240 animals. Based on Suring's observations, there are about 54 bucks for each 100 does and only about 35 fawns for each 100 does. The small number of fawns in relation to the number of does is not considered detrimental to the herd because the limited habitat probably would not support an expanded population, meaning that for every fawn that survives, there must be a mortality elsewhere in the herd, said Vohs. Winter mortalities are common among both adults and young and fawn deaths also are quite frequent during the spring and early summer, he added.

Several deer were marked with 2½-inch-wide plastic collars. Movement patterns of the marked deer indicate that the bucks move about on the refuge much more than the does.

More deer will be marked with collars this fall as Richard Vowles, Ph.D. candidate in the Department of Fisheries and Wildlife, follows up on Suring's work with a three-year study of his own. Vowles will be observing movements and social interaction of the deer and hopes to determine why the deer are restricted to such a limited habitat. Such information could open the door to relocation of some of the animals—a move that hopefully would increase their numbers.

A grazing plan also is under way to pinpoint the interaction between the deer and cattle. Cattle are suspected of playing an important role in management of the deer, said Vohs. Fields representing five different vegetative communities will be grazed with varying intensities to determine deer response to the grazing.

A committee of representatives from the Bureau of Sport Fisheries and Wildlife, Oregon Game Commission, OSU, and the Washington Department of Game has been formed to develop a management plan to expand the deer population. The OSU studies will assist the committee members with development of their management objectives.

The area inhabited by the white-tailed deer is shared with more common black-tailed deer. The white-tailed deer can be distinguished from the black-tailed deer because their tails, which have a white underside, are longer and the coats are not as red as those of black-tailed deer. The antler rack also is different. Antlers on the white-tailed deer are formed from one main stem. Those on the black-tailed deer fork into two or more branches.

Presence of the Columbian white-tailed deer was first noted by Lewis and Clark in 1806. They reported seeing and killing deer from what is now The Dalles to Astoria. The deer also originally were reported to have ranged from the lower end of Puget Sound in Washington to Roseburg.

If the Roseburg white-tailed deer belong to the same sub-species as those found along the Columbia River, it is possible to speculate that the two bands may have become separated and driven to their present locations as their habitat in the river valleys, particularly the Willamette Valley, gradually dried out and were developed for agricultural use.

Regulators grow into new fields

Growth regulators are helping bring rhododendrons into the home by forcing early blooms and keeping the plants small and compact.

Growth regulators—synthetic chemical compounds based on natural hormones produced by plants—have been around for a long time and have been put to a variety of beneficial uses in agriculture.

Thinning fruit, increasing fruit set, altering fruit shape, increasing flower initiation, chemical training, loosening fruit for harvest and preventing physiological disorders are some of the varied uses that horticulturalists found for the chemicals. Several of the special uses for the regulators were developed or adapted to Oregon conditions and crops by OSU Experiment Station scientists.

Now, agronomist David Chilcote and horticulturalist Bob Ticknor are expanding the use of growth regulators from fruit crops to grasses, legumes and ornamentals.

Chilcote, working with Southern Oregon Experiment Station agronomist John Yungen and graduate student John Phillips, conducted field experiments to determine the effect of several growth regulators on alfalfa seed production. A one-year-old, drill-sown stand of Talent alfalfa was used for the tests. Single applications of the chemicals were made following the first cutting of hay. One-half of the plots was sprayed 10 days later than the other half to see if timing had an influence on results.

The researchers obtained statistically significant increases in alfalfa seed yield when two growth regulators—TD6266-R and Alar-85—were used, suggesting potential for these chemicals in crops grown for seed production. Compared to the check plots which averaged 150 pounds of seed per acre, the TD6266-R applied at a rate of two quarts per acre produced seed yields of 368 pounds per acre. Alar-85 applied at a rate of one pound per acre produced yields of 366 pounds per acre. The chemicals increased the number of seeds per pod. The total number of pods or average seed weight was not increased. Cycocel, TIBA, Ethrel, and 2,4-DB were other growth regulators tested. Greenhouse and field experiments involving the use of growth regulators on alfalfa are continuing. Chilcote has initiated similar experiments on grass varieties.

Ticknor, working at the North Willamete Experiment Station, is testing growth regulators on ornamental plants. He is increasing the number of blooms on rhododendrons during the first year following propagation and thinks there is a good possibility of getting rhododendrons into bloom for the Valentine's Day commercial market.

Getting the young plants into bloom early cuts down on maintenance time and costs in the nursery, meaning a better price for the consumer. By channeling more of the plant's energy into bud production the growth regulators also produce a more compact plant capable of staying in containers and in the home longer.

