Rangelands

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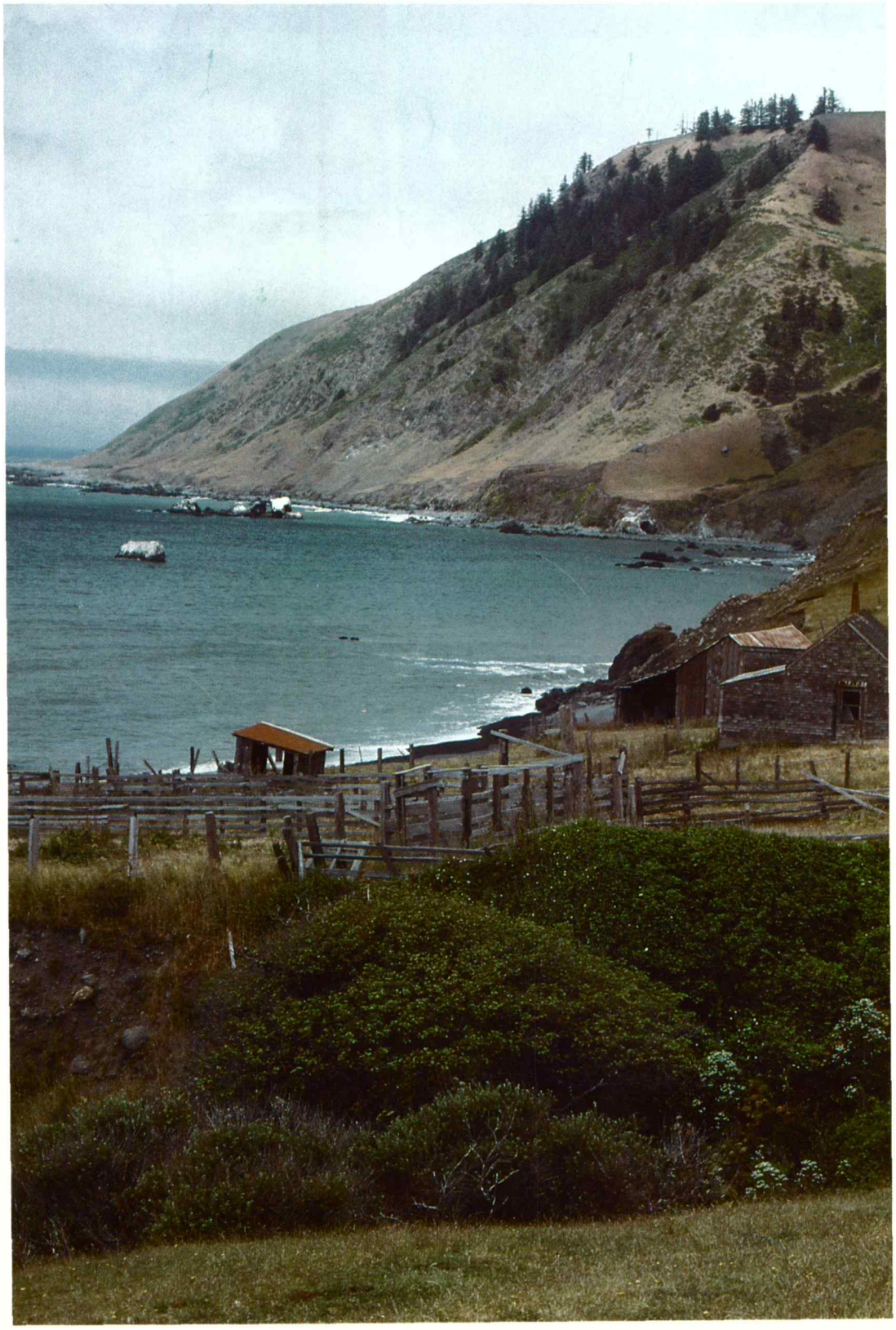

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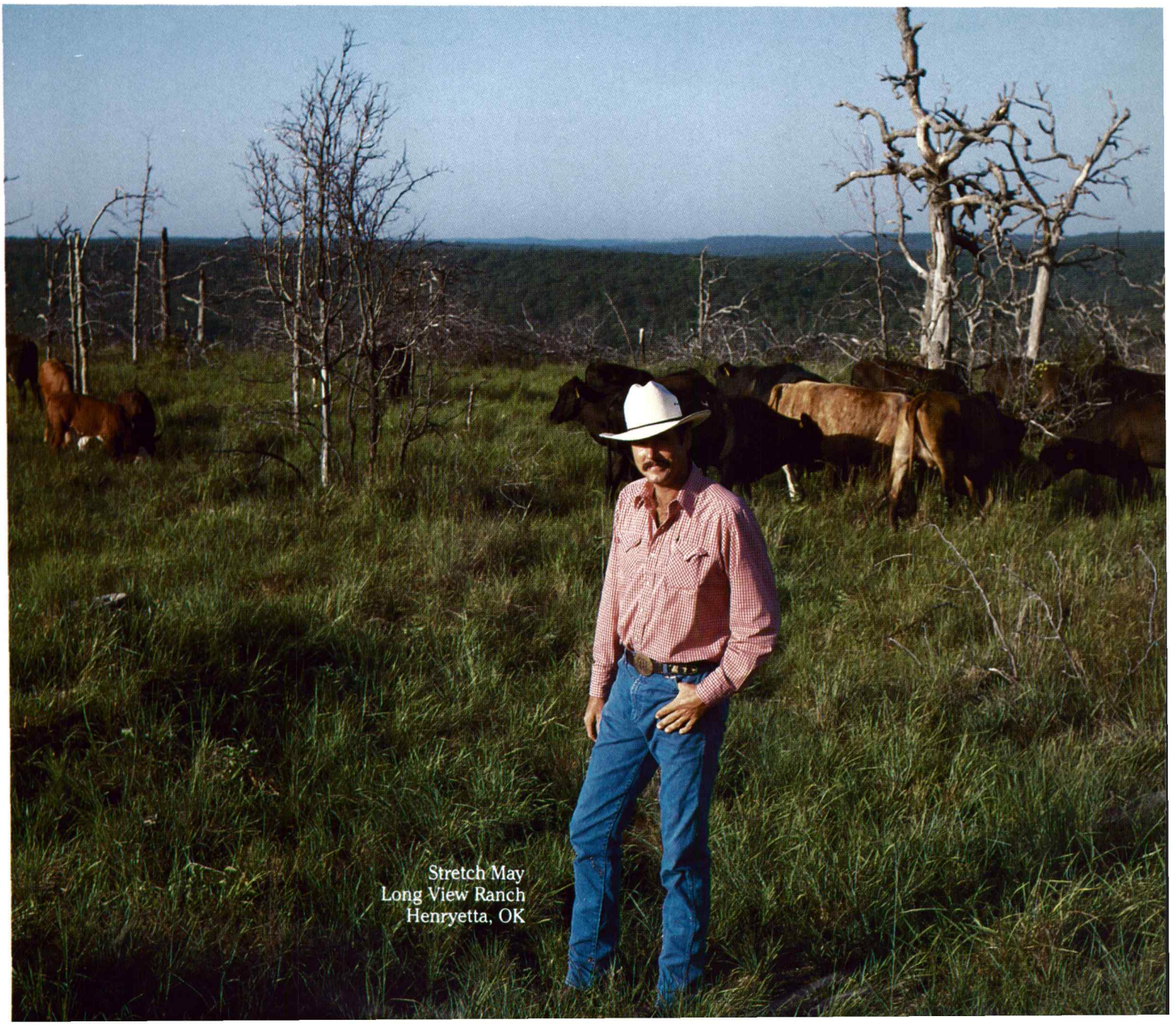

Stretch May
Long View Ranch
Henryetta, OK

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—to assist all who work with range resources to keep abreast of new findings and techniques in the science and art of range management;

—to improve the effectiveness of range management to obtain from range resources the products and values necessary for man's welfare;

—to create a public appreciation of the economic and social benefits to be obtained from the range environment;

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COVER: From the Mocher Cabin looking north along the California coast to be seen by those attending the SRM Summer Meeting in Arcata. See symposium information on page 128. Photo by Dawson.

Guayule: A Rangeland Source of Natural Rubber

M.A. Foster and Jaroy Moore

The United States is entirely dependent on foreign sources for its supply of natural rubber, a critical and strategic material. Almost one billion dollars is spent annually for imports of natural rubber from the rubber tree *(Hevea brasiliensis)* (USDA 1984). The range of the rubber tree is restricted to tropical zones, where political unrest and economic changes could influence the availability of *Hevea* rubber. The South American leaf blight has devastated *Hevea* in its native Brazil and should the disease reach Southeast Asia, the tropical supply of rubber could be threatened.

Over 2,000 plant species are known to produce rubber; however, the rubber tree and guayule *(Parthenium argentatum)* have been the only continuing sources of commercial rubber. Guayule (wy-oo-lee), a member of the *Compositae* (sunflower family), occurs in native stands scattered throughout 130,000 square miles of rangeland in the Chihuahuan Desert and surrounding regions. Guayule is the most promising source of domestic natural rubber which can be grown successfully in the United States.

Early History

Lloyd (1911) reported that a Jesuit Priest saw Indians playing with rubber balls in northcentral Mexico in the middle of the eighteenth century. The rubber was extracted by communal mastication of the guayule bark, a common practice of the time. Lloyd expressed little doubt that this practice predated the invasion of Mexico by the Spaniards.

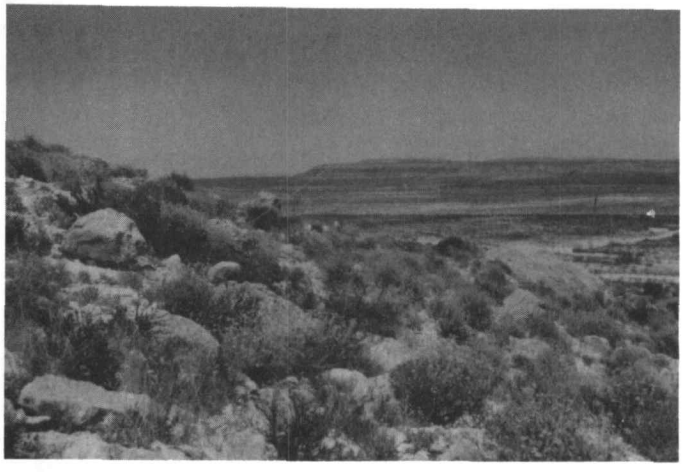
Another early use of guayule was fuel for Mexican smelters, which depleted thousands of acres of the shrub. The absence of guayule stands in certain regions in north and northcentral Mexico is due to this destructive process.

Guayule was first "discovered" in 1852, near Escondido Creek, Texas, by Dr. J.M. Bigelow, a member of the Mexican Boundary Survey party. Specimens were sent to professor Asa Gray at Harvard University, where Gray first described the plant.

Early Commercialization

Public attention was first drawn to guayule in 1876 by an exhibition sent by the Mexican Government to the Centennial Exposition at Philadelphia. Later, in 1888, the New York Belting and Packing Company obtained 100,000 pounds of guayule from Mexico and extracted the rubber by immersion in hot water. In 1902 several American businessmen financed an experiment in Mexico to develop a mechanical extraction method. The pebble mill extraction process was perfected and the first lot of rubber was shipped to the United States in 1904. The Continental-Mexican Rubber Company was formed and a large factory was constructed in 1906 near Torreon, Mexico. Other factories were built in Mexico and in 1909 a mill was located in Marathon, Texas, by the Texas Rubber Company. Mexico exported 9,542 long tons of guayule to the United States in 1909 (Hammond and Polhamus 1965).

A typical guayule plant in a cultivated field at the TAES Guayule Research Site near Fort Stockton, Texas.



A native stand of guayule near Fort Stockton, Texas.

The authors are assistant research scientist and professor, Texas Agricultural Experiment Station, Fort Stockton and Pecos, Texas.

Sustained harvesting of entire plants (tops and roots) resulted in depletion of the native guayule stands and many Mexican plants closed. The Continential-Mexican Rubber Company remained in operation and in 1910 anticipated the need to establish cultural experiments to maintain adequate guayule stands for processing. The Mexican Revolution forced the company to transfer its operation to the United States. Headquarters were established by W.B. McCallum near San Diego, Calif., in 1912 as the American Rubber Producers, Inc., of the Intercontinental Rubber Company. After a move to Arizona in 1916, permanent headquarters were located in the Salinas Valley, California, in 1925. The Depression of the 1930's caused rubber prices to fall and the guayule industry was arrested. However, between 1931 and 1941 nearly 3 million pounds of guayule were processed.

Guayule during World War II

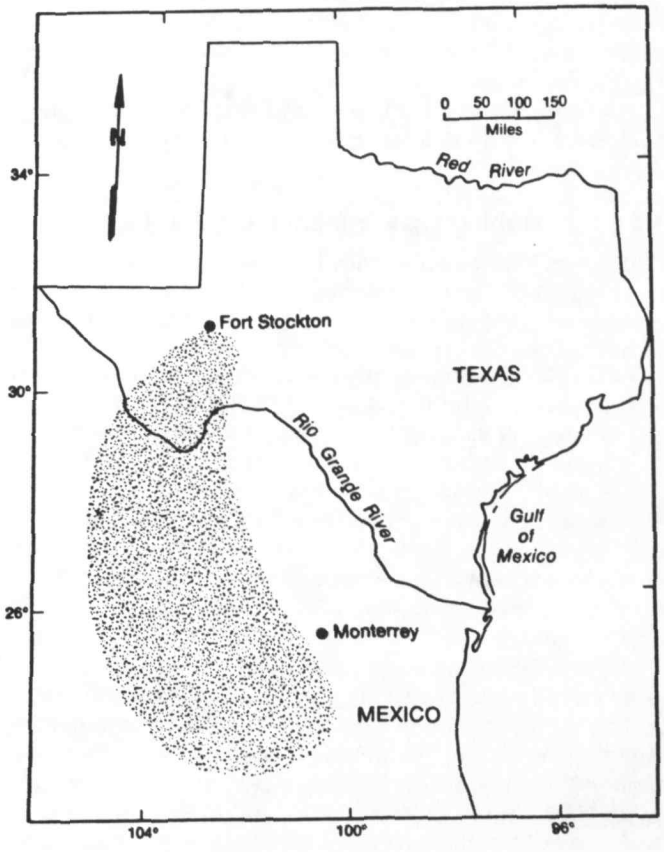
The U.S. War Department, in 1930, anticipated the loss of *Hevea* rubber in the event of an Asian War. Major Dwight D. Eisenhower and Major Gilbert Van Wilkes were appointed to study the feasibility of guayule as an alternative rubber source. It was recommended that guayule development be supported by the government. The plan was ignored and in December 1941 the Allies lost more than 90% of their rubber supply when Japan invaded Southeast Asia.

Holdings of the Intercontinental Rubber Company were purchased by the U.S. Government in March 1942 and the Emergency Rubber Project (ERP) was created. The program was administered by the USDA with the Forest Service organizing and directing the production and research. A massive research program was initiated to investigate all facets of guayule rubber production and nearly 32,000 acres were planted and 3 million pounds of rubber produced by war's end. With the development of synthetic rubber and renewed availability of *Hevea* rubber, the ERP was liquidated in December 1946. The remaining shrub stands (accounting for about 21 million pounds of rubber) were destroyed.

A reappraisal of the rubber situation indicated that synthetic rubber was not satisfactory for certain uses, and that natural rubber was still a critical material. Therefore, a new research program was initiated by the USDA in 1947 at Salinas, Calif. In December 1950, a program of stockpiling reserves of natural rubber was initiated. Nurseries were established in California for seed production and in Texas for possible use in a production program. By 1952 with 26,334 pounds of seed stockpiled, the program was discontinued.

Description

Guayule is a profusely branched shrub which reaches a height of 1 to 3 feet (Correll and Johnston 1979). This bushy perennial has small gray-green leaves covered with a silvery pubescence, hence, the species name *argentatum*. Mature leaves are characterized by one or two teeth located near the middle of each margin. Small yellow flowers, which may appear continuously throughout the season if soil water is available, are borne in heads on long axes extending above the canopy. The roots form a modified taproot system. Successive production of laterals soon obscures the primary root and the mature system is fibrous in appearance (Muller 1946). In native stands adventitious shoots (retoños) may form on shallow roots exposed by erosion.



Natural distribution of guayule in southwest Texas and Northcentral Mexico.

Current Distribution

Native stands of guayule occur in the Trans Pecos of southwest Texas and northcentral Mexico, and persist within a wide range of climatic tolerances. Annual precipitation averages 10 to 15 inches and occurs mainly in late spring and early fall. Moreover, the shrub grows extremely well under irrigation in Texas, New Mexico, Arizona, and California. Temperatures are known to range from lows of –10° F during winter in the northernmost limit near Fort Stockton, Texas, to near 120° F in summer.

Distribution is generally at altitudes of 2,300 to 3,500 feet in Reeves, Pecos, and Terrell counties, Texas, the northern limit of occurrence. Farther south in the Big Bend in Presidio and Brewster counties, stands are found from 3,500 to 4,200 feet. Some Mexican stands may occur at elevations of 6,000 to 6,500 feet.

The altitudinal range, restricted to a narrow transitional zone located between desert and grassland elevations, is the result of two limiting factors (Muller 1946). The lower limit of guayule occurrence is set not by competition, but by the severity of the desert climate which includes low and uncertain rainfall, high percentage of sunshine, low atmospheric humidity, high daily temperature, great range in daily temperature, and high soil surface temperatures (Shreve 1942). The upper limit is fixed by competition with highly developed grassland

communities, occurring above 5,000 feet elevation and where the annual rainfall exceeds 14 inches. Guayule distribution between these limits is determined, in part, by the presence of favorable sites on rocky slopes where competition is limited. Lloyd (1911) stated that the formation of retoños was a significant factor in the survival of guayule in native stands.

Rubber Distribution in the Plant

Rubber is located principally in the woody portions of the guayule shrubs, with two-thirds in the stem and branches and the remainder in the roots (National Academy of Sciences 1977). The bark is the main site of rubber synthesis and may contain 75 to 80% of the total rubber weight. Guayule rubber is not concentrated in latex ducts as in *Hevea*, but occurs in single cells located in the vascular rays of phloem and xylem.

Cultivated guayule at the TAES Guayule Research Site near Fort Stockton, Texas.

When guayule is actively growing, rubber is not accumulated. Rubber synthesis occurs in the late fall and winter when night temperatures reach 40° - 45° F (Goss et al. 1984). In native stands rubber accounts for, on the average, about 8–10% of plant dry weight. Nonetheless, great variation exists, with some plants containing close to 20% and others almost none. Guayule contains resins that account for about 10% of the plant dry weight.

Prospects for Future Commercialization

Guayule accounted for 10% of the world's natural rubber supply in 1910 and continued to be a minor source for nearly 40 years (National Academy of Science 1977). After World War II there was no need for an alternative source of rubber; nevertheless, the outlook for natural rubber has changed. Natural rubber is preferred for products that require elasticity, resilience, tackiness, and low heat buildup. It is especially useful for automobile tires (particularly radials), airplane tires, and where heat buildup under severe conditions could be critical. Radial tires require almost twice as much natural rubber as the bias ply tires.

Petroleum supplies are exhaustible and coupled with the chaotic situation in the Middle East, are not assured. Since petroleum is the essential raw material for synthetic rubber, supplies of this product may eventually become limited. Guayule rubber is a viable alternative to manmade rubber derived from petrochemicals, and importantly is a renewable resource.

Surpluses and associated low prices for traditional crops have resulted in a new emphasis being placed on viable, alternative crops. Furthermore, energy and water costs are forcing American farmers to consider other crops which may be more water-use efficient. During World War II and more recently in west Texas and other states in the Southwest, guayule has been successfully cultivated.

Stockpiling natural rubber, to ensure that it will be available if normal supplies are disrupted, provides added support for developing a domestic rubber industry. The Federal Emergency Management Agency has established a stockpile goal of 813,000 long tons of crude natural rubber. Currently there are only 119,000 long tons on hand.

Economics

Research and past experiences have demonstrated that it is technologically feasible to produce natural rubber from guayule. However, there is little commercial expertise available to adequately assess the economic implication of guayule cultivation in the United States. Most production costs are based on information from the ERP and current research data. Recent economic studies, based on broad agronomic and economic assumptions, suggest that guayule can be an economically competitive crop (Cornforth et al. 1980, Wright 1984).

It is generally accepted that for guayule commercialization to be feasible, some combination of improved rubber yield, favorable production costs, or increased rubber price must occur. A viable guayule industry would lessen the dependency on imports of *Hevea* rubber, improve the balance of trade, and maintain national security goals.

Current Research Activities

The Federal Government has established policy on the development of guayule as a domestic agricultural crop. Congress passed the Native Latex Commercialization and Economic Development Act in 1978 (P.L. 95–592). The Act stated: "It is the policy of the Congress, therefore, to provide for the development and demonstration of economically feasible means of culturing and manufacturing *Parthenium* and other hydrocarbon-containing plants for the extraction of natural rubber and other products to benefit the Nation and promote economic development." In 1984, Congress amended this act and renamed it the Critical Agricultural Materials Act (P.L. 98–284) and restated its commitment to guayule commercialization.

With renewed interest in guayule, the Firestone Tire and Rubber Company initiated a guayule research program in 1978 near Fort Stockton, Texas. They established about 200 acres of cultivated guayule and leased the site to the Texas Agricultural Experiment Station (TAES) in 1983. Presently TAES scientists are investigating guayule harvesting techniques, direct seeding, chemical weed control, irrigation, dryland production, seed harvesting and cleaning procedures, and germplasm selection. A laboratory for rubber and resin analyses has been established at the research site.

Scientists at the TAES Guayule Research Site are cooperating with researchers in the agricultural experiment stations of Arizona, California, and New Mexico and the USDA/ARS in evaluating guayule selections for regional adaptability and rubber production. Studies in conjunction with scientists in the TAES Department of Biochemistry and Biophysics are focusing on the effects of selected bioregulators on guayule rubber synthesis. Cooperating researchers with the Texas Engineering Experiment Station's Food Protein R&D Center have developed a solvent extraction method for guayule processing. Firestone has also established a pilot processing plant at Akron, Ohio.

Summary

Guayule, a semidesert shrub native to the Trans Pecos of southwest Texas and Mexico, produces natural rubber. Significant supplies of guayule rubber were produced in the early 1900's, and more recently during World War II. Political and economic situations worldwide have caused a renewed interest in guayule as an alternative source of natural rubber. The development of a domestic rubber source would alleviate the dependence on foreign supplies and provide an alternative crop for farmers in the Southwest. Past experience has indicated that technologically, guayule can be cultivated for the production of natural rubber. Current research is committed to improving existing production, harvesting, and processing technologies to develop an economicaly viable guayule production system in the United States.

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Coyotes, Guard Dogs, and Electric Fences

C.V. Hulet, W.L. Shupe, and V.W. Howard, Jr.

Editor's Note: The reader may wish to refer to the following articles for further information on coyote predation and control.

"Toward a More Effective Coyote Lure" by Jerry H. Scrivner, Walter E. Howard, Roy Teranishi, and Daniel B. Fagre, *Rangelands* 7(2), April 1985.

"Cost and Other Effects of Predation on an Angora Goat Ranch" by Jerry H. Scrivner, Dale A. Wade, Guy E. Connolly, and L. Charles Howard Jr. *Rangelands* 7(2), April 1985.

"The 1080 Livestock Protection Collar for Predator Control" by Jerry Scrivner and Dale A. Wade, *Rangelands* 8(3), June 1986.

In 1983 sheep were introduced on the Jornada Experimental Range (JER) in southwest New Mexico to determine if cattle and sheep grazing would lead to more efficient utilization of the range. It was rumored that there were many coyotes in the area and predation was expected to be a serious problem. A year after the sheep were introduced, the Fishery and Wildlife Sciences Department at New Mexico State University (NMSU) in cooperation with USDA estimated from scent-post visitations and helicopter gunning that coyote density was 1 per 2.7 square miles (Kumm 1985).

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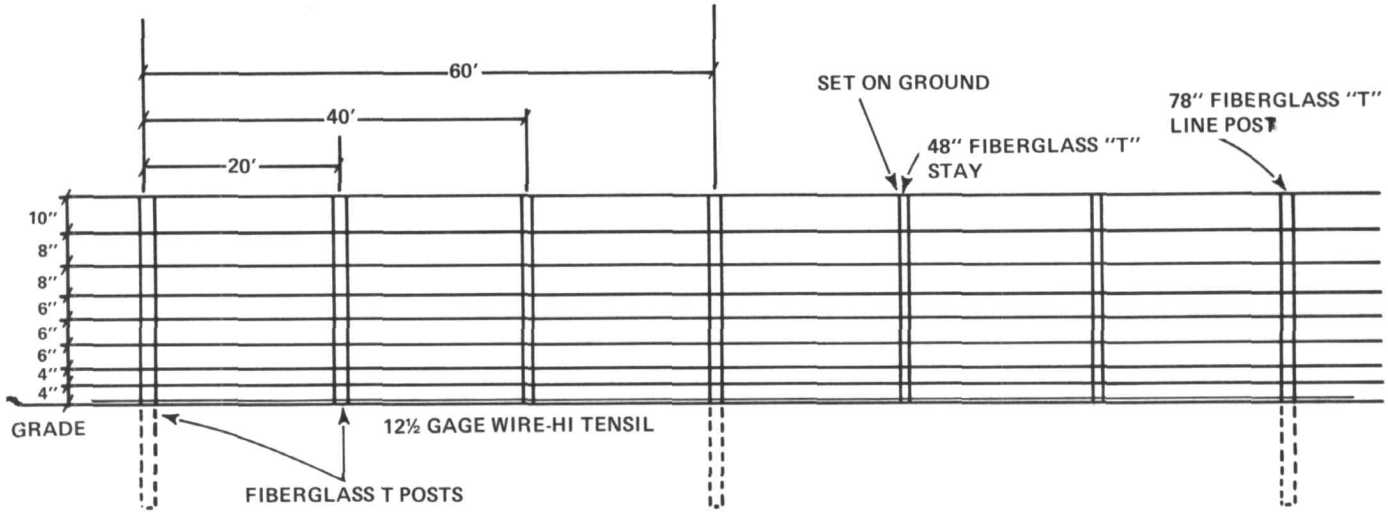
Loss of Sheep in an Unprotected Flock

In early February 1983, 144 aged, Rambouillet-type range ewes were placed in a fenced area to study the effects of nutritional environment on ovulation and to evaluate predation. A smaller representative sample of 54 ewes from the same source were maintained in drylot on alfalfa hay. This article presents an assessment of the predation problem. subsequent predator management practices which were instituted, and changes which occurred in the incidence of predation on large, expansive, brush-covered, fenced pastures.

Two noncharged high-tensile smooth wires were added to the lower part of an existing 4-strand barbed wire cattle fence to contain the sheep in 2 major areas on the range. One area (East Area) included 2 pastures (4,463 and 2,537 acres). The second area (West Area), 5 miles from the first area, also had



TYPICAL NEW FENCE SECTION

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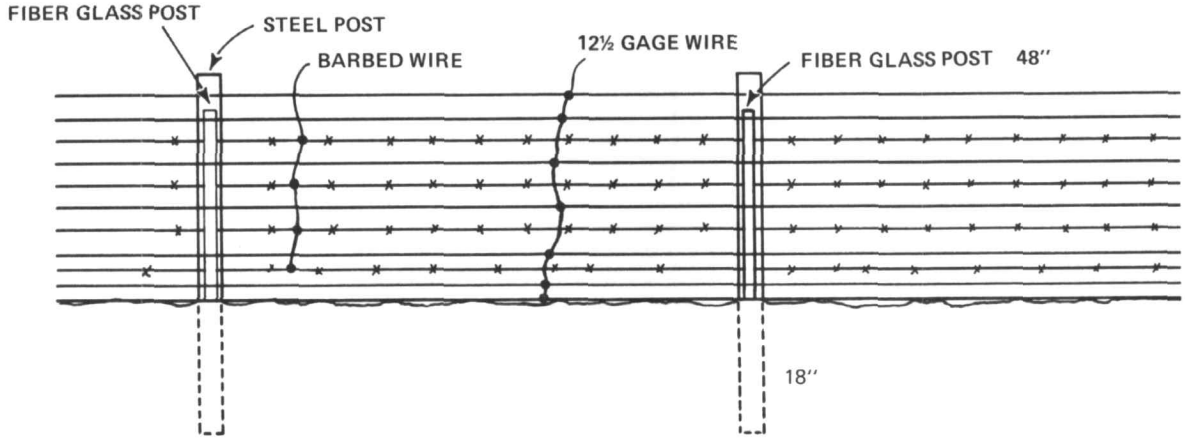

TYPICAL MODIFIED FENCE SECTION

NO SCALE

Specifications for new and modified electric anti-predator fence.

2 pastures (5,512 and 3,172 acres). The predominant vegetation in both areas was dense mesquite and tarbush, but part of the West Area was more open with mesa dropseed and desert forbs.

The large size of the pastures and the brushy vegetation made it extremely difficult to find and gather sheep for counting, weighing, and other activities. To aid in locating the sheep, 6 head were fitted with radio transmitter collars. The collars, an all terrain vehicle (ATV), and a stock herding dog facilitated gathering the sheep. We counted the sheep at least twice a week. It was virtually impossible to locate all of the dead sheep. However, we developed a practical approach to account for losses. We observed 3 important causes of loss: (1) woolly paperflower poisoning, (2) coyote predation, and (3) escaping from the pasture. Poisoning from paperflower was a cumulative condition, and the sheep characteristically had massive discharges of thick green mucus and labored breathing for several days before death. Poisoned sheep were noted and presumed dead from poisoning when they became missing. If sheep were unaccounted for, the ground around the perimeter fence, gates, and cattle guards was checked for tracks. If tracks were discovered, an estimate was made of the loss, and a search was made for the missing sheep. Usually the sheep were found and returned. However, in 2 instances sheep observed outside the pasture were not recovered. The straying losses all occurred at the

beginning of the study before fence deficiencies were fixed. Losses from woolly paperflower poisoning occurred in January, February, and March during the early vegetative growth of this forb. As the plant matured toxicity declined. Few losses occurred during April and virtually none from May through the remainder of summer and fall.

We found no evidence of predation during the first 44 days of the study, perhaps due to the unfamiliarity of the local coyotes with sheep as potential prey. No sheep had been kept in this area for over 50 years.

The first evidence of predation occurred in late March, 1983. Once predator-wounded sheep were observed, sudden and otherwise unaccountable disappearances of sheep increased markedly. The rate of predator verified or unaccounted for loss accelerated during April and early May in the East Area. Most coyote-inflicted wounds in nonfatally attacked sheep were to the upper part of the right hind leg. Ten ewes survived coyote attacks and were gathered with other sheep at times of counting or weighing. Eight of these sheep recovered. It is presumed that the sudden disappearances of sheep was due to predation if no earlier symptoms of illness or poisoning occurred and no escape from the pasture had been observed. The sheep were then moved to pastures in the West Area in an attempt to reduce predation. The loss dropped substantially and remained low through mid-October. However, 6 ewes were lost in 28 days (Oct. 13 to Nov. 10). Following this loss the sheep were moved frequently between areas in an attempt to reduce predation. During the next 92 days 32 ewes were either missing, maimed, or killed by coyotes. This completed a one calendar-year assessment of predator losses. Sixty-three ewes (44%) of the original 144 sheep managed on the range were estimated to have been killed by coyotes during the 12-month period of the study. Only 1 ewe out of 54 (2%) maintained in the drylot control group on alfalfa hay died during the same period.

Predation Associated with Different Electric Fence and Guardian Dog Management Strategies

The next step was to evaluate various predation control technqiues. An anti-predator electric fence was constructed around the East Area. Existing cattle fences in good condition were modified as shown on the lower half of Figure 1 in an effort to reduce cost. This area was split into 5 pastures varying from 600 to 2,000 acres in size. The pasture cross fences were not predator proofed. An attempt was made to remove coyotes from within the perimeter fence. During a 6-week period, 13 coyotes were either shot or trapped within the fenced area, yielding an estimated density of more than 1 coyote per square mile. Some coyotes apparently penetrated the electric fence not only during the coyote removal phase, but periodically thereafter. Knipe (1985) states that 4″ spacings are necessary up to 16″ from the surface of the ground to consistently prevent coyote penetration of the fence. Our fence had 4″ spacings only up to 12″ followed by 6″ spacings. This may have allowed some coyote access.

One hundred forty-four young Rambouillet type ewes 1 to 3 years of age were kept in close confinement with a spayed 2-year-old Great Pyrenees (Pyrenees) guard dog in a 0.1-acre enclosure in the East Area beginning on May 3, 1984 (Flock A). This (socialization) was done so that the sheep would learn to tolerate the close association of the dog and not scatter. After 6 days the sheep were divided into 2 groups

Princess with Rambouillet sheep on the Jornada Experimental range. Socialization of sheep to dog and cohabitation is critical to the protection of sheep from coyote predation.

of 72 ewes each and placed in adjoining pastures. The guard dog was placed with 1 group of sheep. However, the sheep were still only mildly tolerant of the presence of the dog. The dog wandered about within the electric fenced area spending more time with both groups of sheep. However, after a while she started leaving the enclosure (over the gate) and going to the ranch headquarters. Subsequent disciplining and refraining from feeding her at the ranch reduced, but did not eliminate, the problem.

Seventeen sheep were badly wounded by coyotes or disappeared during the 175-day period. A periodic effort was made to trap or call and shoot coyotes within the enclosure when this could be done with minimum hazard to the guard dogs. Two male and two female coyotes with blood on their heads were shot within the East Area.

On July 19, 1984, another study (flock A remained in the same location) was begun in the East Area. Fifty-three head of aged Rambouillet-type ewes (Flock B) were divided into 3 approximately equal groups and placed in 3 adjoining pastures. These sheep were on a nutritional supplement study and were weighed at monthly intervals. The weighing record was used as inventory to detect predation. Losses declined sharply in Flock A but were exceptionally heavy (105% annualized rate) in Flock B. Flock A was socialized and tolerant of the presence of the dog, whereas Flock B would not allow the dog to come near. The guard dog spent most of her time with the 2 socialized groups (flock A).

On October 25, 1984 a 3-year-old Akbash female guard dog which had previously been used for guarding sheep on the range was placed in the East Area with the Pyrenees. The dogs selected separate groups of sheep in different pastures and were seldom found together. However, there were 5 groups of sheep in 5 separate pastures and only 2 guard dogs so it was not possible to have a dog with each group. However, with the addition of one more guard dog there was some reduction in the annualized loss rate when compared to the rate loss with one guard dog.

On January 21, 1985 the 3-year-old female Akbash and an 8-month-old Akbash male were moved with 121 surviving sheep of Flock A to the West Area where a new anti-predator electric fence (4,000 acres) had been completed. By this time

Flock A had become very tolerant of the close association of the guard dogs. The Pyrenees and a second Akbash male guard dog were put with the surviving Flock B sheep maintained in 3 seperate pastures in the East Area.

Although only 8 months old, the Akbash male in the East Area was very mature in behavior. He sought out and remained with a group of sheep separate from the group the Pyrenees dog was with. In spite of the addition of another dog, losses continued to increase in the East Area until an extremely high rate (249% annualized) occurred during May, June, and July 1985. The losses occurred in only 1 of the 3 pastures at any one time, suggesting that coyotes were preying heavily on the group of sheep unattended by a dog.

By contrast, the single group of sheep moved to the West Area with 2 guard dogs experienced no predation loss for at least a 133-day period and only 1% loss over the total 233-day period. The only obvious difference in management was that there were 2 dogs with 1 consolidated flock of ewes in the West Area and 2 dogs with 3 sub-flocks of ewes in the East Area. Both areas appeared to be equally accessible to and subjected to predator coyotes. The West Area flock was well guarded, whereas it was physically impossible for 2 dogs to be with 3 widely separated sub-flocks of sheep at the same time in the East Area.

The loss in the West Area flock was similar to the loss rate in the drylot control group the year before (2%) which was not subject to predation. This contrasts with the loss of 29 of 53 ewes (74%) in the 3 groups of aged ewes maintained in the East Area during approximately the same period of time. These ewes did not become accustomed to the guard dogs and would run away whenever they would approach.

This study suggests 2 principles for successful protection of sheep by guard dogs: (1) Sheep must be well socialized and highly tolerant of the dogs so that they stay with the dogs and do not scatter (this was previously noted by McGraw and Blakesley 1982), and (2) at least 1 dog must cohabit with each group of sheep and leave them only for relatively brief, noncritical periods. Other studies (Green, et al. 1984, Green and Woodruff 1985) stress the importance of early socialization of dogs with sheep while they are young puppies (6–10 weeks of age).

One may tend to discount, in view of these results, the importance of electric fencing in predator control. However, we believe that the electric fence can complement guard dog performance. A properly installed and maintained electric fence will establish a well-defined perimeter to confine both guard dogs and sheep to specific territory. The guard dog often patrols and scent marks the fence line. The electric fence, the presence of the dog, his scent, sight and sound all serve as deterrents to penetration by coyotes. However, due to the low carrying capacity of these arid ranges (about 25 acres/sheep) it may not be economical for a commercial producer to construct electric fences on this type of range, since the cost of fencing material was about $64 per ewe. Adding this to the cost of labor and fence maintenance, and the relatively poor performance of the fence under the existing conditions, the best current alternative in our view would be a stable supply of proven guard dogs with highly dog-socialized sheep with good flocking instinct. Although our dogs performed well in a 1,500-acre pasture in the West Area, the experience of other observers suggests that guard dog performance is best in small pastures of 1,000 acres or less. Two or even 5 dogs per range flock would cost only a small fraction of the cost of constructing and maintaining an electric fence (Green et al. 1984). Further research is needed to establish the optimum number of dogs to protect flocks of various sizes under different types of range (rough or smooth terrain, brush or open rangeland, sparse or heavy vegetation, large or small pastures).

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Patagonia: Range Management at the End of the World

Guillermo E. Defossé and Ronald Robberecht

Cold, disagreeable winters, arid steppes with fierce winds at all seasons—mixed with a bit of mystery, romance, and adventure—is the image that arises in the minds of people when the word "Patagonia" is brought up. While many similarities in climate and vegetation exist between the semiarid lands of Patagonia and those of the western United States, as well as similarities in the early settlement of these regions, several key differences have led to contrasting philosophies in the management of their respective rangelands. In Argentine Patagonia, livestock breeding for high quality meat and wool to satisfy the demanding markets of Europe was foremost, and care for the land was secondary. In contrast, management of western United States rangelands has tended to emphasize appreciation of both livestock and vegetation. The cultural and ethnic backgrounds of the early settlers and the concentration of wealth, educational institutions, and political power in the Argentine capital, Buenos Aires, have played a major role in the development of Patagonia. This article examines some of the historical and cultural factors that have led to the development of these two divergent land-use philosophies and their effect on range management practices in the United States and Patagonia.

The Land

The Patagonian region of the Argentine Republic extends from the Colorado River in central Argentina to the Beagle Channel in the south and from the Cordillera de los Andes to the Atlantic Ocean. It covers an area of about 1 million km^2 or about 1/3 of the total land area of Argentina. The climate is generally dry, cold, and windy. Below-freezing temperatures can occur throughout the year, and annual precipitation varies from more than 4,000 mm in the Patagonian Andes to less than 150 mm in central plateau of Patagonia. Since only about 4.5% of Argentina's population of 30 million people inhabit the Patagonian region, this wide and expansive land is indeed sparsely populated.

Although vast uninhabited steppes create an impression of desolation for visitors, not all Patagonia is arid and semiarid. The Patagonian Andes, for instance, is a highly scenic region with majestic mountain peaks. Several national parks with lakes, forests, and glaciers of magnificent scenic beauty occur there. The city of Bariloche, the main skiing center of South America and considered by some to be one of the world's beautiful cities, is located in this Andean mountain range. Other popular tourist attractions of Patagonia include numerous indigenous animal species such as the rhea, guanaco, and mara; the marine mammal reserve at Península Valdés; and Usuahia, the southernmost city in the world.

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Argentina, like the United States, lies almost entirely in the temperate zone of the western hemisphere. Patagonia (hatched area) is a semiarid shrub steppe region, of which nearly 90% is rangeland. Comodoro Rivadavia is Patagonia's largest city, and is the center for commerce and industry in the region.

These notable scenic areas and cities may sometimes obscure the fact the the majority of Patagonia—nearly 90%—is rangeland. Forested land accounts for only about 10% of the Patagonian region, and irrigated valleys less than 1%. Patagonia is thus truly the rangeland region of Argentina. Vegetation throughout this vast cool semidesert/steppe zone consists mainly of tussock grasses (bunchgrasses referred to as *coirons*) intermixed with shrubs. Dominant grass genera include *Festuca, Poa, Stipa, Bromus*, and *Hordeum*, and the major shrub genera include *Nassauvia, Berberis, Mulinum, Adesmia*, and *Senecio*. The physiognomy, or overall appearance of Patagonian vegetation, is somewhat similar to that of many shrub steppe vegetation zones of the western United States rangelands. Soils of Patagonia vary from humic in the forests to alluvials and lithosolics in Patagonian tablelands. The article by Soriano (1983) is suggested for a detailed review of the climate, vegetation and soils of Patagonia.

Colonization

The coast of Patagonia was first explored in 1518 by members of the Magellan expedition. Prominent scientists and explorers such as Darwin, Ameghino, Musters, and Dusen mounted several significant expeditions of scientific

discovery to this region in the last century. Until the opening of the Panama Canal in 1914, the arduous journey around the South American continent by way of the Strait of Magellan was the only way to travel from the Atlantic to the Pacific Oceans by sea. Although there were many opportunities for settlement during this period, where coastal ports were used to resupply the ships, this region was apparently uninviting because of its cold climate and high winds.

It was not until 1865 that effective settlement of Patagonia was realized when a small group of Welsh immigrants established two settlements in northern Patagonia. The prosperous city of Puerto Madryn was established at the original landing site, and the city of Gaiman was established about 70 km to the south by the Chubut River. Within 25 years, other settlements were developed along the Chubut River. The Welsh colony developed sufficiently to support agricultural systems based on irrigation and a railroad to interconnect those settlements with the exporting port of Puerto Madryn. Additional settlements were also established on the foothills of the Andes, now the cities of Esquel and Trevelin. Immigrants from several other European countries followed later, and by the turn of the century the entire Patagonian region was fully explored. By 1920, ranches or *estancias* based on a sheep livestock industry as well as coastal meat packing factories and ports had been established.

Sheep raising is the main activity on Patagonian rangelands.

Development of a Sheep Livestock Industry

In the first decades of this century the Patagonian economy was based entirely on the sheep industry, which expanded vigorously. The importation of rams from Australia was a practice commonly used for improving the quality of Patagonia sheep herds, a practice that is still quite common. Despite the impetus for industrial and economic development of Patagonia that came in the early 1900's with the discovery of oil in the region, the economic base of Patagonia remained largely dependent on the sheep industry for meat and wool production. To put the prominence of Patagonia's livestock industry and the region's natural resources in perspective, the Patagonian rangelands since settlement have produced more than 5 billion kg of wool—enough wool to make a sweater for every human on earth today—, 15 billion kg of meat, and more than half the energy (oil, coal and hydroelectricity) that Argentina has consumed up to the present. Unfortunately, economic benefits to Patagonia were minimal because most of these resources were exported from the region to develop Buenos Aires and the surrounding humid pampas. In recent years depressed wool prices on international markets coupled with increased growth of new textile, aluminum, and fishing industries have caused the traditional and once powerful Patagonian sheep industry to decline in terms of gross income.