Ticknor is testing plant response to several growth regulating chemicals, using several varieties of rhododendrons. He is varying the method of treatment as well as dosage given each plant. Spraying the chemicals on the plants is the most economical, saving time and labor compared to drenching the soil around each plant, but waxy leaves of rhododendrons have prevented spraying from being as effective.

Although the number of flowering plants obtained in relation to the total plants treated varied depending on plant variety, two treatments—drenching with Cycocel and drenching with Phosphon—produced the best results on most varieties.

Agriculture gets a partner . . . garbage

Agriculture is going to waste in the arid expanses of north central Oregon.

A cooperative project between the Department of Soil Science at Oregon State University and The Boeing Company is under way to see if municipal wastes and agriculture can be blended for mutual benefit—the waste aiding with erosion control and moisture conservation and perhaps contributing some necessary trace elements for crops and the thousands of acres of sandy soil offering a potential receptacle for big city garbage. If the system works, it would be an alternative for many heavily populated areas facing waste disposal problems.

Oregon State University soil scientists V. V. Volk and C. H. Ullery are working with The Boeing Company to determine what happens to the garbage, soil, crops and water quality when varying rates of shredded municipal waste and sewage sludge are mixed with the sandy soil.

If the unique idea is feasible and accepted, Boeing proposes to barge as much as 800 tons of garbage a day up the Columbia River from Portland to Boardman where the garbage would be mixed with the soil as part of an overall land use program the company is developing for the 100,000-acre Boardman test range it leases from the State of Oregon.

Some 200 tons of shredded waste from Vancouver, Washington, were trucked in September, 1971, to the Boardman test plots and rototilled into the soil at rates of 100, 200 and 400 tons per acre. The garbage was composed of normal household and store wastes but did not include industrial wastes. When garbage was applied at a rate of 400 tons per acre (8 inches thick after packing) it was difficult to mix with the soil using common farm rototillers. Sewage sludge was added in amounts proportional to the garbage application—55 gallons per ton of waste. Nitrogen fertilizer was added in varying amounts to each of the soil-waste mixtures to encourage rapid waste decomposition.

Hyslop wheat was planted as a winter cover crop and followed by spring plantings of Fawn fescue and Sernac alfalfa. The plantings were irrigated.

Paper products in the waste decomposed considerably during the first winter, leaving pieces of rubber tires, tennis shoes, plastic, wire and other more resistant items. Volk and Ullery suggest that these materials may have to be shredded more thoroughly or removed to keep them from presenting problems in commercial planting and harvesting operations. Two years after the garbage application, no paper products can be found in the soil.

The winter stand of Hyslop wheat on the plots having 100 tons of gar-

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Shredded garbage goes into the soil at a rate of 400 tons per acre.

Researchers harvest alfalfa grown on the garbage-soil mixture.

Slow to decompose items remain in the soil after the first year.

Winter wheat pushes back calendar

Research on varying the planting dates of spring and winter wheat at the Pendleton Experiment Station indicates that winter wheat can be planted as late as February 15 in most years and still outyield spring wheat.

Station superintendent and agronomist C. R. Rohde has compiled five years of data on the effect that planting date has on yields at the station and has initiated similar research in off-station plots about 15 miles west of Pendleton.

Although weather conditions have prevented use of the exact same planting date from year to year, Rohde made five successive plantings at approximately two-week intervals each year. The earliest experimental plantings ranged from January 23-25. The second planting dates ranged from February 7-18, the third from February 21-March 1, the fourth from March 9-12 and the fifth from March 23-27.

Rohde's research covered seven varieties of wheat—five winter and two spring wheats. He also made the same planting date comparisons with barley, using three spring and three winter varieties.

For the first two sets of planting dates, most of the winter wheats clearly outyielded the spring wheats planted on the same date. The one exception was Moro winter wheat which produced yields close to those of the spring wheat and well below that of the other winter wheat varieties. Nugaines and Hyslop winter wheats performed the best in the winter plantings. When planted near the end of February, the winter and spring wheats produced comparable yields. After March 1, yields from the winter wheats dropped rapidly, while the spring wheat yields stayed about the same.

Unlike the wheat, the spring barleys outperformed the winter barleys at every planting date during the first three months of the year, suggesting that the cutoff date for planting winter barley is much earlier than for winter wheat. The earliest maturing winter barleys such as Hudson and Kamiak performed more poorly than later maturing varieties such as Luther when planted in March—just the opposite of what would be expected, said Rohde.

Similar research by superintendent Malcolm Johnson at the Central Oregon Experiment Station, Redmond, produced different results. Yield averages for three sets of planting dates over three years show that winter wheats planted from February 23 to March 3 clearly outyielded spring wheats planted during the same period. This means that winter wheat can be planted a couple of weeks later in Redmond than in Pendleton and still produce good yields.