Range Management Practices

Today, range management in Patagonia primarily involves the raising of sheep for wool and meat production. Although cattle ranching along the Cordillera de los Andes is becoming an important industry, particularly in response to the

Vegetation deterioration and soil erosion are the main problems caused by overgrazing on Patagonian rangelands.

growing markets for beef in several coastal cities, it remains a relatively minor industry compared with sheep ranching. There are about 350,000 cattle in Patagonia, quite a small population relative to the 16 million sheep.

Sheep management has always been quite simple, with the herds maintained in the field yearlong. Animals may be moved between summer and winter ranges on ranches near the Andes in western Patagonia, though overstocking on both ranges tends to deteriorate the land in a similar manner as yearlong grazing (Soriano 1956b). Utilization of coastal valleys as winter ranges, which are milder in climate and closer to meat markets, is becoming quite common. A few ranching events are noteworthy: the *señalada* (counting of new lambs), *esquila* (sheep shearing), *pelada de ojos* shearing around the eyes), and *baño* (dip) against an ectodermic parasite called *sarna* (mange). In the estancias workers typically have the daily tasks of fence maintenance and searches for wounded or dead animals. Skin obtained from the dead animals provides an additional source of income.

Exhibitions of livestock, wool, and meat are held annually in towns throughout Patagonia—commercial and highly festive events called *La Rural.* Livestock improvements have earned the sheepherders of this region world-wide recognition for high quality wool and meat. This reputation has been known to swell the pride of the sheep breeders or *cabañeros.* Although several sheep breeds occur in Patagonia, only two are very important. Australian Merino sheep, renowned for their high quality wool, are generally raised in the arid areas of Patagonia because of their hardiness. In areas with semi-arid and colder climates, the Corriedale breed used for both wool and meat is commonly found. Some half-breed black faced sheep are raised in coastal valleys to produce lambs of excellent quality.

Improvements to the range are not common, and are certainly not encouraged by the relatively low sale price for wool. Although some estancias practice sound range management based on empirical observations, basic information on the Patagonian rangelands such as plant productivity, animal carrying capacity, range trend, range condition, and proper use are badly needed in order to design grazing systems based on ecological principles. This need for more information on range science, and especially the need for an organizational structure to guide and implement sound rangeland management, is magnified by rangelands that are, on the whole, in relatively poor condition.

Ethnic and Cultural Factors

Attitudes toward rangelands appear to have been greatly influenced by the land-use philosophy developed during the colonization of this region by European immigrants. As in the United States, Patagonia was settled by immigrants from many different European ethnic backgrounds. Welsh immigrant established farms along the Chubut River and in the foothills of the Patagonian Andes. The Scots, English, and Germans tended to be dedicated sheepherders, colonizing the arid steppes, constructing fences and sheep handling facilities in the estancias. People of Italian, Yugoslavian, Spanish, and Arab origin tended to settle in the cities and dominate commerce.

These ethnic and cultural influences lead to rangeland practices that focused primarily on the quality of livestock with little regard for the vegetation that supported the animals. The vast shrub steppe expanses of Patagonia appeared to these late nineteenth century European settlers as an inexhaustible resource for livestock production. This philosophy fostered little desire for the conservation of these *inexhaustible* rangelands. Low regard for the shrub steppe rangelands of Patagonia was reinforced by the establishment of agronomy and veterinary colleges north of this region near Buenos Aires, which, with little exception, tended to emphasize development of the humid pampas. The less productive lands of Patagonia, viewed as marginal for agriculture, were accorded slight consideration. The lack of interest and understanding of such *marginal* ecosystems inhibited the development of range science. Only recently has concern for more than just the animal and its performance become of general interest of Argentineans. Range science as a whole, then, has been a field nearly absent in Patagonia.

Festuca pallescens *grassland on the foothills of the Patagonian Andes.*

Woolfolk (1955) stated that English, Scottish, and Australian sheepmen carried to Patagonia their ways and habits of handling livestock. The vegetation of the new ecosystem they encountered was unfamiliar to them, thereby making it difficult to manage. These groups therefore focused on the more familiar and traditional ways of livestock breeding. In the words of Woolfolk, *"the knowledge of range vegetation and its management was not and still is not comparable with the general livestock handling and wool grading knowledge in the Argentine...".* This statement is true today, and even though the general improvement in herds quality is noteworthy, the condition of the range is today worse than 30 years ago.

Rangeland Research in Patagonia

In 1945, the young ecologist Alberto Soriano made the first observations of what could be called the *range approach* in this region. In a series of papers on Patagonia published between 1948 and 1956, Soriano implied that this region was an ecosystem essentially different in character from the agronomic humid pampas. Soriano stated that this "new" ecosystem should be managed ecologically, namely that secondary succession and not the production of new crops must be the dominant process utilized in range management. He suggested several ecological principles that should be followed to halt deterioration and improve the condition of the range, which by then was seriously threatened by

overgrazing. These included familiar concepts such as reduced stocking rates and deferred rotational grazing systems to allow secondary succession to proceed toward a climax community. While these recommendations seem quite reasonable to contemporary range scientists in the United States, one should remember that these views were formulated as early as 1945—and independently of the development of range science in the United States.

The series of articles by Soriano on Patagonian vegetation and its management were considered particularly significantly by Beetle (1954). In his review of the Argentine literature on range management, Beetle noted the lack of trained range extensionists in Patagonia. Furthermore, he perceived that thorough understanding of rangelands was hampered because almost all the botanists, taxonomists, plant geographers, and ecologists resided in Buenos Aires—far away from the rangelands of Patagonia. This impression was echoed by Woolfolk (1955) after visiting Argentina. Woolfolk was impressed with the excellence of Argentine ecologists and botanists, but recognized, as Beetle did, that most of those scientists lived in Buenos Aires and its surroundings. Woolfolk realized that development of range management required not only scientists with an appreciation and knowledge of the Patagonian ecosystem but also extensionists to transfer this knowledge to the rancher. He viewed this transfer of range research to the rancher as an indispensable step for the proper development and management of the range.

Range management curricula began to expand in universities throughout the western United States during the 1950's. This is in sharp contrast to the trend that occurred in Argentina during this period. Universities, centralized in Buenos Aires and La Plata, emphasized the agronomic and animal sciences. This fostered a production-oriented perspective of the rangeland, rather than one that was ecologically oriented. Agronomists and veterinarians educated at those institutions gave preference to improvements in livestock quality rather than to the ecology of the region. The results of these two different educational philosophies toward range management are clearly expressed in the present state of rangelands and range science in the United States and Argentina.

A considerable infrastructure has developed in the United States since the 1930's that guides the use, improvement and conservation of rangeland resources. Important in this infrastructure are the state and federal land agencies, university research and extension programs, ranchers, and concerned citizens. While there are often competing interests for the use of rangelands among these groups, management of rangelands in the United States tends toward a multiple-use approach. Although considerable scientific expertise in the agronomic and animal sciences does exist in Argentina, the consolidation of a national policy on management of rangelands as multiple-use resource has been slow to develop. The integration of such rangeland aspects as wildlife, vegetation management, conservation, and tourism with livestock production has yet to be achieved. The land-use philosphy still remains largely one oriented to the single-use purpose of animal production.

A substantial change toward Patagonian rangelands began around 1970, stemming from the noticeably deteriorated rangelands, a depressed sheep livestock industry, and renewed interest in Patagonia's oil and gas reserves. The general world-wide concern for environmental quality also affected governmental policies toward land use and conservation. Various research groups began to focus their attention on vegetation, wildlife, soils, and environmental aspects of Patagonia. This change in attitude was reinforced by the creation of the *Centro Nacional Patagonico* in the city of Puerto Madryn. This research center, a branch of the National Research Council of Argentina (CONICET), has one program exclusively devoted to the development of arid and semiarid areas. Other research groups sponsored by the CONICET, the National Institute of Agricultural Technologies (INTA), and various state agencies initiated programs for collection of basic scientific information on soils, wildlife and vegetation. These programs were aimed at closing the gap in information that existed since the significant papers by Soriano in the late 1940's and 1950's. These procedures should lead to considerable improvements in the management of Patagonia's rangelands.

It is an appropriate time for Argentina to join the international community of range scientists. Local and national professional socieites for range management, perhaps eventually to be affiliated with the international Society for Range Management, are needed to develop the scientific and governmental infrastructure necessary to halt rangeland deterioration and promote proper multiple-use land management. Support for improvement of rangelands should be cultivated among scientists, teachers, extensionists, ranchers, wildland recreationists and concerned citizens to forge a group that will influence the future of rangelands of this vast, mysterious and visually exciting land known as Patagonia.

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Tamarix: Impacts of a Successful Weed

Jack D. Brotherson and Dean Field

Saltcedar (*Tamarix* sp.) is an introduced shrub and phreatophyte of western North America where it occupies in excess of one and one-half million acres (Robinson 1965). It is a vigorous, woody invader of moist pastures, rangelands, and riparian habitats; it is poor in forage value and, as a weed, it is continually causing management problems.

Originally thought to have been introduced by the Spaniards, it is now believed that the first introduction of saltcedar to North America was made by nurserymen on the east coast of the United States in 1823. In 1828, Bartram's nursery of Philadelphia was selling saltcedar and in 1868, the U.S. Department of Agriculture began raising saltcedar and reported that six different species were growing in the Department Arboretum (Horton 1964).

Although saltcedar was planted as an ornamental in the western United States during the latter half of the 1800's, it apparently did not escape cultivation until the 1870's. The only accurate information concerning its escape is found in herbarium collections. Little attention was paid to the increasing spread of saltcedar for the next several decades, and there is no record that anyone was aware that a problem was in the making. For example, in the early 1900's farmers were using this plant for erosion control (Everett 1980). However, it became clear by the 1920's that saltcedar was becoming a serious problem for it was spreading rapidly from one watershed to another.

During this time, early pioneers throughout the Southwest and in the Colorado River Basin began to populate preferred areas along the various waterways. The native woody plants along these rivers and flood plains were harvested for building materials and fuel, as well as cut to allow for agricultural development and subsequent overgrazing (Horton and Campbell 1974). Later in the early 1900's, these same lands were left barren because of upstream water use, damming, and the abandonment of tilled land during the Great Depression. Increasing soil salinity also contributed to the decline of the indigenous riparian forests (Engel-Wilson and Ohmart 1978).

Saltcedar's ability to colonize riparian areas (Figure 1) rapidly as well as accommodate wide variation in its environment has led to its being classified as a troublesome weed. The characteristics of saltcedar that have enabled river bank and shoreline dominance are numerous. Baker (1974) developed a list of characteristics that is evidenced in "the ideal weed." He indicated there are no species which fill all of the categories; instead, the greater the number of weed-like characteristics combined in a single species, the more serious a weed the plant should be. Saltcedar as a species combines 9 of his 12 characteristics (Table 1). To Baker's 9 we have added 4 additional characteristics (Table 1) that appear equally important to saltcedar's success as a weed.

Foremost, saltcedar has the capacity to produce enormous numbers of seed during an extended production season of late May to October. One mature saltcedar plant can produce up to 500,000 seeds per season. The tiny seeds have high viability and long hairs allowing for wind distribution, but may also be carried and deposited along sandbars and riverbanks by water (Tomanek and Ziegler 1960).

Table 1. Characteristics of saltcedar which contribute to its success as a weed. The (*) corresponds to Baker's (1974) criteria of the ideal weed.

*1. Continuous seed production for as long as growing season permits.
*2. Cross-pollination by the wind.
*3. Self-compatible when cross-pollination unavailable.
*4. High seed output in favorable environmental circumstances.
*5. Ability to produce seed under a wide range of environmental conditions.
*6. Adapted for long or short range dispersal.
*7. Vigorous vegetative reproduction capability.
*8. Brittleness in its stems and not easily drawn from the ground.
*9. Competes interspecifically by allelochemics due to presence of salt-glands.
10. Capability for tolerating extreme range of environmental conditions.
11. Vigorous root sprouter following fire.
12. "Facultative phreatophyte" due to ability to live totally inundated or in total absence of saturated soils.
13. Difficult to control with foliar chemicals.

Fig. 1. *Established stands of saltcedar along the floodplain of the Virgin river in southern Nevada.*

Observations in the field indicate saltcedar seedling establishment most often occurs when soils are seasonally saturated at the surface such as where water has recently

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Fig. 2. *Young saltcedar plants which have recently established where flood water has receded.*

receded from flood or seasonal high water levels (Figure 2). Once established, the primary root of saltcedar grows steadily downward with little branching until it reaches the water table. Secondary branching of the root becomes profuse upon contact with the water (Tomanek and Ziegler 1960). The primary root of a tree in one study (Merkel and Hopkins 1957) was followed to a depth of 16 feet, where it was 3/16 inch in diameter and still descending. The water table, in this case, was located at a depth of 26 feet. Upon establishment, saltcedar rapidly dominates an area, forming dense stands (Figure 3). Mature plants reproduce vegetatively, by adventitious roots or by seed. Its extensive lateral root system plus its habit of dripping salt onto the soil beneath its canopy make it competitive with other vegetation for space and water and, therefore, restricts competitive undergrowth.

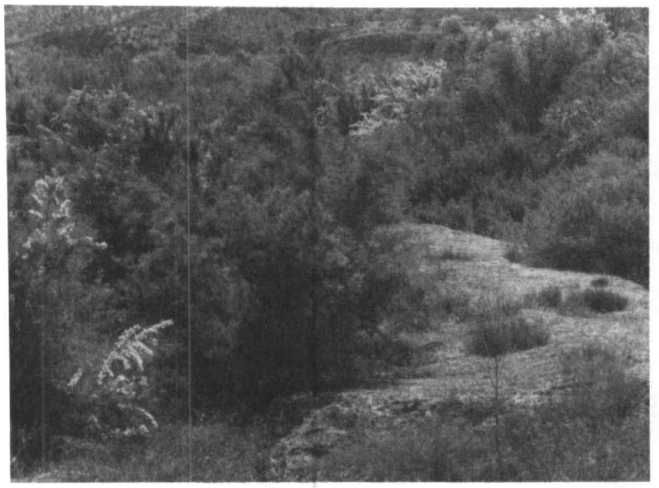

Fig. 3. *Dense stands of saltcedar along the floodplain of the Virgin river. Plants in foreground are in bloom.*

Only xeric species (plants requiring little water) or halophytes (salt-tolerant species) can tolerate the understory environment of saltcedar (Brotherson et al. 1984).

Saltcedar is also extremely adaptable and tolerant of a wide range of environmental conditions: (1) It prefers to grow in very saline soils (up to 15,000 ppm sodium) (Carmen and Brotherson 1982); (2) it can withstand inundation, which frequently occurs in its environment for long periods of time (70–90 days); (3) it can vegetatively resprout after fire, severe flood, or treatment with herbicides (Warren and Turner 1975); and it is able to accommodate wide variations in soil and mineral gradients in its environment (Brotherson and Winkel 1986).

The problems that are associated with saltcedar when found in dense stands are of major concern to resource managers. First, saltcedar has been labeled an "extreme phreatophyte" because of its ability to exploit deep water tables. However, once established, it can survive almost indefinitely in the absence of surface saturation of the soil (Everitt 1980). Among phreatophytes, saltcedar has very high transpiration rates. In one experiment, saltcedar transpired from 0.1 inch to 0.4 inch of water per day and from 4 ft to 13 ft of water per year (Davenport et al. 1982). Robinson (1965) showed that saltcedar in the Safford and Gila River valleys of Arizona used between 4 and 5 acre feet of water per acre per year. Along the Colorado River it has been estimated that up to 568,000 acre feet of water are lost per year to channel vegetation of which saltcedar is a major component (Van Hylckama 1976).

Following are some figures which give an estimated value of the water being lost because of saltcedar invasion. Agriculture uses approximately 177,000 acre feet of water per year from the Bonneville Unit of the Central Utah Water Project at a cost of $50 per acre foot. Another 91,000 acre feet of water are used annually for culinary purposes, at $200 per acre foot. Therefore, a total of 261,000 acre feet of water worth almost $27,000,000 is used annually from these projects. Robinson (1965) estimates that one acre of saltcedar consumes 4 to 5 acre feet of water per year which would be worth $200 to $1,000 per acre annually.

A second major problem created by saltcedar is the narrowing of river channels. The saltcedar slows the river flow,

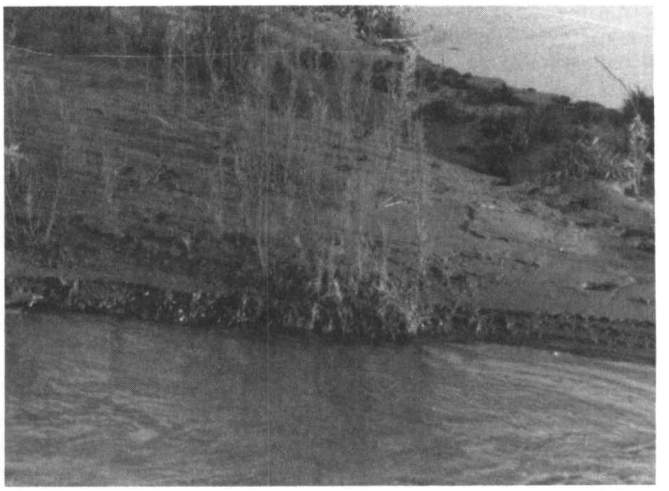

Fig. 4. *Saltcedar seedling establishment on sandbar of Virgin river following spring flooding.*

which increases deposition. When this occurs a number of times at high water, sediments build along the river bank. As the river recedes, saltcedar establishes itself further out into the channel (Figure 4). At the next high water event, more sedimentation occurs further narrowing the channel. This process continues until streamflow is severely reduced. On

the Brazos River, in Texas, this trend has continued for over 40 years resulting in the river's width being reduced by up to 71% in some places (Blackburn et al. 1982). Similar problems have also occurred on the Salt and Gila Rivrs near Phoenix, Arizona (Graf 1980).

Saltcedar also effects local bird communities. In comparing the number of birds in native cottonwood, willow, mesquite and saltcedar stands, saltcedar was consistently more depauperate (Cohan et al. 1978). Doves and other granivores or ground-feeding birds were found to nest in saltcedar but forage in nearby agricultural fields. Other avian frugivores and insectivores tended to avoid saltcedar altogether.

Despite its many problems, saltcedar has some beneficial characteristics. It can tolerate harsh environments and has become established because of disturbances created in the riparian forests and thickets along riverbanks and flood plains. Saltcedar now provides some form of erosion control and wildlife habitat in riparian areas. Saltcedar's extensive root system is definitely more stable and resistant to erosion than the area was prior to colonization. The channel stabilization and increased sediment deposition reduces sedimentation of reservoirs further downstream. Saltcedar is also one of the few plants that can colonize and stabilize extremely saline soils (Campbell 1970).

In areas where saltcedar is a problem, it would be beneficial to have an effective control method. Several have been employed, including flooding, mechanical removal by cutting or shredding, biological control, burning and herbicides (Stott et al. 1982). Mechanical control by cutting or shredding serves only to break down the plant's brittle stems leaving the root system to vigorously resprout. The most successful control methods employed have been burning in combination with herbicides and/or root plowing in combination with herbicides (Howard et al. 1983). These methods were found to be from 85% to 100% effective. The success of root plowing in combination with herbicides is related to the fact that once saltcedar's roots are severed by a root plow, it must obtain water and nutrients from above the cut line. By placing the herbicide into the altered rooting zone, herbicide uptake is increased to lethal levels. However, this type of treatment, which is difficult and expensive, is limited in many areas because of terrain (Hollingsworth et al. 1979).

In reviewing the challenges of managing saltcedar, there appear to be no universal solutions. Each infested area has unique problems, sometimes the most pressing being flood control. In other situations, water conservation, wildlife habitat, beautification, alone or in combination with recreation, are the primary needs. In each case, something different may be required. Cost and various environmental considerations will determine the control method finally chosen. It is the author's opinion that saltcedar's invasion and ecological impacts have not received adequate attention. Inadequate information will continue to handicap control programs until the cost of the water and nuisance of floods becomes great enough to arouse the public as well as state and federal governments.

Available information demonstrates the need for better management of saltcedar along our waterways. Riparian zones are highly valuable resources, especially in the Southwest, and they should be managed wisely. Management of saltcedar has proved to be difficult and expensive. A firm commitment must be made concerning the control of saltcedar because of its unparralleled aggressiveness.

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Sagehen Exclosure: A History of Bitterbrush Reproduction

Robert R. Kindschy

Built in 1939, through the joint efforts of the Grazing Service and the Civilian Conservation Corps, the 15-acre Sagehen Exclosure, 10 miles SW of Jordan Valley, Oregon, was intended to enhance habitat for sage grouse. It may have been successful in this respect for a few years, but the accumulation of vegetation plus successional advancement had made the site entirely unsuitable for these birds by 1962, when the writer first examined it. What had happened, though, was of considerable interest. Bitterbrush *(Purshia tridentata)* had become a major shrub component within the 7-strand barbed wire area while none was noted outside the fence (Fig. 1).

Fig. 1. *Young bitterbrush was restricted to the interior of the Sagehen Exclosure in 1962.*

Bitterbrush is one of the more valuable browse forages for both livestock and big game animals in the Great Basin area. Habitat managers have often observed and expressed concern that little reproduction occurs. Most stands tend to be of older, often even-aged, plants. The Sagehen exclosure tells a story that could shed some light on the reproductive ecology of bitterbrush in southeastern Oregon.

Aerial photographs from 1954 and 1967 were available for the area. The exclosure site was evident on both, which enabled copying with a macro-lens. The resultant prints showed the darker bitterbrush plants quite well. These prints documented that the increase in bitterbrush was restricted to the protected exclosure. Obviously the grazing system of the surrounding range at that time was not conducive to the establishment of bitterbrush.

The local management records disclosed that season-long grazing with cattle, a cow/calf operation, had been in effect until the mid 1960's. Grazing normally commenced about the first of April and continued until late October. About 1965, a 4-year, 4-pasture rotation grazing system was established. Eash pasture had a different season of use each of the four years. In the late 70's it was decided that there was insufficient perennial bunchgrass present in the pasture containing the exclosure to warrant management for an increase in bunchgrass. In 1980, spring grazing was initiated in this pasture where cheatgrass and Sandberg's bluegrass were the predominant grasses. Cattle grazed from April until the last of May and then were rotated among the three remaining pastures which contained good stands of desirable bunchgrass.

The stage was set for some remarkable changes in the vegetation outside the exclosure. The cattle foraged on the lush, green spring growth of Sandberg's bluegrass, cheatgrass, and forbs. Palatable shrubs, such as bitterbrush, were bypassed. In 1983, impressive stands of seedling bitterbrush were noted outside the exclosure with lesser amounts of seedlings inside the exclosure. Grazing system change was only partially responsible for the sudden proliferation of bitterbrush, for no cattle use had occurred within the exclosure since 1939.

Short-term changes in annual precipitation amounts were suspect. Weather records from the nearby Danner weather station showed that one of the most severe droughts in recent times had occurred in 1977. The following years, 1978 through 1984, were exceptionally moist (Fig. 2).

During 1984, belt transects 500 feet long and 3 feet wide were run both within and without the exclosure. This allowed a more detailed comparison of the bitterbrush reproduction. Within the exclosure 18 mature, 7 young, and no seedling bitterbrush were encountered. Outside the area, 6 mature, 25 young, and 3 seedlings were tallied. Thus there were 4 times the number of seedling and young bitterbrush plants outside the exclosure compared to inside. Aging through annual ring counts using a hand lens revealed that the young plants ranged from 2 to 6 years; however, the majority (40%) of the plants were 4 years of age. Young plants were similar in height and crown width between the two populations (Fig. 3).

Two factors, livestock grazing and weather, appear to have interacted to enable the expansion of bitterbrush into potentially suitable habitat. The lesser extent of reproduction within the exclosure was most likely due to the excessive competition from well-established perennial vegetation. It was, in fact, already fully stocked with climax species including bitterbrush, sagebrush, bluebunch wheatgrass, and Idaho fescue (Fig. 4).

The two observed reproductive events of bitterbrush at the Sagehen Exclosure site suggest that major reproduction of bitterbrush through seedling establishment occurs only when both weather and seedbed conditions are favorable. The initial population of bitterbrush became established

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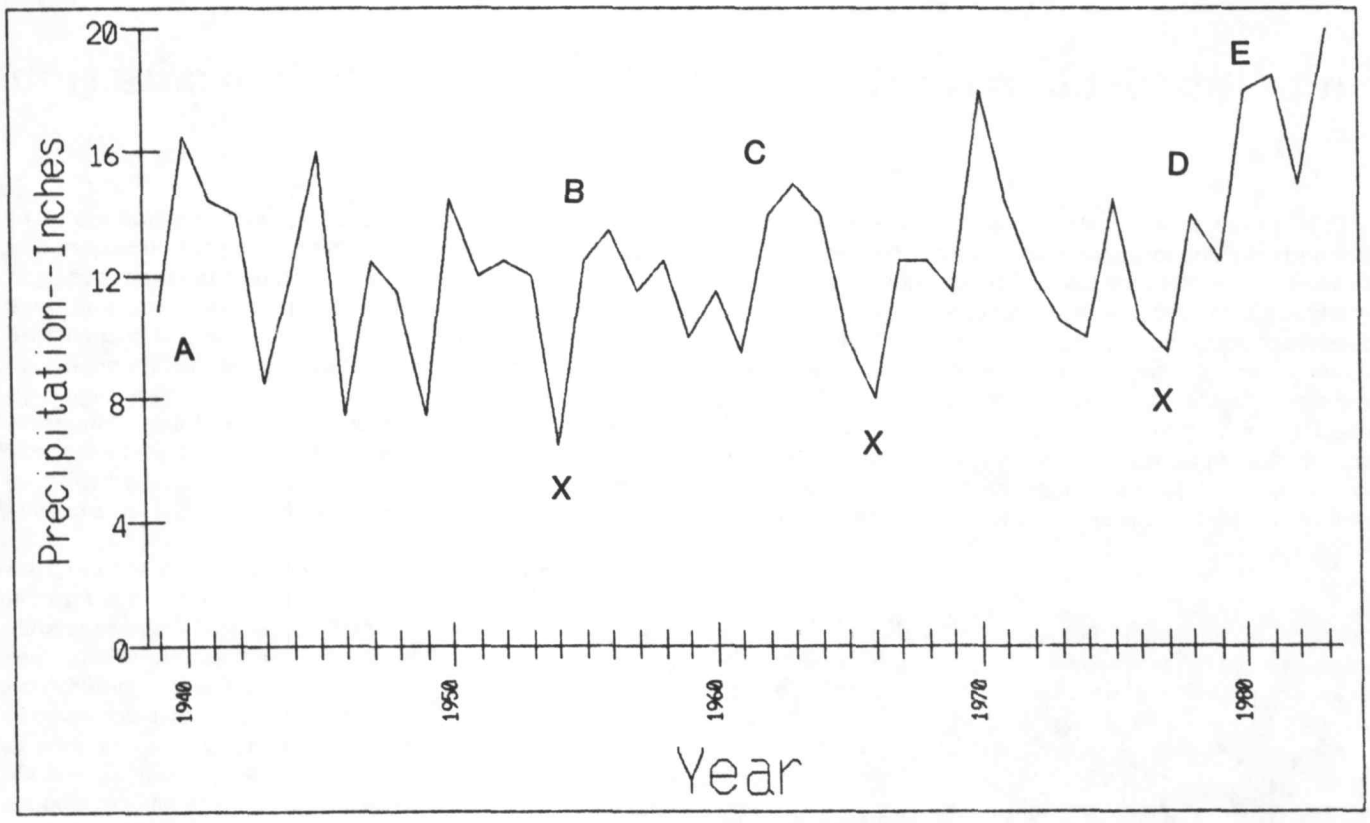

Fig. 2. *Annual precipitation at the Danner, Oregon, weather station: 1939-1983.*

Fig. 3. *In 1984, young bitterbrush outside the exclosure averaged 21 inches tall and 4 years of age. Bitterbrush reproduction was 4 times more frequent outside the exclosure than within.*

Fig. 4. *Bitterbrush within the Sagehen Exclosure in 1985 was typically mature and stagnant after 45 years of protection from livestock use. The site was nearly fully stocked with climax perennial plants. Bitterbrush reproduction was only 25% of that outside the exclosure.*

within the exclosure following severe drought and grazing conditions of the 1930's. Subsequent spread of this browse species to areas outside the exclosure followed a similar pattern after the 1977 drought and a major change in the livestock grazing system.

Survival of seedlings requires continued favorable weather and low utilization levels from herbivores such as deer, rodents, and domestic livestock. Rarely, perhaps at 20 to 40-year intervals for a specific site, does such a combination of environmental factors occur. Resultant stands of bitterbrush tend to be even-aged with little subsequent reproduction—until the next favorable cycle.

Managing Southern Grazing Ecosystems with Fire

Dale D. Wade and Clifford E. Lewis

The use of fire to manage the movement of animals undoubtedly predates their domestication. Stewart (1965) has traced the recorded use of fire as a range management tool back to 500 BC in Africa. Across the Atlantic in the Southeastern United States, fire also has a long and varied history. Here, the vast, open longleaf pine forests had long been in dynamic equilibrium with their environment, shaped first by lightning fires and then additionally by Indian fires. Numerous early European explorers documented the Indians' widespread use of fire for such purposes as the stimulation of early-season grass growth to attract game.

Spaniards brought the first cows to Florida in the early 1500's and before long, cattle were found throughout the Deep South. Early settlers in this region were predominantly farmers and herdsmen. Their wealth was measured by their herds and not by land ownership. The southern Coastal Plain was open range—cattle were fenced out, not in. Fire was the primary range management tool and the settlers used it much as they had on their fathers' farms in Great Britain and Spain. These frequent low-intensity fires stimulated a lush growth of grass which was higher in nutrients and more palatable than the coarse grasses of the unburned range (Fig. 1). In fact, ca. 1731 a North Carolina law required the burning of all pastures and rangelands every March (Hardison 1976). Without fire every few years, the grazing resource under the parklike forests of fire-resistant longleaf pine deteriorated.

This somewhat idyllic way of life came to an abrupt end as our country changed from an agricultural to an industrial base and timber became a valuable commodity. Large-scale turpentining and logging of the southern pinery began the decade before the turn of this century and within 30 years the virgin longleaf pine forests were gone. Without the competing overstory, the range resource became even more productive as long as it was frequently burned, which allowed a corresponding increase in livestock numbers.

By the mid-1920's, large cutover tracts were already in the hands of farsighted absentee landowners who wanted to reforest them. Several fire-free years were required to establish a well-stocked stand and fencing was desirable to keep feral hogs from rooting up the seedlings for their tender roots. Some owners attempted complete fire exclusion to maximize timber productivity. These actions were seen by the rural southerner as threats to his very survival! He was not interested in someone else's future profits—he needed the continued use of this land as open range for his livestock. A bitter and often violent struggle ensued but eventually the South's second forest took hold. Fence laws were passed in most states and the ubiquitous practice of burning adjacent land holdings was outlawed. Dense forests of faster growing loblolly pine and slash pine replaced the former open long-

A paper presented at the 1985 American Advanacement of Science Annual Meeting held in Los Angeles, Calif., on May 26–31, 1985. Authors are, respectively, research forester, Southeastern Forest Experiment Station, Forest Service, USDA, Southern Forest Fire Laboratory, Dry Branch, Ga., and range scientist, University of Florida, Gainesville.

Fig. 1. *Southern piney woods kept brush-free and relatively open by frequent burning provide ample forage for cattle and wildlife.*

Fig. 2. *Low intensity backfires are used to improve cattle forage, wildlife habitat and timber yields. Regular burning can eliminate fuels that contribute to devastating wildfires.*

leaf stands.

Where do these dramatic changes in the southern grazing scene leave today's range manager? Perhaps not as bad off as one might first envision. Early cattle "management" was little more than survival of the fittest, and only the toughest survived. Hot humid summers, winters with little nutritious forage, and occasional severe drought were particularly hard on calves. Over the years, improved cattle breeds, supplemental feed, improved pastures, and a more scientific approach to cattle management had a very positive impact on cattle production.

Eventually, most forest landowners found complete fire exclusion was neither cost effective nor desirable since the potential fire damage from accumulating fuels increased as the fire-free interval increased. The resistance to the planned use of fire remained strong, especially among State and Federal agencies. Research results were emerging, however, that demonstrated the benefits of intentional fire—now called prescribed burning. Many of the purported damaging effects ascribed to the use of low-intensity prescribed fire were found to be overstated or just not true (Fig. 2). This is not to say prescribed fire is a panacea, but the benefits from the judicious use of fire far outweigh the disadvantages. And just as today's forests are often managed for multiple uses, prescribed fire can often satisfy multiple objectives. In fact, fire can simultaneously enhance range, wildlife, and timber management objectives to the extent that the net economic return from multiple use will be greater than if managed exclusively for a single resource.

Forage Types

The major range ecosystems of the South have been classified according to the forest overstory and/or available forage resource (Fig. 3). Salt-water and fresh-water marsh

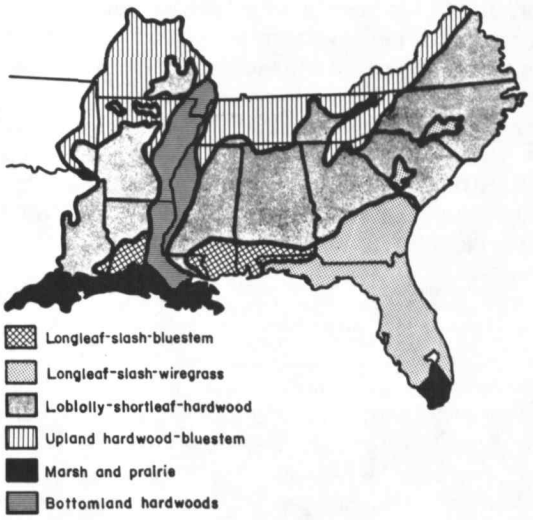

Fig. 3. *Major range types in the southern United States.*

ranges are the most productive per unit area. Since a primary benefit from burning is increased solar energy that reaches the forage-producing stratum, the greatest response to fire occurs in these marsh ranges where the most light-intercepting vegetation accumulates. Salt-water marshes are, however, difficult to effectively graze.

The longleaf-slash pine-bluestem range is also an excellent producer of high-quality forage. The longleaf-slash pine-wiregrass range produces slightly less forage of somewhat lower quality. Although overstory crown canopy can vary from 0–100 percent in any timber type, natural stands of longleaf-slash pine are comparatively open, often because of past management practices. However, central and south Florida are the only locations where extensive sparse stands can still be found. Timber production is the primary objective throughout the remainder of the longleaf-slash pine belt with plantations being the norm. In these stands, grazing is generally limited to the first 8 to 12 years, after which time the tree canopies close and the herbaceous species are shaded

out. Later thinnings may permit a grazable forage resource to again develop.

The loblolly-shortleaf pine-hardwood range (sometimes called the loblolly-shortleaf pine-bluestem range) is the most extensive type in the South. In natural stands, pine overstory and midstory hardwoods are often so dense that little understory vegetation is present and few opportunities exist to increase forage production. If larger hardwoods are not present, however, periodic fire can hold the smaller hardwoods in check and result in moderately abundant forage, especially when used in conjunction with thinning. In plantations, hardwood competition is usually temporarily set back before planting so these stands provide fair grazing until the hardwood sprouts shade out the herbaceous species after 3 to 5 years.

The upland hardwood-bluestem range provides little forage except in open glades because of the usually dense hardwood canopy. Fire is rarely compatible with timber management objectives in these stands because most hardwoods are susceptible to bole damage from even low-intensity fires.

The bottom-land hardwood type that occurs along major river drainages is not considered to be grazable. Prescribed fire has no place in the management of these hardwoods either. Detailed descriptions and primary species in these range types can be found in Lewis et al. (1974).

Plant Growth

Annual forage yields can reach 8,000 pounds per acre (ovendry) in salt- or fresh-water marshes, 3,000 pounds in open longleaf-slash pineland, or practically zero under densely planted pine stands. The effect of fire on promoting and maintaining high forage yields is virtually always positive but differs by range type, plant species, and various fire-related characteristics such as timing and behavior. Accumulations of inedible grass, dead thatch, and pine litter that physically obstruct plant growth can be removed by fire. Burning can also stimulate new growth and seed production of desired forage species and change species composition, while controlling the hardwood and shrub component. Fires need to be repeated every 2 to 4 years or forage production will return to preburn levels. The season of burn can also have a profound effect. After 20 years of various burning treatments, Lewis and Harshbarger (1976) found annual winter fires in loblolly-shortleaf-bluestem range yielded 23 times more forage than unburned control plots (Fig. 4). Since herbage weights were not sampled before the summer burns (about July 1) and the current-year's growth was consumed by the fires, total yields as estimated from October clipping were much higher than indicated.

Summer burns are probably best from a range management perspective but, since most southern pine ecosystems are also managed for timber and wildlife production, the effects of fire on these resources also have to be considered. For example, burning favors legumes which are a major source of seed for several wildlife species including the northern bobwhite; annual or 2-year burning rotations are generally used, with the burns completed before the spring nesting season. Fire improves hunting conditions and hunter success, particularly in respect to quail, by knocking back the understory shrubs and hardwoods to facilitate travel and provide for a clear shot. Prescribed burning increases the

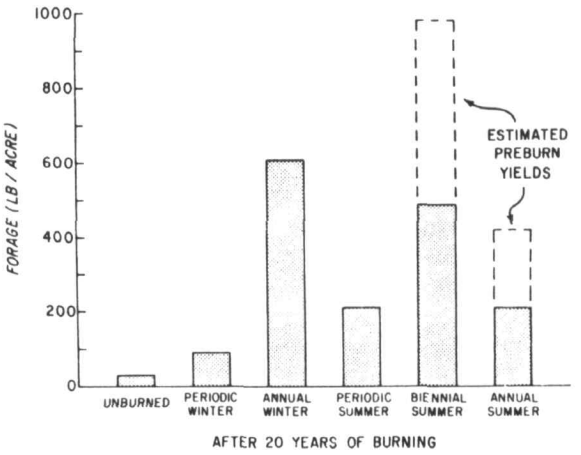

Fig. 4. *Annual yields of forage as influenced by 20 years of seasonal and cyclic burning in South Carolina (adapted from Lewis and Harshbarger 1976).*

density and biomass of arthropods, a major food item in the diet of baby quail, and is thus important in determining chick survival.

Under some situations fire increases the growth of timber trees (Johansen 1975; Villarrubia & Chambers 1978)—perhaps by reducing the competition for water and nutrients and by recycling nutrients locked up in the vegetation. Grelen (1983) found that May burns accelerated longleaf pine height growth, but this is a two-edged sword because faster height-growth means quicker crown closure and thus less sunlight reaching the forage layer. Fortunately longleaf pine maintains a more open crown than other southern pines and thus allows more sunlight penetration. Although summer fires are very effective in controlling understory shrubs and hardwoods, fires under high ambient air temperatures are also more likely to damage overstory pine crowns. Prescribed fires also keep dead fuels from accumulating, thereby reducing the damage from chance wildfires during more critical burning conditions. A combination of grazing and prescribed burning in young southern pine plantations is an excellent method of reducing the wildfire hazard during vulnerable periods when the tree crowns are still part of, or just above, the understory.

Forage Value

Forage quality on southern pine ranges is a major concern because plants growing on the infertile soils characteristic of these forest types are generally deficient in both energy and nutrients required for good animal growth, especially for breeding herds (Campbell et al. 1954, Hilmon and Lewis 1962). Also, many forage plants, especially wiregrass, are low in digestibility. As plants age, their lignin content increases, which depresses digestibility. Burning is widely used to improve the nutrient content and palatability of herbage; but these benefits are short lived, disappearing within a year or so.

Cattle seem to detect the more nutritious plants and thereby maintain a fairly adequate diet by selective grazing. The availability of succulent new growth appears to be the primary factor determining when a particular plant is grazed. Since green forage can develop soon after burning, well-timed fires can be used to provide quality forage during

seasons when there would otherwise be none. Furthermore, nutrients are higher in plants previously grazed than in ungrazed plants, and cattle prefer such regrowth to older herbage.

Because cattle tend to concentrate grazing on fresh burns and on areas recently site prepared and planted to pines, they can overgraze them and do considerable damage if not closely monitored. However, nearby sites can be burned to attract animals away from sensitive areas thereby preventing excess injury and achieving better distribution of livestock over the range. Heavy grazing in young pine plantations can also result in severe tree damage, but injury must be quite severe to greatly affect pine survival and growth (Hughes 1976, Lewis 1980). However, if cattle numbers are kept in balance with forage yields, young pines and cattle are compatible (Pearson et al. 1971).

Cattle Responses

The combined benefit from burning to increase forage quantity, quality, and availability is reflected in cattle weight gains. Halls et al. (1952) found that cattle gains on low-quality pine-wire grass range in Georgia were consistently better on burned range regardless of whether it was all burned annually or if portions were burned every 2 or 3 years (Fig. 5). Kirk et al. (1974) reported similar gains on burned

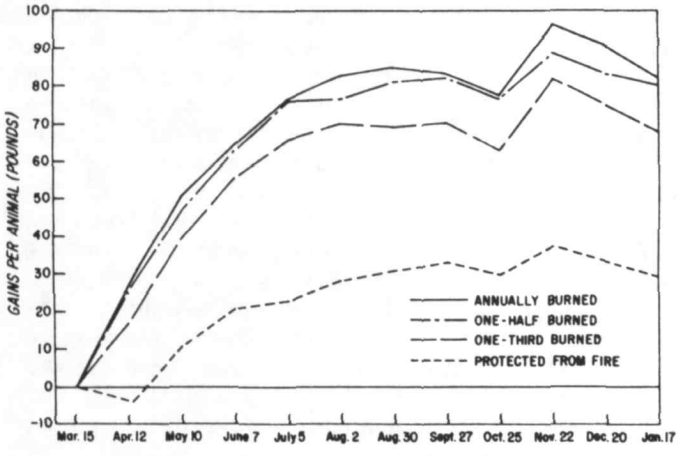

Fig. 5. *Average cumulative seasonal gains over 7 years under different burning programs in south Georgia (from Halls et al. 1952).*

versus unburned native Florida range. On longleaf-slash pine-bluestem range, Wahlenberg (1937) reported that over a period of 11 years, cattle that grazed annually burned range gained almost two-thirds more per season than those on unburned range.

As one might expect, herbage utilization is greatest the first growing season following burning. Utilization then decreases to less than 20 percent after 3 years on longleaf pine-bluestem ranges (Duvall and Whitaker 1964).

A 3-year burning cycle is common on pine-bluestem range, but pine-wiregrass range is burned on 1-, 2-, or 3-year cycles depending on whether the primary interest is quail, cattle, or deer and turkey management. A 2- to 4-year burning cycle is near optimum for timber management needs, such as hazard reduction and control of understory hardwoods; therefore, burning for other resource needs will enhance timber management.