Three winter barleys—Luther, Casbon and Adair—used in the Redmond trials all outyielded Hannchen, the only spring variety tested, for each of the three sets of planting dates. Casbon and Adair have to be seeded in the late winter or early spring because —although considered winter barleys in other areas—they are not hardy enough to survive Central Oregon winters.

Knowing how late in the winter season winter wheat or barley can be planted and still produce satisfactory yields is important if a farmer cannot get his crop planted in the fall because of bad weather or other reasons or if he needs to reseed because of winter injury.

Yield (bushels/acre) of wheat varieties seeded during late winter and early spring at Redmond

Varieties	Seeding Dates		
	Feb. 23-Mar. 3	Mar. 23-Mar. 24	Apr. 23-Apr. 27
Winter			
Nugaines	54.2	45.1	------
Hyslop	57.0	34.4	------
Yamhill	16.5	------	------
Kharkof	48.0	33.3	------
63-130-66-5	60.7	48.6	------
Paha	60.4	39.0	------
Spring			
Federation	53.6	55.0	45.0
Pitic 62	58.2	70.0	49.0
Tobori 66	54.2	60.9	51.1
Inia 66	43.2	49.1	49.8

Yield (bushels/acre) of wheat varieties seeded during late winter and early spring at Pendleton

Varieties	Seeding Dates				
	Jan. 23-25	Feb. 7-18	Feb. 21-Mar. 1	Mar. 9-12	Mar. 23-27
Winter					
Gaines	51.2	48.2	40.2	24.4	------
Nugaines	65.0	58.1	52.2	30.6	------
Hyslop	64.6	59.9	52.3	28.7	------
Moro	41.0	46.0	38.5	19.0	------
Paha	57.4	57.8	49.5	27.2	------
Spring					
Idaed 59	39.2	47.6	45.8	44.8	38.2
Adams	50.1	51.1	51.0	51.5	52.5

Nitrosamines: food for thought

Nitrosamines can cause cancer. These chemical compounds, formed when nitrites combine with naturally occurring amines, have been appearing sporadically in some food products over the last few years and have prompted worldwide research to learn more about them.

Researchers are finding that nitrosamines are rather elusive when it comes to identifying their presence in our environment. But, of the more than 100 nitrosamines that have been identified so far, approximately 80 percent have caused cancer in laboratory animals. The liver is the organ most frequently attacked but certain nitrosamines will cause cancer in specific organs other than the liver.

An OSU research team under the leadership of food scientist Richard A. Scanlan is in its third year of work with the compounds. The team is developing and improving procedures for detecting nitrosamines in foods and is testing the cancer-causing ability of different nitrosamines in feeding trials with rats. It also is studying the chemistry of nitrosamine formation, hoping to learn how to block their formation in foods.

Nitrosamines gained prominence in 1956 when trace amounts of dimthylnitrosamine were proved to be carcinogenic by two English scientists. Then, in the early 1960s, a group of Norwegian researchers linked nitrosamines in fish meal with liver cancer in mink and sheep. Formation of the nitrosamines was traced to excessive usage of sodium nitrite, a common preservative in hams, bacon, luncheon meats, hot dogs, corned beef and other cured meat products.

Nitrite, as a food additive, has three functions: 1) as a preservative, it keeps *Clostridium botulinum* bacteria from producing the toxin that causes botulism; 2) it gives meat an attractive bright pink color; 3) it contributes to the flavor of cured meats.

Although most people probably would be willing to accept safe grey hot dogs rather than red ones that might cause a nitrosamine hazard, the choice between nitrosamines or botulism is not so clear. The problem is determining whether the risk of using nitrites is more than offset by the potential risk of not using them, particularly when nitrosamines have been found only in a few instances and at low levels, said Scanlan.

Also, removal of man-added nitrites in foods may be insignificant because nature offers many other sources of nitrites. Researchers in Germany and the Massachussetts Institute of Technology have found that nitrites are produced in substantial amounts in saliva. They conclude that this may be the principal source of nitrites consumed by humans.

Nitrates, from which nitrites can be formed, are widely distributed in nature. They are abundant in spinach, celery and certain other plants. They can be found in significant concentration in many water supplies, particularly in agricultural areas. Sewage discharges, intensive use of nitrate fertilizers and rising water tables which leach sub-soil nitrates into well waters are some of the sources for nitrates in water.

Laboratory studies have suggested that nitrosamines can be formed in the stomach, the only place in the gastro-intestinal system where the acidity is high enough for this to happen. Fortunately, the most common amines do not appear to react with nitrites to form nitrosamines in the stomach.