Because integrated resource management is possible does not guarantee that it is financially attractive. Managing for a single resource is easier than trying to mix management objectives and techniques for multiple-use management. Each of the resources must be carefully managed to derive a combined net benefit. Because of the myriad possibilities, economic evaluations are difficult, yet they must be made. Several analyses utilizing combinations of native range, pastures, and timber alternatives have been undertaken (Anderson and Hipp 1974, Lundgren et al. 1983, Haney 1980). All showed positive results under some combinations especially when the forage resource was primarily range. Wildlife benefits have yet to be incorporated into such an analysis; but the results should be favorable, especially in light of the high prices people currently pay for hunting rights on well-managed forest land.

Conclusions

Managing wildland for the simultaneous production of cattle, wildlife, and timber requires a knowledge of the complex interactions involved. Serious conflicts can arise. However, opportunities are there, and the goals of foresters, ranchers, and wildlife biologists can be woven together through the judicious use of prescribed fire to produce increased returns for all three.

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Plant Succession on Prescribed Burn Sites in Chamise Chaparral

Melanie Florence

California chaparral species evolved under a regime of natural (lightning) fire occurring during the hot, dry summer months. As a result, chaparral vegetation is dependent upon fire occurring optimally every 30 to 60 years to rejuvenate itself (Biswell 1979). With wildfire suppression during the twentieth century, this natural fire cycle has been interrupted in many chaparral areas. Large acreages of chaparral now exist with a continuous cover of decadent brush containing large amounts of dead material. A wildfire in one of these areas could burn with high intensity over thousands of acres causing severe environmental damage and site degradation. Prescribed burning is a method which can be used to break up continuous brushfields and reduce unnaturally high accumulations of fuel, to improve wildlife habitat and to improve rangelands.

Prescribed burning is one of the most cost effective and ecologically acceptable solutions to managing California chaparral (Biswell 1980, Koenigs 1980). Its use is becoming more widespread each year with burns during the cool months of the year. Since chaparral species have naturally burned during the hot, dry months, many people have expressed apprehensions about cool-season prescribed burning and its effect on native species.

The response of herbaceous species after cool season fires was studied on several prescribed burn sites at Pinnacles National Monument in the central California coast range. Three chamise chaparral sites on south-facing slopes were burned using a driptorch in 1981 during the winter (February 19, 1981), early spring (April 28, 1981) and late spring (June 2, 1981). The sites were studied for two consecutive spring seasons to compare species composition and successional trends. Also, data obtained from a nearby July, 1978, wildfire site adjacent to the Monument on Bureau of

Location of Pinnacles National Monument.

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Plant Succession on Prescribed Burn Sites in Chamise Chaparral

Melanie Florence

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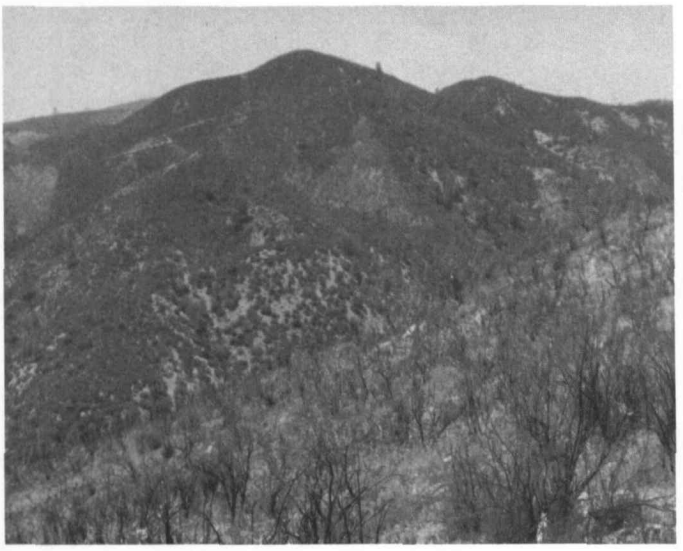


Typical prescribed burn sites at Pinnacles National Monument. Close-up of a burn site in the foreground and patches of burned areas on the hills. Photograph by Brian Mattos

Land Management land were compared with the prescribed burn site data.

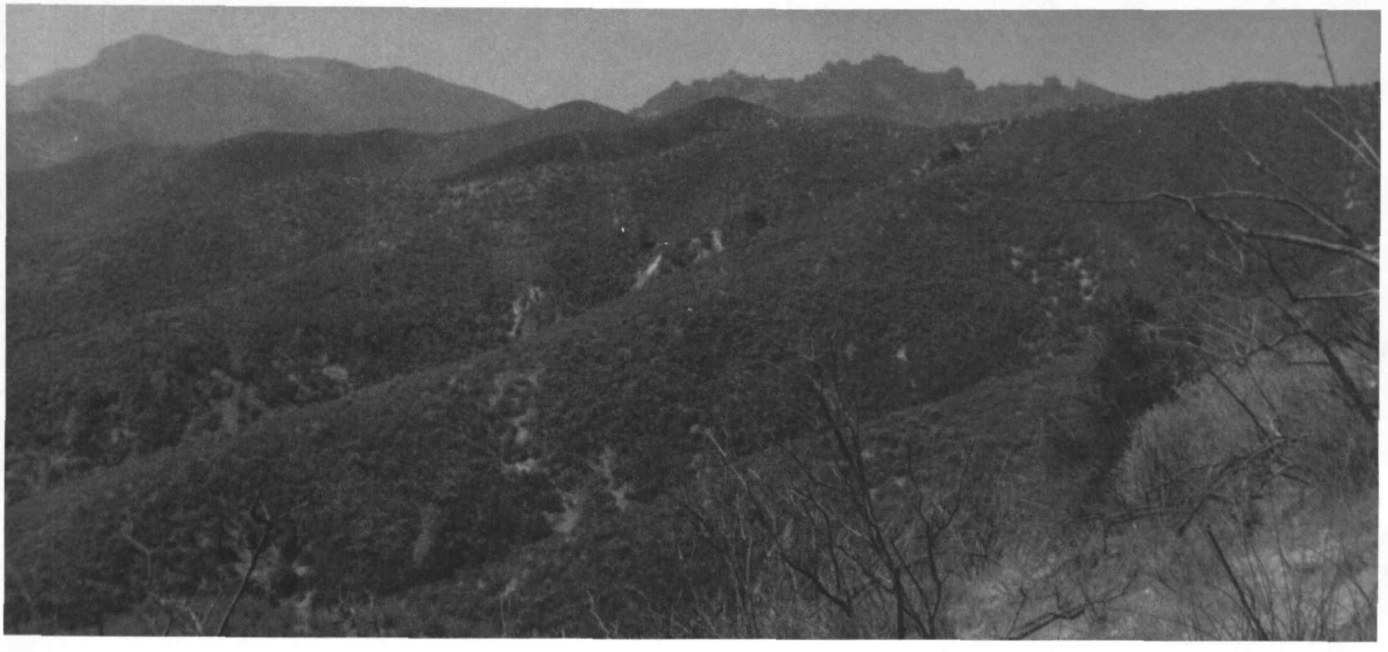
Chaparral succession after a warm-season wildfire follows an established progression. During the first few post-fire years, native annual and perennial plants are abundant on the burn site. Many of these plants are specialized fire-followers. These species have refractory seeds, seeds which need scarification in the form of heat or charate (chemicals released from fire-charred shrubs) to germinate, and therefore are only found on burn sites in the early post-fire years (Keeley and Keeley 1981). These long-lived seeds are deposited on the soil after the plants mature and stay dormant until the next fire. Also, some species have root burls, lignotubers or underground stems which sprout after fire destroys the apical parts of the plant (Sweeney 1956).

Generalized fire-followers are also found on burn sites during the early post-fire years. These species grow on disturbed areas and on openings in mature chaparral so they are not restricted solely to early post-fire year burn sites. They are often non-native weedy species with non-refractory seeds (Keeley et al. 1981). Generalized species have broad ecological tolerances which allow for extended survival under changing conditions (Hutchison 1975). The presence and abundance of the annual species is related to the amount and distribution of rainfall in a growing season.

A first post-fire year burn site is typically occupied predominantly by fire-following forbs; grasses are less important (Sweeney 1956). Specialized fire-following forbs decrease in abundance with succeeding years because of the absence of fire as a dormancy breaking influence and/or the inability of these species to compete with grasses and generalized fire-followers (Hutchison 1975). Fire-following shrubs and subshrubs gradually become larger, eventually crowding and shading out the herbaceous plants. Subshrubs such as deerweed and black sage reach maximum development the third or fourth year after fire. Dominant shrubs such as chamise and buck brush comprise an increasing cover percentage in succeeding years while generalized annuals and subshrubs are restricted to smaller and smaller openings (Keeley et al. 1981). After ten years or so, a dense shrub cover with little understory has again developed. Dense growth of the shrubs (many with flammable compounds in the foliage), accumulation of fuels, and summer drought eventually result in another fire.

Herbaceous species presence and dominance the first post-fire year is determined by many factors: (1) topography of the site including elevation, aspect, soils and microsite availability (Hutchison 1975); (2) seeds present on the site, their germination requirements and heat tolerances; (3) fire intensity; and (4) the precipitation and temperature regime after the fire (Ammirati 1967). In this study, fire intensity appears to be the overriding factor controlling diversity and dominance in herbaceous plant communities.

The vegetation found on the wildfire study sites and two of



Very mature, dense chaparral in Pinnacles National Monument. Photograph by Brian Mathos

Pinnacles, NM—US Department of the Interior, National Park Service Photo by Richard Frear

the prescribed burn study sites (the spring burn sites) closely approximated the warm-season herbaceous plant successional trends described above. Dense chaparral and hot, dry weather resulted in a high intensity burn on the wildfire site. The spring burns both had weather, fuel conditions, and fire behavior resulting in moderate intensity burns. In contrast, the winter burn had conditions resulting in a low intensity burn. The wildfire and spring burns were hot enough to heat-stimulate the seeds of specialized fire-followers and form charate. The fires killed most non-refractory grass seeds and some generalized forbs. Species diversity was highest on the moderate intensity burn sites and these sites were floristically more similar to each other than to the low intensity burn site.

The low intensity burn allowed more non-refractory seeds to survive the fire resulting in a high proportion of grasses the first post-fire year. The temperature was not hot enough to kill most heat sensitive seeds but it was hot enough in spots to form charate and heat-stimulate the seeds of some specialized fire species.

Because of the high grass cover the first post-fire year, the low intensity burn site was dominated by grasses the second post-fire year. All other study sites had the expected, but much smaller, increase in grass cover the second post-fire year. Increased competition from annual grasses may reduce the dominance and eventually the occurrence of specialized fire-followers if low intensity fires occur frequently or over large areas.

The above conclusions can be applied to management of chamise chaparral. Most chaparral areas should be managed to promote species diversity and regeneration of native vegetation in coordination with management goals. Since intensity of fire affects species response, burns can be timed to maximize the desired response.

A prescribed burn in progress. Photograph by Scott Florence.

To perpetuate specialized fire annuals and perennials, the burn should be performed under conditions which will produce a moderate to high intensity burn so that most nonrefractory annual seeds will be destroyed. In contrast, if a good grass crop is preferred, a low intensity burn should be performed. This pasturage would be temporary unless the shrubs were killed.

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California Annual Grassland and Oak Savannah

James W. Bartolome

The grasslands and savannahs of California cover approximately 15 million acres or 15 percent of the State, but provide 80 percent of the range forage for sheep and beef cattle (California Department of Forestry 1987). With a growing population, rangelands are foci for suburban development, water, wildlife habitat, and recreation. Annual forbs and grasses introduced from other regions with winter rains and summer drought (Heady 1977) dominate the vegetation of the herbaceous layer. The woody overstory, where present on suitable sites, is most often an open canopy of oak, a genus *(Quercus)* shared with savannahs of the Mediterranean Basin (Griffin 1977).

The original California grassland, a mix of perennial bunchgrasses and annuals, formed the resource, enabling settlement by Europeans. Cattle and sheep, introduced from Baja California upon the founding of Mission San Diego in 1769, and later resupplied from Tubac in Arizona, numbered in the millions by the early 1800's (Burcham 1957). The few thousand non-native people in California depended upon these livestock as the mainstay of the economy for eighty years. The only major exports were hides and tallow shipped from points along the coast. Not until gold was discovered and populations of hungry miners formed a local market, did meat production become important in livestock ranching. The forage base of native bunchgrasses, not adapted to this kind of heavy use, was rapidly destroyed. Later expansion of cultivation in the 1860's and 1870's further contributed to the demise of the native grasses. As with other fertile rangelands of the U.S., the best sites in the Central Valley were those put to the plow.

New plants, survivors of thousands of years of livestock use in a climate similar to California's, arrived from the Mediterranean region with the earliest settlers. Verified by the presence of their seeds in adobe bricks used to construct the missions, successive waves of plant immigrants moved into California (Burcham 1957). Some weedy species from Europe arrived in the 1700's, but most of the annual grasses, the wild oats (*Avena* spp.), filarees (*Erodium* spp.), bromes (*Bromus* spp.), and fescues (*Vulpia* spp.), which produce most of the forage annually, arrived in the middle 1800's. Soft chess *(Bromus mollis),* now the most widespread annual, was a late comer and only became abundant in the 1890's (Heady et al. in press). By the mid 1800's the take over from native perennials was complete and no areas free of exotic annuals are left. Although grazing started the process of change by damaging or destroying the native grasses, the new immigrant plant species made the change permanent and irreversible, even under complete protection.

The present annual grasslands and oak savannahs (Fig. 1) intergrade across a wide geographic range and could be separated into numerous subtypes. The most commonly described divisions are the Coastal Prairie, Valley Grassland, and Oak woodlands (Barbour and Major 1977). The Coastal Prairie extends from the Monterey Bay in Central California northward to the Oregon Border near the immediate coast and along the San Francisco Bay. The cooler coastal climate, with annual rainfall from about 20 inches to over 80 inches annually, should place less summer drought stress on perennial grasses than the hot inland Central Valley. Indeed, native and exotic perennial grasses are common along the coast, even under livestock use. The dominant grasses are California oat grass *(Danthonia californica),* Pacific hairgrass *(Deschampsia holciformis),* and Pacific reedgrass *(Calamagrostis nutkaensis)* (Heady et al. 1977). Average forage production exceeds 3,000 lbs/acre/year. Little has been published about management of grazing or burning in Coastal prairie and much of the type is in Parks or other reserves.

The Valley Grassland forms a ring around the Central Valley, extending into the Mountains of Southern California

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Fig. 1. *California annual grassland with blue oak savannah in the background.*

and the Central Coast (Heady 1977). Average annual rainfall ranges from less than 6 inches in the Southern San Joaquin Valley to 30 inches or more in northern Sacramento Valley. Perennial grasses are rare, with only a few scattered relicts (Barry 1972). Even with complete production from grazing, the introduced annuals can maintain dominance. Originally, the native grasses were thought to have been present throughout the Valley Grassland. In the San Joaquin Valley, stands were more scattered, with pine bluegrass *(Poa scabrella)* as the likely dominant. Perennial grasses increased in density with increasing rainfall. Purple needlegrass *(Stipa pulchra)* was the likely dominant in these regions (Heady 1977). Recent evidence from soil microfossils has shown that one site in the Sacramento Valley, now exclusively introduced annuals, was occupied by purple needlegrass at densities that would not have excluded annuals (Bartolome et al. 1986).

The Mediterranean annuals of the Valley Grassland produce abundant forage. The amount is correlated with annual rainfall, and varies from about 1,000 lbs/acre with 12 inches of rain to 2,000 lbs/acre with 25 inches on a typical range site (Bartolome et al 1980). Soft chess is the most widespread species, found throughout the grassland in areas with more than 12 inches of annual rainfall (Bartolome et al. 1980). Broad-leaved filaree *(Erodium botrys)* accompanies soft chess on almost as many sites, and both extend into the Coastal Prairie. Associated with these two species, and locally dominant, are annual fescues, wildoats, and several other grasses. Red brome *(Bromus rubens)* replaces soft chess and red-stem filaree *(Erodium cicutarium)* replaces broad-leaved filaree in the portions of the Valley Grassland with less than 12 inches annual precipitation.

Unpredictable annual weather patterns dictate forage productivity and composition. The first range research by the Forest Service at the San Joaquin Range near Fresno documented these yearly changes, referred to as grass, "clover", and filaree years (Bentley and Talbot 1951). The timing and amount of fall rains, coupled secondarily with spring rains, determines the composition and standing crop at maturity. The fluctuating annual legume component of clovers and medics provides important nutrients to grazing animals and the forage crop (Woodmansee and Duncan 1980). Annual changes in composition can have a marked effect on forage quality. For example, fall and winter forage quality provided by early maturing filaree contrasts with rapid disappearance and low forage amounts at the spring peak. This pattern contrasts to the higher and later peak standing crop in a grass year (George et al. 1985), with important effects on grazing capacity.

Because of the obvious links to livestock production, predictions of forage production and composition based on weather have been attempted several times but variation between locations has affected application of results. Murphy (1970) found a good correlation between weather and forage

production at the Hopland Field Station, representative of the higher rainfall regions of the Valley Grassland. Duncan and Woodmansee (1975) did not find such a relationship at the drier San Joaquin Range. Pitt and Heady (1978) correlated annual weather patterns with some changes in composition and productivity at Hopland but saw little application to management because of the importance of spring rains, too late to adjust stocking rates.

The annuals respond to changes in grazing use. Ungrazed Valley Grassland pastures are often dominated by either wildoats or ripgut brome. Species diversity may be low. Under grazing use other grasses such as soft chess and broad-leaved species increase. Although the forage species differ in value at maturity and segregate out in a general way to grazing use (Sampson et al. 1951), forage value ratings and range condition evaluations have proven of limited value for management of annual ranges (USFS 1984). The patterns of response to grazing have been successfully recreated using the manipulation of mulch or plant residue as a substitute experimental treatment for grazing (Heady 1956, Bartolome et al. 1980). An outgrowth of these studies, management of yearlong grazing use to leave a targeted amount of residue in the fall has proven the only practical method for influencing composition and production (USFS 1984).

An overstory of oaks changes the grassland into a savannah. The California oak savannah can be divided into three types, the northern, southern, and foothill woodlands (Munz and Keck (1949). The oak types on rangelands can be grouped conveniently by dominant oak species, although other hardwoods and some conifers may be present. The northern type is characterized by blue *(Quercus douglasii)*, garry *(Q. douglasii)*, and interior live *(Q. wislizenii)* oaks. Coast live oak *(Q. agrifolia)* and Englemann oak *(Q. englemannii)* dominate the southern oak woodland. The foothill woodland is dominated by blue oak and interior live oak, often associated with digger pine *(Pinus sabiniana)*. Collectively these types occupy about 10 million acres of rangeland. A Valley oak *(Q. lobata)* savannah, much of which has been cleared for crop production, formerly extended across much of the lowlands of interior California and into foothills where late season moisture is present (Griffin 1977).

Little has been published about response of the herbaceous layer of the oak woodlands to grazing management. Most writers remark that the understory contains many of the same species found in the adjacent annual grassland (Heady 1977) and assume a similar response to management. A few important species are found both in the open grassland and under the oak canopy, such as annual fescues, soft chess, and wild oats. Yet, in a study of five widely separated locations in California, McClaran and Bartolome (1987) found that species composition differed more between open and canopy within sites than between locations within cover type. Miner's lettuce *(Montia perfoliata)* and Italian thistle *(Carduus pyncocephalus)* were exclusively under the canopy but owl's clover (*Orthocarpus* spp.) and lupines (*Lupinus* spp.) were only in the open. The oak savannah will likely require different understory management practices from that of grasslands.

Oaks are widely used for fuel wood and cleared for enhancement of livestock forage. Oaks are a desirable firewood and several hundred thousand cords are cut for this purpose each year. However, the local impacts of fuelwood harvesting probably are not generally endangering the different oak savannahs (California Department of Forestry 1987). Clearing for range improvement has historically altered the structure and extent of oak savannahs. Individual deciduous oaks increase understory production (Holland (1980), while individual coast live oaks decrease productivity (Parker and Muller 1981). In higher rainfall locations moderate stands (less than 50 percent canopy cover) of blue oak decrease understory productivity at all periods of the growing season (McClaran and Bartolome 1987), while in drier, and more southern locations the oak canopy may increase understory production and animal utilization (Duncan and Reppert 1960). Dense stands of liveoaks dramatically reduce understory productivity and removal results in much more herbaceous forage (Pitt and Heady 1978).

Recent concern over management of the hardwood canopy on rangelands led to a joint effort by the University of California and the California Department of Forestry and Fire Protection to increase funding for research, management, and education (Passof and Bartolome 1985). Much public concern centers on present tree stand size distributions with well-publicized lack of small trees. Stand structure suggests that regeneration was more frequent in the past, and present lack of recruitment represents a threat to oak survival (Bartolome et al. 1987). Valley, blue, and coast live oaks are apparently not regenerating in sufficient numbers to maintain existing stands (Muick and Bartolome 1986). The causes have not been determined and are the subject of intensive research, but appear to vary by species, region, and site. Increasingly, traditional extensive use of annual grassland and oak savannah will be constrained by land development, with smaller ownerships and intensive uses.

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Forest and Meadow Ecosystems in California

Barbara H. Allen

Forest and meadow ecosystems occur in all 6 major mountain ranges on about 25 million acres in California. Forest ecosystems are highly diverse with some 18 widely occurring and 12 more restricted conifer species. Meadows range in size from a few square meters to several hundred acres and are interspersed through-out every forest type in the state. The diversity in California forest and meadow ecosystems has its roots in the evolution of California's mountain ranges and subsequent change in the state's climate. Early explorers found a rich natural resource which today provides timber, forage, recreation, wildlife and water to a rapidly growing population.

During the Eocene epoch, California was characterized by a mild, wet climate with year long rainfall. The Sierra Nevada and Cascade mountain ranges had not yet emerged from a lowland plain. Eocene forests, richer in species than any of today's surviving forests, were made up of taxa whose nearest relatives occurred in the conifer forests of the western interior United States and the conifer-deciduous hardwood forests of the eastern U.S. and eastern Asia (Axelrod 1977).

By the Pliocene period, the Sierra Nevada and Cascade ranges were uplifted. This resulted in dramatic changes to the relatively uniform Arcto-Tertiary flora (Ornduff 1974). As the mountain chains were elevated to the east and west, a double rain shadow was created. This largely eliminated forests in the Great Basin region except in favorable upland sites, and created separate forest types on wetter, west slopes and dry, east slopes of the Sierra Nevada. As the mountains rose, climate changed from wet to dry characterized by today's summer drought. The forest and woodlands moved to the coasts and mountains (Munz and Keck 1975).

Meadow ecosystems evolved primarily during the Pleistocene period. The origin of montane meadows has been attributed to the filling of glacial lakes or valleys (Storer and Usinger 1963). However, as meadows also occur in unglaciated areas, other reasons contribute to the current scattered distribution of meadows. Wood (1975) states that the single most important factor explaining the distribution of meadows is the existence of a shallow water table which provides for high soil moisture content year round.

Meadows are often considered fragile and temporary in nature. However, meadow stability can be examined in terms of biological and geological stability (Benedict 1982). Biological stability refers to the persistence of meadow species, while geological stability refers to the persistence of the geological conditions which provide an environment favorable for meadow formation and maintenance. Geological stability is directly related to meadow origin and persistence. For example, a meadow that forms in a bedrock basin as a result of water accumulation is stable as long as the basin is intact and continues to collect water. Such a meadow is more

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stable than a meadow in a basin formed by a morainal dam, which is more easily eroded.

Evidence indicates that meadow ecosystems may often be as stable as the surrounding forest vegetation (Benedict 1982). Both meadow and forest ecosystems have experienced biological changes caused by human occupation and use. However, meadow ecosystems appear to be more sensitive than forest ecosystems to geologic change,as a result of lower thresholds of tolerance to geological change, and thus appear to fluctuate more widely between forest and meadow species (Wood 1975), than forest types.

Current Vegetation

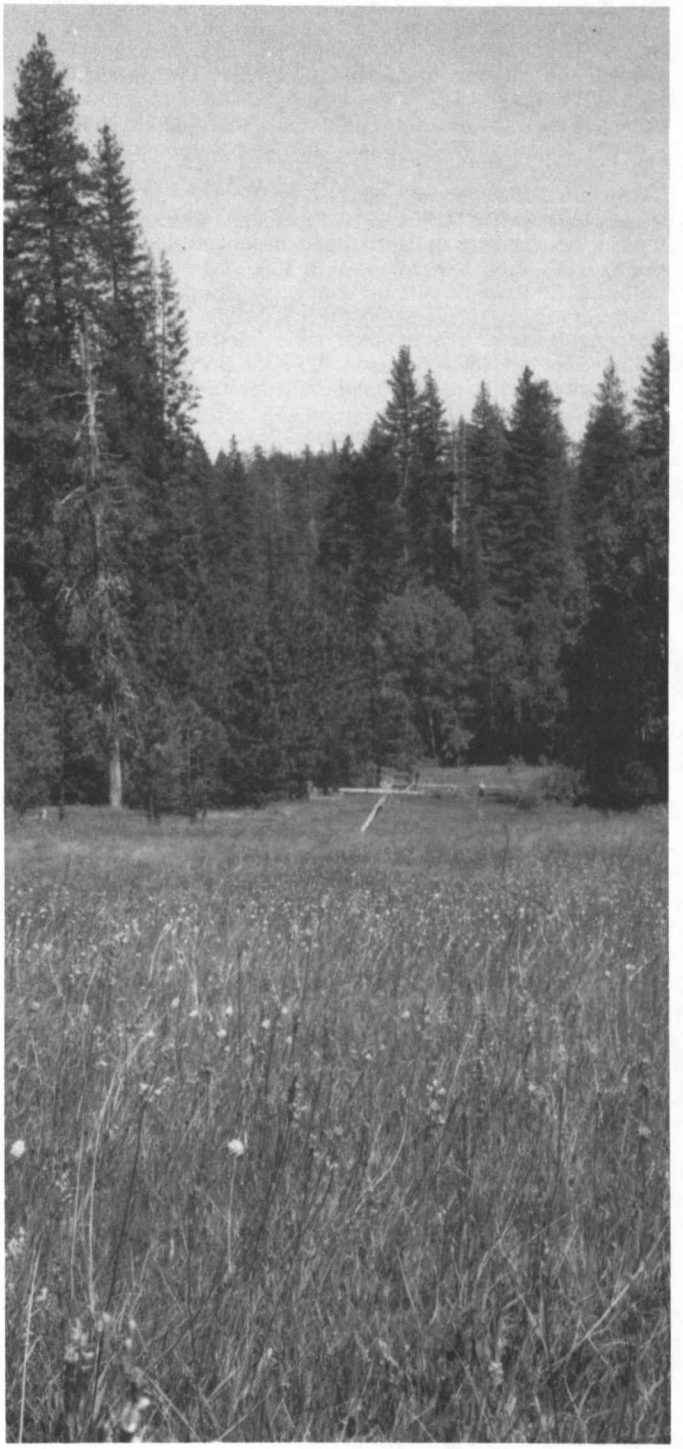
The present forests of California occupy over 25 million acres and can be grouped according to geographical location into coastal, montane, and intermountain types (Barbour and Major 1977). Meadows can also be grouped by geographical location, such as montane, sub-alpine, and alpine, or northern and southern California, but are better described as hydrologic/floristic types (Ratliff 1982, 1985), and can be broadly categorized as wet/mesic and dry types.

The coastal Douglas-fir forests of the state occur at elevations between 1,650 and 13,000 ft in the north Coast and Klamath mountains. Douglas-fir makes up more than 50% of the basal area in this type and may be associated with sugar pine, ponderosa pine, Jeffrey pine, incense cedar, and red fir. Associated hardwoods include tanoak, madrone, and canyon live oak. Understory forage species may include silk-tassle bush, blueblossom ceanothus, western mountain mahogany, and blue elderberry.

Redwood forests occupy areas of the coast of California from San Luis Obispo county to the Oregon border. These forests, which contain some of the tallest trees in the world, are dependent on cool, foggy coastal conditions and extend inland only 80 miles. The closed-cone pine and cypress forests are largely remnant, endemic forests typically dominated by a single species, which may be one of the cypresses: Tecate, Cuyamaca, Piute, MacNab, Sargent, or Monterey cypress; or a pine: knobcone, Monterey, Bishop, or Torrey pine. These forests occur in patches along the coast of California from sea level to 650 ft elevation.

The montane ponderosa pine forests occur primarily on the west slope of the Sierra and east slopes of the Klamath, Coast and Transverse mountain ranges at elevations between 800 and 6,500 ft in the north, and 4,200 and 6,825 ft in the southern part of the state. Ponderosa pine makes up more than 50% of the basal area in these forest and associated species may include sugar pine, Jeffrey pine, incense cedar, Coulter pine, Douglas-fir, canyon live oak, and California black oak. Understory forage species for large ungulates and livestock include deerbrush, willow, mountain mahogany, black oak, and perennial grasses.

The mixed conifer forest, occurs at higher elevation, and consists of three or more species of conifers, where no one species contributes over 80% of the conifer basal area. Conifer species may include Douglas-fir, white fir, ponderosa pine, incense-cedar, sugar pine, and Jeffrey pine, while California black oak, tanoak, and chinquapin are major hardwood associates. Elevation ranges from 2,450 to 4,000 ft in the northern part of the state, and 4,000 to 10,000 ft in the southern part. The mixed conifer forest occurs on western slopes of the Sierra, Peninsular, Transverse and Coast ranges, while a variant of enriched conifer and white fir occurs in the Klamath mountains. Understory forage species are similar to those in the ponderosa pine forests.



Other major conifer types such as red fir, lodgepole pine, and subalpine conifer, occur at higher elevations (5,900 to 11,000 ft) on suitable sites throughout the state. These forests produce significantly less forage for large browsing

animals than the other forest types, although some forage, such as cascara and bittercherry, is available.

The intermountain Jeffrey pine forests (commonly called the eastside pine type) occur over extensive areas on the eastside of the Klamath, Cascade, Transverse, Peninsular, and Sierra Nevada mountain ranges on drier sites. Elevation ranges between 500 and 9,500 ft depending on latitude. Associated species include ponderosa pine, Coulter pine and some sugar pine, lodgepole, incense cedar, and redfir. Major hardwood species include black cottonwood, aspen, sagebrush, and black oak. Forage species include bitterbrush, bluebunch wheatgrass, idaho fescue, and western mountain mahogany.

The pinyon-juniper forest and juniper forest occur primarily on the eastern slopes of the Sierra Nevada from approximately 3,300 to 8,900 ft, and 2,500 to 4,900 ft, respectively. The major pine species are singleleaf pinyon and Parry pinyon, while the main juniper species are western, Utah, or California juniper. Associated species include ponderosa or Jeffrey pine, scrub or canyon live oak, and whitebark pine and sagebrush. Understory forage species may include perennial grasses, bitterbrush, and western mountain mahogany, depending on a site.

Montane meadows are found scattered throughout the forest ecosystems and can be broadly characterized as wet/-mesic meadow and dry meadow types. Ratliff (1982, 1985) has identified 21 distinct meadow vegetation series, 72 theoretical hydrologic series, and suggests that perhaps over 1,500 meadow types may be identifiable. Size varies from a few square meters to several hundred hectares and species composition is diverse.

The wet/mesic meadow type is generally found above 3,900 ft in the north and 6,000 ft in the south and is characterized by a continuous vegetation canopy and standing water all or part of the year. The wet/mesic type grades from sites with standing water, such as *Sphagnum* dominated meadows characterized by acidic, organic muck, highly sensitive to disturbance, or *Juncus* dominated types, which are low in palatability and tolerance to frost, to more mesic, well-drained sites. More mesic meadows include sites dominated by sedges and sites comprised primarily of grasses and forbs. The more mesic subtypes are the most common of the wet meadow types, are significantly more resistant to disturbance, and are of significantly higher forage value (Rundel et al. 1977).

The dry meadow types are found in scattered locations above 6,000 ft. Dominant vegetation is typically sparse grasses and forbs interspersed with conifers, mainly lodgepole pine and poplars with little or no standing water (Rundel et al. 1977). The short-hair sedge meadow is a higher elevation dry meadow type characterized by *Carex exserta* sod and is generally found above 6,900 ft. Though the vegetation is adapted to withstand disturbance and frost, historical use of these meadows by sheep and current use by pack stock and hikers has had a detrimental effect on these meadows. Once the short-hair sedge sod is broken, it becomes reestablished slowly and with great difficulty.

History of Use

Early explorers of the Sierra Nevada, such as Jedediah Smith, Kit Carson, John Fremont and John Muir, faced a steep east-facing slope rising 5,000 to 10,000 feet above the Great Basin, which gave way to the more gradual west slope. However, they encountered numerous notable features including cirques, moraines, lakes, meadows, and glacial valleys in addition to large expanses of red fir, mixed conifer, Douglas-fir, Jeffrey, and ponderosa pine forests. Explorers from the north found similar forests among giant volcanic peaks, serpentine outcrops, and ancient metamorphic and sedimentary intrusions (Sawyer and Thornburg 1977). Roaring rivers filled with salmon, and highly complex patterns of vegetation, including many endemic and relict species, met the early explorers. The forests were little used by Spanish and Mexican settlers, who remained along the coasts.

By the 1840's however, California was a state and people had moved into the interior. Major enterprises in the Sierra Nevada included mining, timber production, and livestock grazing.

Domestic animals grazed the montane forest ranges because they provided summer green feed commonly unavailable at lower elevations, ample water, relative freedom from insects and disease, and high quality forage. With the discovery of gold and subsequent increases in human population, large numbers of livestock began to use California's forest ranges and mountain pastures as a market for red meat surpassed the original hide and tallow market. With the early railroad near Donner summit, a flourishing recreation industry was ensured (Storer and Usinger 1963). A policy of fire suppression was implemented to protect the forests from the destructive effects of periodic wildfires that had turned thousands of acres of productive forests into brushfields by the turn of the century (Kosco and Bartolome 1981).

As people continued to utilize the forest and meadow resources, changes in land ownership and use occurred. The grizzly bear became extinct in 1924; mountain sheep, wolverine, fisher, and marten populations were greatly reduced and coyotes, wolves, and wildcats were hunted to protect deer and livestock (Storer and Usinger 1963).

At the turn of the century, livestock use of federal forest rangelands provided more income to the treasury than any other product (Kosco and Bartolome 1981). Demand for timber increased, and after 1940, the income from harvesting wood quickly surpassed income from livestock grazing, assuming the dominance held today.

Today California forest ecosystems provide 3.4 billion board feet of timber, 100 million recreation visitor days, 50 million acre-feet of water, primary wildlife habitat for some 311 vertebrate species, and superior summer forage for over 497,000 AUMs (animal unit months), (State of California 1987). Managers continue to be faced with often incompatible demands for use of the forest and meadow resources. Continued population pressure and highly consumptive lifestyles require that resource managers understand resource capabilities, design careful plans for resource use, and educate the general public on the wise care and use of their limited, yet highly productive forest and meadows resources.

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Arcata Symposium, July 13

Symposium: Complexities of Land Use and the Decision-Making Process—a California Example

Kate Buchanan Room
University Center

1:30 pm Welcome	**James W. Timmons** California Cattlemen
1:40 pm Welcome	**Donald Neal** President, CA Section
1:50 pm The Rangeland Resource	**Harold F. Heady** Professor emeritus Univ. CA, Berkeley
2:20 pm History of Settlement	**James R. Young** Range Scientist ARS, Reno NV
2:50-3:20 pm Break	
3:30 pm Current Conflicts in Demands for Use of Rangeland Resources	**Gordon Van Vleck** Secretary, California Resources Agency
4:00 pm Complexities of the Decision-Making Process	**Harold R. Walt** Chairman, State Board of Foresty
4:30 pm Open Panel Discussion	
5:30 pm Close	

Coppicing: Using A Forester's Tool on Rangelands

Linda Howell Hardesty

The phenomenon of coppicing, widely used by foresters, can also be an important range management tool. Coppice is defined as "all regeneration that is derived from vegetative sprouting of dormant or adventitious buds." Range managers talk about sprouting in conjunction with brush control, generally in a negative sense, as in: "mesquite's sprouting ability makes control almost impossible."

While most people know what sprouting is, coppicing is only vaguely familiar as a management tool. Foresters use coppice methods to insure a rapid, economical return to full stocking after wood is harvested, to maintain a desirable species and genetic composition, and to shorten rotation times. Following this more positive vein, what advantages might coppicing have for the range manager interested in improving forage production?

Cutting back coppice growth of Auxemma oncocalyx.

Some woody plants are important as forage, although many problems are caused by less desirable trees and shrubs. If brush management is considered as minimizing the undesirable effects of woody plants while maximizing their contribution to sound management, then coppicing can be a useful tool for the range manager also.

Coppicing results from injury to, or removal of the aboveground plant parts. It is a common response to fire, mechanical treatment, heavy browsing, and some herbicide treatments. The coppicing stump uses the root system and reserves of the original plant, and under the influence of a chemical "contingency plan" reinitiates growth with properties very different from seedling growth. These properties can affect forage production and quality.

Coppice regeneration and uncut caatinga woodlands in northeast Brazil.

The most familiar phenomenon is the speed with which coppice shoots emerge and grow. Most range managers have seen coppice shoots emerge from charred shrubs within days of a range fire, or have cut a tree in the yard only to have it begin almost immediately to fight back. The forestry literature notes that coppice shoots may out-grow seedlings for as long as 40 years (Daniel et al. 1979). Coppicing stumps can provide browse in a hurry.

In addition, stumps which coppice once can usually do so repeatedly. Some European woodlands have been managed for centuries for short rotation fuelwood production. Each stump has produced many generations of regrowth. We don't have much data on the prolonged sprouting performance of rangeland shrubs, but the persistance of sprouting species such as mesquite, and salt cedar suggest that repeated sprouting is possible under rangeland conditions.

Not only do sprouts grow differently, but the crowns they produce are different as well. Coppicing can cause a shift from a tall, tree-like growth form to a lower shrub-like form. This change may be short lived, or may persist for many years. This increases accessibility for browsers, and can improve fuel conditions if burning is planned. In many cases, coppice shoots produce proportionally greater amounts of

Author is assistant professor, Department of Forestry and Range Management, Washington State University. At the time of this research the author was research associate at Utah State University.

This paper was based upon research carried out as a part of the United States Agency for International Development Title XII Small Ruminants Collaborative Research Support Program under Grant No. AID/DSAN/XII-C-0049, in collaboration with the Empresa Brasileira de Pesquisa Agropecuaria, Brazil. Portions of this paper appear in a doctoral dissertation at Utah State University.

Stump of Caesalpinia pyramidalis *sprouts within days of cutting.*

foliage and tender stems to inedible woody growth.

Phenology is also affected by coppicing. In northeast Brazil coppice growth of deciduous species may shift to a more evergreen pattern when regrowing. In 1983, undisturbed woodlands shed their leaves in June. Coppice growth retained its leaves an additional 60 days. More remarkable were coppicing stumps whose regrowth had been heavily browsed by goats. These stumps leafed out again in June and July, with the dry season already underway, and maintained green foliage for the duration of the 6-month dry season. With no further treatment, this pattern persisted into the 1984 dry season (Hardesty 1987). Dried fallen leaves of several tree species are the major component of sheep and goat diets during the dry season (Pfister and Malechek 1986). If accessible, coppice shoots, with their delayed leaffall, can be used to extend the period when green feed is available, or can be deferred until the leaves have cured and be used late in the dry season when other forage sources are exhausted. Similar observations have been reported in Africa, Costa Rica, and the California chaparral. As yet there is no clear explanation for these shifts but reduced water stress or the effects of growth regulators have both been suggested.

In addition coppice shoots are often quite palatable, even those of species which are not normally browsed. Animals selected coppice even in the rainy season when ample supplies of normally more palatable herbaceous forages were available. Similar observations have been reported in the literature, and this preference for coppice shoots is recognized by deer hunters who seek out disturbed areas. Differences in succulence, mineral, and nutrient levels have all been proposed to explain this tendency. To date few studies have compared the nutritional quality of coppice and mature growth of the same species. However, these reports generally support the idea that the nutritional value of browse is enhanced by coppicing (Reynolds and Sampson 1943, Leege and Hickey 1971, Hallisey and Wood 1976).

Although this discussion of coppicing is primarily in terms of forage production, two points related to site quality should be mentioned. Treatments which stimulate coppicing, such as nonlethal herbicides, light fires, slashing, or browsing, create less site disturbance than some treatments which remove or kill roots and eliminate coppicing. Intact root systems help stabilize the site and rapid regeneration pro-

First year's coppice growth of Caesalpinia pyramidalis.

Mature coppice of Caesalpinia pyramidalis. *Note decadent stump in center.*

vides protection for the soil surface and a more moderate environment for understory growth. When the roots of woody plants remain alive, the deep root space is occupied and may be more resistant to woody invaders, while still allowing growth of shallow-rooted herbaceous species (Smith 1970).

Numerous factors influence the coppicing ability of trees and shrubs, the most obvious of which is genetic. Some species do not sprout at all, while others have varying ability depending on the site. Blaisdell and Mueggler (1956) report that bitterbrush does not sprout in Oregon, but does sprout in eastern Idaho and Utah. They suggest that sub-specific genetic differences may be involved.

Age and size are also a factor, as the ability to coppice varies during the life of a plant (Blake 1973). Production of sprouts from dormant buds may decrease with age due to thickening of the bark or damage to the buds. Age may not be as important a factor in plants which readily produce adventitious buds, except in terms of a general decline in vigor with age or site changes. None of these variables are within our control, but when recognized they can be used to predict the response to a particular treatment.

There are other factors however which can be manipulated directly. One of these is the height of the remaining stump. The height of the stump affects both the origin and the number of sprouts produced. Adventitious sprouts appear

Goats eagerly browse coppice growth of Mimosa acutistipula. *The foliage of uncut trees is out of reach of browsers.*

more rapidly and may have a different growth potential than dormant bud sprouts. Thus you can influence the sprout type and density most consistant with your goal for a particular species, be it control or propagation.

The season of injury has a great effect on the ability to resprout. Generally, injury during the dormant season produces the strongest coppicing response. Conversely, injury shortly after the canopy leafs out hits the plant at a time when regrowth is more difficult and pathogens and insect pests are most active. Often plants cut during the growing season resprout, but with only the remainder of the growing season in which to recover, they do not survive the following year. Secondary stresses such as drought, browsing, fire, or disease, may further reduce survival or vigor. Mixed stands of species with varying phenologies can be manipulated through precise timing of treatments or selective seasonal treatments. Preferred species can be cut when coppicing will be most vigorous and less desirable species when coppicing will be least likely.

The extent of the original treatment also influences regrowth. Some species root graft with neighbors of the same species resulting in a vascular connection similar to that of clonal species. Coppicing is inhibited by growth regulators translocated from the crown. To encourage abundant coppicing, the aboveground parts of all individuals of a species should be killed to prevent growth regulators produced by intact neighbors from inhibiting sprouting in connecting stumps (Wold and Lanner 1965). This same principle suggests that leaving some intact individuals of less desired species might reduce coppicing of nearby stumps of the same species. This would be most advantageous with species which do not reproduce well from seed, as is the case with prolifically sprouting species such as aspen and some chaparral species (Keely and Zedler 1978).