There may be other factors influencing nitrosamine formation. Researchers have found that certain substances such as tannins, which are in tea and fruit juices, inhibit nitrosamine formation by rapidly reacting with nitrite. Vitamin C has also been shown to block nitrosamine formation. This has led to the suspicion that diet might be a variable causing the formation of nitrosamine-induced tumors in some populations while preventing them in others.

Scanlan's interest in nitrosamines was sparked several years ago when a paper by some Norwegian scientists claimed that nitrosamines were produced by heating certain amino acids and sugar. This suggested that

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bage per acre was only slightly below that of the check plots containing no garbage. At the 200-ton-per-acre rate the stand was reduced by approximately 25 percent. The wheat did poorly at the 400-ton-per-acre rate, covering only 5 to 10 percent of the plot area, mainly because of poor garbage incorporation.

Alfalfa yields for the first cutting were reduced for all waste treatments. The greatest decrease occurred at the highest waste application rate. Yields improved with the second and third cuttings, ranging between 2.5 and 3 tons per acre. In the plots with 100 tons of waste per acre, the alfalfa yields were similar to those in the control plots. Yields in the plots with 200 tons of waste per acre were only 10 percent less than the control plots.

Fescue forage yields decreased slightly with the application of 100 and 200 tons of garbage per acre.

The uptake of some chemical elements by the different crops increased with the addition of waste to the soil, but, with the possible exception of boron, none appeared to be detrimental. Analysis of wheat tissue grown on the garbage-soil mixture showed a high boron content, even though the soil was close to boron deficiency before waste application.

Although wheat has a high boron tolerance and was not affected by the increase, greenhouse studies supplementing the field research revealed considerable reduction in the growth of beans and other boron sensitive plants on the garbage-soil mixture. The boron levels in plant tissue decreased with successive crops and, by the end of the first year, appeared no longer to be a problem. Boron was readily leached out of the root zone. The researchers attribute the increase in boron to glue and other adhesives in the waste material.

Increased uptake of other elements such as zinc and molybdenum are potential problems as they approach levels of plant toxicity or, as in the case of molybdenum, may affect livestock eating the forage. Suitability for animal use of forage grown on the soil-garbage mixture is an area that needs further research, said Volk.

Addition of waste caused significant changes in physical properties of the soil. Moisture retention and water storage capacity of the soil increased with the addition of shredded waste, but the increases were small for waste applications less than 200 tons per acre.

One of the biggest changes caused by the addition of waste was the reduced soil loss from wind erosion. Exposed waste particles act as windbreaks, greatly reducing wind velocity near the soil surface. Wind tunnel tests in the laboratory indicated that the garbage could substantially reduce erosion. During a 20 minute soil exposure to a 30 mile per hour wind, the application of 200 tons of garbage reduced erosion by 88 percent—cutting airborne soil losses from 35 tons per acre on untreated soil to 4 tons per acre on the treated soil.

Volk and Ullery see little potential for contamination of underground water supplies by leaching of metals from the waste if proper irrigation management is combined with the low rainfall of the area.

Based on the first year's information, the researchers feel that it is possible to incorporate municipal waste with sandy soil and then use the mixture for agricultural production, providing the waste is not applied in excess of 200 tons per acre and is shredded more finely than that used in the experiments. The first year's cropping pattern also would have to be planned to accommodate the high boron content of the waste treated soil.

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the carcinogenic compounds could be created without nitrites and indicated that nitrosamines were much more widespread than originally thought to be.

Skeptical of the Norwegian results, Scanlan initiated a study to see if he could duplicate their findings and concluded that the Norwegians had a case of mistaken identity—what they thought were nitrosamines were really pyrazines, another class of chemical compounds. A group of German researchers conducting a similar study concurrent with Scanlan's reached the same conclusion.

Scanlan's research team has since shown for the first time that nitrosamines, usually formed by nitrites, reacting with secondary amines, also can be formed from tertiary amines and certain primary amines. They also have synthesized several nitrosamines and are feeding two of them—nitrosoproline and nitrosohydroxyproline—to rats. No apparent carcinogenic effects have appeared as the two-year feeding trials approach completion.

Another mystery the OSU food scientists are trying to unravel is the formation of nitrosopyrrolidine, a heat-induced nitrosamine formed when bacon is cooked. Although they do not know for sure how nitrosopyrrolidine is formed, the researchers have identified several chemical suspects that could cause its formation and are examining those in more detail. They also are exploring the reaction products between several amino acids and nitrite.

The OSU research, coupled with other studies of the relatively unexplored nitrosamines, will lead to a better understanding of the highly carcinogenic compounds. The goal is removal of any potential hazards they may have for humans.

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