Further manipulation is possible through the subsequent management of the coppice stand. As mentioned earlier,

browsing, burning, and mechanical treatment can all be used to reduce the vigor of coppice stands, or to renovate them and keep them in a young and productive stage. Both the timing and degree of the treatment determine the effect. In one study, two periods of heavy goat browsing during the initial period of regrowth stimulated additional regrowth by 4 tropical browse species and prolonged the period when green foliage was available (Hardesty 1986). This treatment reduced total browse production the following year. Perhaps more importantly, this caused high mortality of stumps of several species. Among species considered forage producers, no mortality occurred. Only the species which are not usually considered browse succumbed to this treatment. This suggests that browse species are more tolerant to repeated defoliation, and that defoliation treatments can be used to favor the persistance of browse species in the stand.

Describing the possible advantages of coppicing to improve forage production, does not mean that this response isn't a problem at times. The point is that with our broadened understanding of the role of wood plants on rangelands and the increasing emphasis on brush *management*, this is an ideal time to take a lesson from the foresters, to reconsider coppicing, and to gain better understanding of how we can manipulate this response to further our management goals.

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Taking the Great Animal Crusades Over the Top

Robert H. Schmidt

Animal rights and animal welfare issues receive a great deal of media attention. Although many would argue that this attention is undeserved because only a small minority of people are involved, it is important to realize that animal welfare issues strike a response chord in many people. I firmly believe that these issues will not disappear anytime soon; indeed, the evidence indicates that these organizations are continuing to consolidate their power. This evidence includes newly formed animal care committees on many university campuses, passage of the federal Dole/-Brown Bill ("Improved Standards for Laboratory Animals Act"), revisions of the Public Health Service's animal care guidelines, and withdrawal of funding from institutions found in violation of animal care regulations (Holden 1986).

In addition to concerns about the use and welfare of laboratory animals, there is a good amount of attention being focused on the production of animals for food (Mason and Singer 1980, Curtis 1980, CAST 1981, Baker 1983). For example, an injunction forced the USDA to modify their Dairy Termination Program to exclude the provision requiring the hot-iron face branding of dairy cows (Animal Welfare Institute 1986). Specific concerns about farm animal welfare, along with concerns about hunting trapping, and predator and rodent control, will keep these issues "boiling" in the future.

The Animal Welfare Institute (API), a major animal welfare group based in Sacramento, California, held their annual conference 17-19 October 1986. The theme for the conference was "Taking the Great Animal Crusades Over the Top." In this article I review some of the major points raised during the conference.

The underlying theme for most of the keynote speakers was that animal rights activists need to approach people on a totally rational level and avoid emotional debates. "Arm yourself with the facts," said Donna Ewing of the Illinois Hooved Animal Society. John Livingston, author of *The Fallacy of Wildlife Conservation,* declared that activists should "Never accept the burden of proof; shift the burden of proof to the other side." This is because ugliness, suffering, and beliefs cannot be quantified. Donald E. Doyle, advisor to API on medical science, noted, "If you scratch an intelligent person deep enough, you'll uncover ignorance." This information must reach the general public. Luke Dommer, of the Committee to Abolish Sport Hunting (CASH), reported that "Unless you crack the media, you're wasting your time."

Issues covered during the major presentations included egg production using hens in battery cases, veal production, the trade in primates, project WILD (a wildlife-oriented teaching curriculum designed for grades K through 12), hunting and trapping on national wildlife refuges, the Dairy

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Editor's Note: Everyone should heed the message in this article.

Termination Program, trapping in general, marine mammals (especially pilot whales in the Faroe Islands), hunting in general, philosophical discussions of why animals have rights, contamination of pesticides in the environment, and drugging race horses.

A presentation of special interest was done by Dr. Ted Friend of Texas A&M University. Dr Friend's research program deals with establishing optimal living conditions for farm animals. His project areas include animal transport, raising of dairy calves, orientation of horses in trailers, bedsores in swine, methods for maintaining pigs during gestation, and how to contain sows during farrowing. The results of his research should be of interest to livestock producers interested in maintaining a healthy stock. Dr. Friend was presented with API's Animal Humanitarian of the Year Award by API president and founder Belton B. Mouras.

I suspect that animal rights and animal welfare organizations are going to get more sophisticated in their approaches and strategies. The more you know about their philosophy and beliefs, the better you will be able to assess your own operations in light of their concerns.

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Holism & Hydrology

Dick Hart and Pat Reece

On Erin's sod, a tale they tell
Of the flowing fantastic fairy well.
It was uncapped against the wishes
Of the fairies, who turned the folk to fishes
And spread Lough Allen's water wide
Where once was pleasant countryside.

Back to the present; a foreign sage,
Full of the wisdom of the age,
Has come to the land of the arid West
To preach his management scheme's the best
And give his solemn certification
That he can halt desertification.

Just build the fences, rotate the critters.
And persevere, don't be a quitter;
Dry springs will turn to flowing fountains
And lakes appear between the mountains.
Cows that rustled for cheat and bluebunch.
Will have a wildrye and alfalfa to munch.

But things are getting out of hand;
The waters spread across the land.
The basement of one veterinarian
Has become a habitat riparian.
And Salt Lake's waters rise and reach;
Will Temple Square become a beach?

Did management cause the lakes to spread?
Should we tear out the fences or go ahead?
If activity's followed by some occurrence
Is it cause-and-effect or just concurrence?
Is flooding caused by bovine rotation
Or years of excessive precipitation?

Beware of fairy tales from sages;
Beware "the wisdom of the ages".
Remember the valid management points
Learned at Dad's knee (and other low joints).
Let's use what works to achieve prosperity
And preserve the range for our posterity.

Editor's Note: This poem was first printed in the Nebraska Section Newsletter, SRM, Vol. 35, No. 2, May 1986.

Old Grass in the Spring

Bob Ross

The days are getting longer,
The sun is shining stronger,
The spring can now be seen,
The grass will soon be green.
The hay is getting low,
It's a terrible tale of woe
Cause, I didn't save some old grass for this spring.

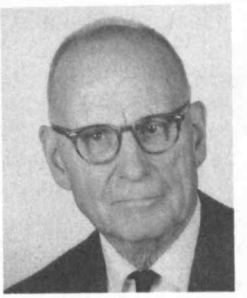
A cow needs a lot of bulk,
Or she'll stand around and sulk.
She'll run from plant to plant,
And still look might gant.
Green grass is mostly juice—
It's a pretty poor excuse
Without a lot of old grass in the spring.

Your worries, though, are over,
Your cows will be in "clover,"
Your grass will green up quicker,
Your cows will give more "liquor."
You may think this is humbug,
But your cows will get the love bug
If you've left a lot of old grass for this spring.

After having had her calf,
A cow needs a ration and a half.
Thirty pounds of "dry"
Puts a glimmer in her eye.
But, a critter bawls herself to sleep
When there's not enough to eat—
This year I'll save some old grass for next spring.

Editor's Note: This poem was first printed in the Intermountain Section Newsletter, SRM, No. 2, June 1986.

William Ridgely Chapline
A Pioneer in Range Research



William Hurst

A 75-YEAR CAREER DEVOTED TO RANGE and forestry research, conservation, and use ended when Mr. W.R. Chapline passed away at his home in Monterey, California, on December 19, 1986. He had moved to Monterey in 1983 from Washington, D.C., where he has resided for 70 years.

Mr. Chapline, or "Chap" as many knew him, was born January 10, 1891, in Lincoln, Nebraska. He graduated from the University of Nebraska in 1913 with majors in forestry, botany, and agronomy and began a long and productive career in rangeland research and range management. During the summer of 1910, 1911, and 1912 he worked for the Forest Service, U.S. Department of Agriculture, on range reconnaissance and timber reproduction studies on the Nebraska and Coconino National Forests.

Chapline received his permanent appointment with the Forest Service in 1913. From 1913 until 1920 he worked in the Branch of Grazing as a grazing assistant and grazing examiner, where he was a pioneer in range research. Among other assignments he worked with Dr. Arthur W. Sampson at the Great Basin Experiment Station on the Manti National Forest near Ephraim, Utah. He played an important role in establishing some of the early grazing studies on the Jornada Experimental Range in Southern New Mexico.

From 1920 to 1925 Chapline was Chief of the Office of Grazing Studies in the Branch of Grazing. During this period he worked under such well-known rangemen as Will C. Barnes and James T. Jardine.

IN 1926 THE OFFICE OF GRAZING STUDIES was renamed the Division of Range Research and transferred to the Branch of Research in the Forest Service. Chapline was moved to this new research unit, first with the title of Senior Inspector and later as Chief of the Division of Range Research, where he served until his retirement in 1952. He gave excellent national leadership and supervision to the Forest Service range research program during this period.

One of Chapline's early assignments in the Division of Range Research was to prepare the range research portion of "A National Plan for American Forestry," an analysis of problems and a plan for organizing and financing research under Regional Forest and Range Experiment Stations. The plan received financial authorization and support under the McSweeney-McNary Forest Research Act. The first substantial financial increases came in 1931. Thus, the transfer of Grazing Studies from Administration to Research gave Chapline the opportunity to work with others in expanding the scope of range research nationwide, to recruit and train qualified personnel and to improve program efficiency.

In 1980 Chapline summarized the history of the first ten years of the Office of Grazing Studies and presented it in a landmark paper at the 1980 Annual Meeting of SRM in San Diego. This was published in the December, 1980, issue of *Rangelands.*

FOLLOWING HIS RETIREMENT FROM THE FOREST SERVICE, Chapline devoted full time in stimulating and enlightening international programs of range and forestry conservation and use. In 1952 he accepted the position of Chief of the new Forest Conservation Section in the Food and Agriculture Organization of United Nations at Rome, Italy. He served there until 1954. He actively participated in many international conferences and scientific meetings and was Executive Secretary of the Organizing Committee for the Sixth International Grassland Congress at State College, Pennsylvania. He worked with FAO and ICA, served as professor in graduate courses on range and pasture management in Uruguay and Brazil, and served as a range consultant to the governments of several South American and European countries. He continued as consultant on international programs for U.S. and international organizations until 1984. During his career he travelled extensively visiting range and pasture programs in 78 countries. He was highly effective in promoting good resource management in other countries and thereby furthered SRM international objectives.

W.R. Chapline was the author and co-author of numerous publications on range management, range research, and conservation including co-authorship with H.H. Bennett of USDA Circular 33, "Soil Erosion, a National Menace," which helped focus national attention on soil erosion and led to the establishment of the Soil Conservation Service. It also strengthened forest and range watershed research in the Forest Service. In 1936 he served as one of the authors of "The Western Range," Senate Document No. 199, 74th Congress, which outlined the major problems on millions of acres of the Public Domain and eventually led to the management of these valuable public lands. In more recent years he authored many articles dealing with the range problems and range management activities in other countries.

CHAPLINE UNSTINTINGLY DEVOTED TIME AND EFFORT to promote formation and development of the Society for Range Management. In the summer of 1946 he enthusiastically endorsed the concept of the new Society. He has continued to serve the organization in many ways. He was a charter and life member. In 1967 in recognition of his

eminent contributions he was presented the Society's Outstanding Achievement Award. In 1977 he was made Fellow of the Society.

In addition to his affiliation with the Society for Range Management, Chapline was a member of numerous other conservation organizations, as well as the Grange, Sons of the Revolution, Sigma Xi, Alpha Zeta and the Masonic Order. He was an active member of the First Church of Christ, Scientist.

W.R. Chapline's strong committement to excellence will be perpetuated in the Society for Range Management by establishement of two endowments. These will provide for annual awards—one, the Chapline Land Stewardship Award, and the other, the Chapline Research Award. Even though Chapline could not be there when these awards were first presented at the 1987 Annual Meeting in Boise, Idaho, he was beautifully represented by his two daughters Barbara Waldner of Downers Grove, Illinois, and Ridgely Peterson of Salmon, Idaho, who were at the banquet.

Many of us remember one of Chap's favorite words: "indubitably." As a premier rangeman he was *indubitably* in the top bracket!

Chapline was preceded in death by his wife Eva Behn Chapline in 1965. He is survived by his two daughters; a brother, George F. Chapline, Sr., of La Jolla, California; five grandchildren and one great-grandson.

Current Literature

The section has the objective of alerting SRM members and other readers of *Rangelands* of the availability of new, useful literature being published on applied range management. Readers are requested to suggest literature items—and preferably also contribute single copies for review—for including in this section in subsequent issues. Personal copies should be requested from the respective publisher or senior author (address shown in parenthesis for each citation).

The Application of Behaviorial Concepts to Livestock Management; by D.F. Balph and M.H. Balph; 1986; Utah Sci. 47(3):78-85. (Bulletin Room, College of Agric., Utah State Univ., Logan, Utah 84322) Applied concepts such as group versus individual activities, grazing motivation, hoof action, diet training/learning and aversion, and their manipulation to short duration grazing.

Controlling Yellow Starthistle; Economic Considerations; by R.L. Smathers, R.O. Brooks, and E.L. Michalson; 1985; Idaho Agric. Expt. Sta. Bul. 650; 8 p. (Bulletin Room, Agric. Expt. Sta., Univ. Ida., Moscow, Ida. 83843; $1) Considers the introduction and spread, eradication and control, economic considerations, and societal relationships of this noxious plant.

Cattle and Sheep Diets on Low Elevation Winter Range in Northcentral New Mexico; by Jerry L. Holechek, Jennifer Jeffers, Thor Stephenson, Charles B. Kuykendall, and S. Ann Butler-Nance; 1986; Amer. Soc. Anim. Sci., West. Sect. Proc. 37:243-248. (Dept. Anim. & Range Sci., N. Mex. State Univ., Las Cruces, N. Mex. 88003) Determined forage species selection and dietary overlap of cattle and sheep during winter in northcentral New Mexico.

Crested Wheatgrass: Its Values, Problems, and Myths; Symposium Proceedings, Logan, Utah, October 3-7, 1983; by Kendall L. Johnson (Ed.); 1986; Utah State Univ., Conf. and Inst., Logan, Utah; 348 p. (Order from the publisher at Logan, Utah 84322; $15) Papers of a 1983 symposium directed to the state-of-the art associated with this important range plant.

An Economic Analysis of Brush Control Practices and Grazing Systems in the Rolling Plains of Texas; by L.W. Vantassell and J.R. Conner; 1986; Texas Agric. Expt. Sta. Misc. Pub. 1619; 13 p. (Bulletin Room, Agric. Expt. Sta., College Station, Texas 77843) Targeted specifically three grazing systems (i.e. yearlong continuous, deferred rotational, and cell-designed rotational) and brush control methods for mesquite, juniper, and sand shinnery oak.

Compiled by John F. Vallentine, Professor of Range Science, Brigham Young University, Provo, Utah 84602.

An Economic Analysis of Intensive Early Stocking; by D.J. Bernardo and F.T. McCollum; 1987; Okla. Agric. Expt. Sta. Res. Rep. P-887; 35 P. (Contact: F.T. McCollum, Anim. Sci. Bldg., Stillwater, Okla. 74078) Reviews the studies in Kansas and Oklahoma on this special grazing treatment and considers its possible influences on enterprise economics and risk and its integration into a ranching operation.

Effects of Early Weaning on Calf Gain and Cow Performance and Influence of Breed, Age of Dam, and Sex of Calf; by J.A. Basarab, F.S. Novak, and D.B. Karren; 1986; Can. J. Anim. Sci. 66(2):349-360. (Anim. Ind. Div., Alta. Agric., Edmonton, Alta. T6H 5T6) Found that early weaning and one-month preconditioning would require a price advantage of calves so treated, that cow reproductive performance was not affected, but that cow winter maintenance requirements were benefitted.

Forage Intake of Rangeland Beef Cows with Varying Degrees of Crossbred Influence; by M.W. Wagner, K.M. Havstad, D.E. Doornbos, and E.L. Ayers; 1986; J. Anim. Sci. 63(5):1484-1490. (Anim. & Range Sci. Dept., Mon. State Univ., Bozeman, Mon. 59717) Concluded that genotype of free-ranging cattle did affect range forage intake but that genotype × environment interactions were variable.

The Future of Forage Quality Evaluation; by Gordon C. Marten and Neal P. Martin; 1986; Forage & Grassland Conf. 1986:7-19. (USDA-ARS, Univ. Minn., St. Paul, Minn. 55108) Evaluated current and developing laboratory methods for forage quality evaluations with special emphasis on voluntary intake and digestion.

Grazing Research in Texas, 1980-1985; by J.W. Stuth, D.D. Briske, J.R. Conner, and R.K. Heitschmidt, et al. (Eds.); 1986; Texas Agric. Exp. Sta. Cons. Prog. Rep. 4416-4457; 68 p. (Bulletin Room, Agric. Exp. Sta., College Station, Texas 77843) Summarizes and applies a wide range of grazing research results to Texas rangelands.

A Guide for Planning and Analyzing a Year-Round Forage Program; by Steven S. Waller, Lowell E. Moser, and Bruce Anderson; 1986; Neb. Agric. Ext. Cir. 86-113; 19 p. (Bulletin Room, Coll. Agric., Univ. Neb., Lincoln, Neb. 68583) Provides background information on estimating livestock forage demand, annual forage production, suggested initial stocking rates, and role of harvested forages and suggests procedures in developing livestock-forage programs.

Juniper Chaining: A Vegetative and Soil Erosion Assessment of a Method of Rangeland Improvement on Fort Hood, Texas; by Victor E. Diersing, Billy R. Jones, Steven D. Warren, Dennis M. Herbert, and Edward W. Novak; 1987; USA-CERL Tech. Rep. N-87/05; 40 p. (Natl. Tech. Info. Serv., Springfield, Va. 22161) Found chaining was a highly effective method of eliminating pure stands of Ashe juniper trees and increasing the amount of open space.

Knapweeds of Washington; by Ben F. Roche, Jr., Gary L. Piper, and Cindy Jo Talbott; 1986; Wash. Agric. Ext. Bul. 1393; 42 p. (Bulletine Room, Coll. Agric., Wash. State Univ., Pullman, Wash. 99164; $3) Covers 14 knapweed species; includes a key to species and summarizes the description, habitat and occurrence, seed production and dispersal, and control of each.

Mechanisms Controlling Feed Intake in Ruminants: A Review; by .A. Baile and C.L. McLaughlin; 1987; J. Anim. Sci. 64(3):915-922. (Monsanto Co., St. Louis, Mo. 63198) Reviews present understanding of central nervous system, hormonal, and gastrointestinal controls of feed intake by ruminants.

Montana Pine Needles Cause Abortion in Beef Cattle; by Jess L. Miner, Robert A. Bellows, Robert B. Staigmiller, Mark K. Peterson, et al.; 1987; Mon. AgRes. 4(1):6-9. (Bulletin Room, Agric. Expt. Sta., Montana State Univ., Bozeman, Mon. 59717) Reports results of inducing abortion by feeding ponderosa pine needles, along with associated visual and endocrine changes in the dams.

Methods for Evaluating Riparian Habitats with Applications to Management; by William S. Platts, Carl Armour, Gordon D. Booth, Mason Bryant, et al.; 1987; USDA, For. Serv. Gen. Tech. Rep. INT-221; 117 p. (USDA, Intermtn. Res. Sta., 324-25th St., Ogden, Utah 84401) Based on the contributions of 13 different scientists, this report develops a standard way of measuring and evaluating riparian habitats with applications to documenting, monitoring, and predicting the effects of management decisions.

Nebraska Range and Pasture Grasses (Including Grass-like Plants); by J. Stubbendieck, James T. Nichols, and Kelly K. Roberts; 1985; Neb. Agric. Ext. Cir. 85-170; 75 p. (Agric. Communications, Univ. Neb., Lincoln, Neb. 68583; $2) This revised edition discusses in detail the identification, distribution, uses and values of 64 grasses and 6 grass-like plants selected as being the most important on range and pasture in Nebraska.

Predicting Feed Intake of Food-Producing Animals; by Natl. Res. Counc., Comm. Anim. Nutr.; 1987; Natl. Acad. Press, Washington, D.C. 20418; $15.95) Discusses control mechanisms of feed intake and quantifies intake for each of the animals commonly used for food and fiber in the U.S., i.e. includes separate chapters on fishes, swine, poultry, dairy cattle, beef cattle, and sheep.

Proceedings—Pinyon-Juniper Conference; by Richard L. Everett (Comp.); 1986; USDA, For. Serv. Gen. Tech. Rep. INT-215; 581 p. (USDA, Intermtn. Res. Sta., 324-25th St., Ogden, Utah 84401) A proceedings of the more than 90 papers presented at a symposium held January 13-16, 1986, at Reno, Nev.; emphasis given to recent research emphasizing ecology and management of pinyon-juniper ecosystems.

Proceedings—Symposium on Plant-Herbivore Interactions; by Frederick D. Provenza, Jerran T. Flinders, and E. Durant McArthur; 1987; USDA, For. Serv. Gen. Tech. Rep. INT-222; 179 p. (USDA, Intermtn. Res. Sta., 324-25th St., Ogden, Utah 84401) Papers presented at a symposium held Aug. 7-9, 1985, at Snowbird, Utah; this is the fourth symposium in a series on shrub biology and management and dealt with plant-animal interactions with emphasis on woody plants and mammalian herbivores.

Rangeland Analysis (Laboratory Manual for Agronomy 444/844); by James Stubbendieck and Walter Schacht; 1986; Univ. Neb.-Lincoln, Lincoln, Neb.; 98 p. (Copies limited; contact the senior author at Dept. Agron., Univ. Neb., Lincoln, Neb. 68583) Comprises instructions for 13 laboratory exercises, beginning with learning the concepts of sampling and measurement in the laboratory using the Schultz Artificial Sampler and then extending these techniques to field work.

Shifts in Cattle and Sheep Diets Under Various Grazing Systems on Mountain Pastures; by R.L. Senft, J.E. Bowns, and C.F. Bagley; 1986; Amer. Soc. Anim. Sci., West. Sect. Proc. 37:252-254. (Dept. Anim., Dairy & Vet. Sci., Utah State Univ., Logan, Utah 84322) Results suggested interactions of availability of individual forage species, plant species palatability, and relative selectivity of animal species are the principal impacts of grazing systems on livestock diets.

Short Duration Grazing; by Kenneth D. Sanders, Lee A. Sharp, and Michael A. Siebe; 1986; Pages 1-8 *In:* James A. Tiedeman (Ed.); Proceedings of the Short Duration Grazing and Current Issues in Grazing Management Shortcourse; Wash. State Univ., Pullman, Wash. (Contact: Ken Sanders, Range Management Specialist, Idaho Ext. Serv. 1330 Filer Ave. East, Twin Falls, ID 83301) Reviews five years of data comparing continuous, deferred, and short duration grazing at the Lee A. Sharp Expt. Area, Cassia Co., Idaho.

Uinta Basin Flora; by Sherel Goodrich and Elizabeth Neese; 1986; U.S. Govt. Print. Office, Washington, D.C.; 320 p. (Contact U.S. Govt. Print. Office or USDA, For. Serv., Ogden, Utah 84401 on availability and price; soft cover; 8 1/2 × 11 in.) Includes about 1,660 specific and subspecific taxa of vascular plants; arranged alphabetically by family, genus and species; omits description of species but provides data on distribution and site; intended as a field manual.

Winter Preference, Nutritive Value, and Other Range Use Characteristics of *Kochia prostrata* (L.) Schrad; by James N. Davis and Bruce L. Welch; Great Basin Nat. 45(4):778-783. (USDA, Shrub Sciences Lab., 735 N. 500 E., Provo, Utah 84601) Determined the preference of tame mule deer for 13 accessions of forage kochia and summarized the results of research on its nutritive value.

Capital Corral

There they go again . . . Interchange legislation to swap management of 23 million acres between the Bureau of Land Management and the Forest Service was sent to Capitol Hill April 23 by the Secretaries of Interior and Agriculture. The proposed bill, "essentially the same" as last year's version, would also transfer mineral management authority to the Forest Service. Unofficial predictions on chances of getting the bill passed as presently conceived range from "slim" to "none".

The report persists that the Forest Service will get a political appointee to oversee its planning process. Originally, plans called for a new Deputy Chief position with broad authority over both the Resources Planning Act (RPA) process and the National Forest Management Act's land management plans. It was widely reported that Douglas MacCleery, Deputy Assistant Secretary of Agriculture, who came to USDA with former Asst. Secretary John Crowell six years ago, would be selected to fill the position. When professional groups, conservation organizations and key committee chairmen in the Senate and House expressed concern, the approach changed, and the proposal became an "Assistant Chief" presumably without line authority, but with the continuing report that MacCleery would get the job.

Objections to the rumored placement focus not on MacCleery's professional status (he is a graduate forester), but on his background as the timber industry's point man on forest planning dating back to the days of the Committee of Scientists when he represented the National Forest Products Association. He had a strong role as Crowell's deputy in revising land management planning regulations and in reviewing appeals arising from the planning process. Conservationists have expressed concern about the precedent that could be set by breaking the 80-plus year tradition of

career professionals in leadership roles in the FS.

SRM President Jack Miller, accompanied by Executive Vice-President Pete Jackson testified before the House Appropriations Committee April 7 on appropriations requests for the Cooperative State Research Service, Agricultural Research Service, Extension Service, Soil Conservation Service, and Agricultural Stabilization and Conservation Service. He called for restoration of 1987 appropriation levels where Administration budgets had reduced or eliminated several line items. He urged funding to enable SCS to respond to the demands of the Food Security Act of 1985, including the Conservation Reserve Program, while maintaining SCS capability to maintain ongoing programs such as the Great Plains Program and Emergency Flood Repair. A similar statement was submitted to the Senate Appropriations Committee on April 8.

A second modern office building is rising amidst the hardwood forest at the Renewable Natural Resources Center in Bethesda, Maryland. The 22,000 square foot building of masonry, glass and a slate mansard roof is scheduled for completion in September 1987. The Center is located on a 35-acre tract—formerly the estate of Gilbert H. Grosvenor of the National Geographic Society.

In announcing the new building, Carl R. Sullivan, chairman of the Renewable Natural Resources Foundation (RNRF), observed that it will permit scientists, professionals and educators to pool facilities and expertise at a common site. SRM is a member of RNRF.

RNRF is developing the exclusive office park complex and environmental center for natural resources and other nonprofit organizations. The Center will ultimately have 300,000 square feet of new offices, including a 16,500-square foot conference center. The new building will bring the total area of office space at the Center up to approximately 50,000 square feet.

Reduced erosion is saving 209 million tons of soil annually on the initial 8.2 million acres of land enrolled in 1986 in the U.S. Department of Agriculture's Conservation Reserve Program, said Wilson Scaling, chief of USDA's Soil Conservation Service.

"The information we've collected so far indicates that the program is exceeding our expectations," Scaling said. The data is based on acreage from the first three sign-up periods, all in 1986. More than 10 million acres of land were added in the February 1987 signup, but erosion reduction information is not yet available.

The goal of the CRP is to retire 40-45 million acres of highly erodible cropland by 1990. SCS officials say if that goal is met, approximately 825 million tons of soil will be saved each year.

"The average annual erosion rate on the 8.2 million acres contracted under CRP in 1986 will drop from 27.3 to 1.9 tons per acre when in permanent cover," Scaling said.

"Our information shows that USDA is enrolling land with a very high erosion rate—that is the intention," Scaling said. "Generally, the states with the highest amounts of erosive land are the states having the highest numbers of acres enrolled in the program."

Farmers from 44 states and Puerto Rico are participating in CRP with Texas and Colorado having the largest numbers of acres contracted through 1986.

The Sodbuster provision of the Food Security Act of 1985 remains intact after an amendment effort in the Senate fell short. The so-called Zorinsky amendment (introduced shortly before the late Senator's death) would have exempted growers of grass (seed), alfalfa and other legumes from penalties under Sodbuster. Conservation organizations, fearing the consequences of unnecessarily opening up a loophole, worked to head off the proposal. Senators Armstrong, R-CO, and Nunn, D-GA, authored a substitute "Conservation Amendment" allowing farmers who have been using alfalfa in an approved rotation schedule to grow row crops under a conservation plan. Because of SCS policy on administering the sodbuster provision, further relief was considered unneeded.

Other changes in the '85 Farm Bill to be discussed in coming months. Among these: status of FmHA foreclosed lands with respect to the Conservation Reserve, or even a new system of Land Utilization Projects in public ownership. The long-term future of Conservation Reserve lands—after the first ten years of the program—is of paramount concern to conservationists. Related to this issue is the question of permitting or even encouraging certain uses on CR lands in order to establish economically viable alternatives to cropping; that will clearly be a controversial subject.

Rep. Buddy Darden, D-GA., has introduced fees on federal lands at rates comparable to what ranchers in that area would have to pay for grazing rights on private lands, reports AgriData News Service. Darden cited a study conducted by the FS and BLM that estimated that grazing rights on private land in the West cost about $6.25 per month. An Executive Order issued last February indefinitely froze fees for public land grazing rights at $1.35 per month, says AgriData. But the National Cattlemen's Assn. (NCA) argues that fees are comparable to private land fees, when all costs associated with grazing animals on public lands are added up. The chairman of NCA public lands committee said that study is not accurate because of changing economic conditions in the West. Since the study was conducted, land values have gone down and interest in leasing land has decreased.

Sterile screwworm flies were released in Miami, Fla., and Albuquerque, N.M., to combat a potential outbreak of screwworms, a serious pest of livestock.

The action followed identification April 21 of screwworm larvae in a hunting dog which passed through the airports in Miami and Albuquerque while being returned to the United States from Venezuela, according to Bert W. Hawkins, administrator of USDA's Animal and Plant Health Inspection Service.

In 1966, the United States was declared free of screwworms, thanks to a cooperative program between industry and the federal governent involving the release of billions of sterile flies, Hawkins said. Small infestations have occurred since then, mostly along the Mexican-U.S. border. The last such infestation was in Texas in August 1982.

Resource managers, conservation and industry leaders, and park and recreation planners from Europe, Canada and the U.S. will convene at the Lodge of the Four Seasons, Lake Ozark, Mo., on Nov. 8-11, 1987, for the world's first International Outdoor Ethics Conference.

The conference will be hosted by the Izaak Walton League.

For more information, including brochures and registration materials, write to IWLA, Box 10EC, 1701 N. Ft. Myer Dr., Suite 1100, Arlington, Va. 22209.

—**Ray Housley,** SRM Washington Representative

President's Notes

As I sit down to write this message to the members of SRM, there is a feeling of Spring in the air. It is a time to look forward to a new season with anticipation and renewed vigor. There are many challenges that lie ahead for the range management profession. The only way those challenges can be overcome is through us, range managers, working together. It matters not whether we are ranchers, educators, employed land managers, commercial providers, or researchers. Whatever our avocation, the part that each of us has to play is important. I'm glad to be a part of it.

Washington, D.C. Liaison—In early April, Pete Jackson and I had the opportunity of spending the better part of two weeks in the Washington, D.C., area. I say opportunity— if you consider being on a dead run the whole time an opportunity. We sure covered the ground, and I came away with an even healthier respect for the job our liaison folks are doing. Ray Housley and George Lea truly deserve a big thank you from all of us.

We visited with legislators, Department and agency heads, and people from other natural resources organizations. There are many contacts within that relatively small area and there is certainly a strong thread of common interest that range management fits in with. Our efforts to establish stronger liaison in the National Capital are paying off. We got the definite feeling the range management message is being heard more and more.

Emphasis for 1987—In the last President's Notes, I said I would talk about one of the areas of emphasis in each issue of *Rangelands*. The emphasis item for this month is *"Recognition of Role of SRM as Leader in the Range Profession."*

SRM is the organization in a position to best represent all aspects of the range management profession. It is important that SRM assume a leadership role and that the Society be viewed by its members and the public in that light. The emphasis on recognition of leadership is woven into the 1987 objectives for all the committees of the parent society. It should also be in the forefront of Section activities.

Some examples of initiatives that promote recognition of leadership include:

—Evaluate range management curricula to best meet present and future needs of the profession.

—Provide the public with factual information regarding the importance and health of range resources.

—Provide on-the-ground resource managers with incentive and knowledge to properly manage range resources.

—Recognize excellence within the profession.

—Initiate productive coalitions with other organizations with similar goals for management of natural resources.

—Promote active range research programs to develop needed technology.

The list could go on. I'm sure you have other ideas of how the SRM can exert leadership. The important thing is that we do it. Each of us, the Parent Society, the Sections, and as individuals, must consciously develop leadership skills and apply them through our profession and within our personal lives.

The SRM presently has a Leadership Development Task Group that is looking into ways the Society can be more effective in this area. I encourage all of you to also work on developing your own leadership skills. Recognition will come along with it.—**Jack Miller**, President, SRM

Executive Vice-President's Report

I heard an expression a long time ago that just might describe how busy we have been for the last two months. The expression describes a person as being as busy as a one-armed paper hanger. Frankly, I know what that person must have felt like with all the activities that have been going here in Denver and Washington D.C.

I had the privilege of accompanying our President Jack Miller and his wife Janice to our national capital, and it was both fun and exhausting. What a pace we kept trying to make all the appointments that were made by our Washington Representative Ray Housley! Our agenda included meeting with Congressional staff, Federal Agency personnel at all levels, and several meetings with representatives of private organizations with similar interests. It seemed that every meeting had a very important subject of concern to the Society or we were asked to join in some vital action. When you sit back and think about it, I just wonder if we haven't turned loose a monster in the form of our Washington, D.C. Rep. He simply never stops going, and every day SRM is more involved. How we are ever going to handle the load is beyond me. But like the old cowboy said, that stew is sure salty but that's just the way I like it.

If you will recall, I have been asking our membership if anyone had a computer they would like to donate to the Society. I was all prepared to continue my quest, this time with a neat one liner: "Is anybody out there?" Well, there was, and now we have a fine second computer for our Denver office. I would like to thank the anonymous donor right now on behalf of every member of the Society for this generous gift. We all appreciate it from the bottom of our hearts. Now why won't you let me give out your name? I think everyone should know.

Without question the most hectic time has been the last two weeks as we moved our offices to the new building at 1839 York St. 80206. This move also required a new phone number: 303-355-7070. Please make these changes in your files.

I want to thank a lot of people for their help during this period, particularly the staff. Every person rolled up their

sleeves and did a super job packing, hauling, unpacking, and cleaning. In addition, thanks to the folks from Colorado State University and the University of Wyoming who spent a long, hard day hauling truck load after truck load of heavy boxes from one office to the other. That was truly an example of devotion to our Society.

In fact we have been receiving a great deal of special attention lately. I will not use names, but one of our members donated his building note to the new office and a second fine person wrote President Jack Miller a letter saying if everyone contributed just a dollar and a half per month for the next five years we would pay the new building right off. Just to prove his point he included a check to cover his full share. Now that's putting your money where your mouth is, as the old saying goes.

I am going to mention the name of one of our fine long-term members. Nelda Linger is initiating an intriguing idea for fund raising for our endowment. Please look for her letter in this issue. It's easy to figure, and not hard on any one. She simply has challenged us all to donate one dollar for every year that we have been a member. Again to prove her point she delivered the first check representing the combined total of Lyman's and her years of membership. This neat idea really touched me and I am going to do the same, won't you?

There are countless other indications of support and loyalty, but I will stop right there with those latest ones before I get in trouble by overlooking some one equally generous.

Did you people realize that our Editor Pat Smith has never had a window in her office for all these years. It just made me feel good to hear her humming around in her new office complete with 110 panes of glass. I'm not sure she can stand the pleasure of watching the world go by.

I always have to growl about something or it wouldn't be normal. We need to put stronger emphasis on the sale of publications. *Range Research* has slowed down to a trickle. Please show your copy to someone who needs one and ask them to send in an order.

In addition, membership is everyone's job without exception. If you're a new member, sign up a friend; if you're an old timer, get up and go, you folks. You know why your professional Society is so vital to your career and the science and art of range management.

Two final points: first, stop by the new office; we are all very proud and would be pleased to give you a complete tour. Second and final point. You won't believe it, but it's true: the *35-Year Index* is off the press and in our office waiting for your order. We have priced them at $10 per single copy with a discount for larger orders. It looks good and you certainly need to have your own personal copy handy for quick reference.

As always, thanks for your patience. There will be a lot of delays and mistakes until everything is back in place, but we are going to do our level best to supply the best service possible. See you at the Summer Board Meeting at Arcata, California. It sounds like a great affair.—**Peter V. Jackson,** Executive Vice-President, SRM.

1987 Winter Meeting, SRM

Advisory Council

The Advisory Council of the Society for Range Management met on February 8, 9, and 10, 1987, with Bill Krueger presiding. The perennial concerns of membership, membership structure, dues, and better communication about SRM to the general public and within SRM were discussed. Items recommended to the Board of Directors for action include: support of HR 357 (Extension of the Renewable Resources Extension Act); the SRM noxious weed resolution to be incorporated into the SRM plan of work; nomination of the Santa Rita Experimental Range headquarters area for the National Register of Historic Places; dues notices at the end of 1987 to include the option of receiving the *Journal of Range Management* only, *Rangelands* only, or both publications, all at the same cost; support of the Conservation Reserve Program Symposium to be sponsored by the Colorado Section; that the Pacific Northwest Section host the 1992 annual meeting; authorization of Sections to sell subscriptions to *Rangelands* on a "cost" basis with 50/50 split of the cost paid by the Section and the parent society, on a 1-year trial basis to increase the circulation of *Rangelands;* investigate ways of getting *Rangelands* information to a broader audience of resource professionals; the Advisory Council also became the vehicle through which Coordinated Resource Management advocacy teams in the United States will be formed between the SRM and the National Association of Conservation Districts. The majority of the recommendations have been acted upon by the Board of Directors or placed for committee action.

Within the Advisory Council several specific reports were presented including: the structure and function of SRM by John Brock (AZ); an Ecological Conservation Field Tour for 6th grade students in Texas by Mark Moseley (TX); overview of the SRM retreat held in Denver in December 1986 by Bill Krueger (PNW); *Journal of Range Management* and *Rangelands* economic report by Bill Laycock (WY); and women in SRM by Katherine Mitchell (NM).

Lines of communication were kept open by committee reports to the Advisory Council, items being recommended to committees by the Advisory Council, joint meetings with the Board of Directors and reports from Presidents Busby and Miller and Executive Vice-President Jackson. The chair-elect of the Advisory Council is Wayne Vander Vorste (SD). Agenda items for the summer 1987 meeting in Arcata, CA, can be routed through your Section representatives, the Denver office of the 1987 Chair of the Advisory Council, John Brock, Division of Agriculture, Arizona State University, Tempe, AZ 85287. (602) 965-7036.

Journals for Sale

I have professionally bound volumes of the SRM *Journal* from 1954-present (volume 7-present) that I would like to sell for a reasonable price. I also have all copies of the *Rangelands* publication I would throw in free. If anyone is interested they may call 913-674-3651 (home) or 913-674-3491 (work) or write to: Dan Nosal, 316 S. East St., Hill City, KS 67642.

1st Graduate Student Papers Contest Rated Successful

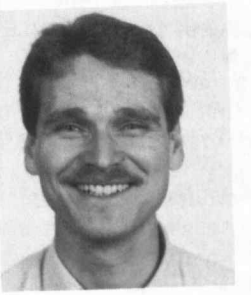
Graduate students from Utah State University and Colorado State University were selected for the most outstanding papers presented from 22 entries at the 40th Annual Meeting of SRM at Boise, Idaho.

Papers were evaluated during their presentation in technical sessions by a panel of judges who rated each paper according to presentation skills and content. Utah State students captured both places in the Ph.D. category and second place paper in the M.S. category. A Colorado State University student placed first in the M.S. category. All contestants were congratulated and received comments regarding methods for improving future presentations.

First place winners in each category received a $50 cash prize; second received a $30 award. The contest was conducted for the first time at the 1987 Annual Meeting and will be held in conjunction with future annual meetings provided interest and participation continue. Graduate students wishing to enter the 1988 competition should refer to future announcements in *Rangelands* and *SRM Notes*.

1987 Graduate Student Papers Contest Winners

Ph.D. category

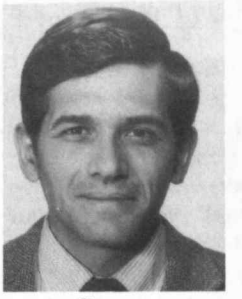


Jefferson

1st Place—Paul G. Jefferson

Citizenship—Canadian
B.S. 1978—University of Guelph, Ontario, in Crop Science
M.S. 1981—University of Guelph, Plant Breeding & Genetics
Current—Ph.D. candidate in Range Science at Utah State University while on leave from the Agriculture Canada Research Station, Swift Current, Saskatchewan.

Title of Paper:
"Environmental and Genetic Effects on Epicuticular Wax of Some Range Plant Species" by P.G. Jefferson, D.A. Johnson, K.H. Asay, and M.D. Rumbaugh.



Flores

2nd Place—Enrique R. Flores

Citizenship—Peruvian
B.S. 1973—Agric. State Univ., La Molina, Peru, in Animal Husbandry
M.S. 1982—Utah State University in Range Science
Current—Ph.D. candidate in Range Science at Utah State University studying range sheep production

Title of Paper:
"Effects of Experience in the Development of Foraging Skills of Range Sheep" by E.R. Flores, F.D. Provenza, D.F. Balph, and C.C. Parker

M.S. Category

Ragotzkie

1st Place—Kim Elizabeth Ragotskie

Citizenship—American (Wisconsin)
B.A. 1982—Western State College, Gunnison, Colorado, in Biology
Current—M.S. candidate in Wildlife Biology at Colorado State University while working part-time as a biological technician for the U.S. Forest Service, Rocky Mtn. Forest and Range Exp. Sta.

Title of Paper:
"Mule Deer Habitat Use in Grazed and Ungrazed Pastures of the Santa Rita Experimental Range, Arizona" by K.E. Ragotzkie and J.A. Bailey.

Thorhallsdottir

2nd Place—Anna Gudrun Thorhallsdottir

Citizenship—Icelandic
Education:
1977—Agricultural Diploma, Agricultural College, Hvanneyri, Iceland
1981—Agricultural degree, Agricultural University of Norway
1982—Minor in Statistics and Plant Physiology, Agricultural University
1985—M.S. Utah State University in Range Science
Current—Ph.D. candidate in Range Science at Utah State University

Title of Paper:
"Role of Social Models in the Development of Dietary Habits in Lambs" by A.G. Thorhallsdottir, F.D. Provenza, and D.F. Balph.

Texas A&M Retires Traveling Plaque

Eighty-nine contestants representing 20 colleges and universities from throughout the United States, Mexico, and Canada competed in the 1987 International Range Plant Identification Contest at the SRM Annual Meeting in Boise, Idaho. Texas A&M University captured first place team honors with 2,905 points out of a possible 3,000 points. The victory for Texas A&M, coached by **Dr. Robert Knight,** was their third win in recent years, therefore retiring the traveling plaque.

Members of the first place team were **Mark Francis, Carolyn Fey, Carlon Stapper,** and **Ann Hoover.**

Second place honors went to the team from Universidad Autonoma Agraria (Antonio Narro). Coached by **Lucio Rodriguez,** the team scored 2,893 points. Team members were **Dagoberto Lopez, Cristobal Rosas, Mario Manzano, Juvenal Gutierrez, Gelasio Huerta, Heriberto Olivaras, and Daniel Ibarra.**

New Mexico State University, coached by **Dr. Kelly Allred,** won third place team honors with 2,797 points. Team members were **Julie Kent, Amy Lester, Kimberley Hackett, Doug Romig, Sherwood Tubman, Leticia Gallegos, Doni Franks, and Katherine Mitchell.**

The first place individual scoring 982 points was **Juvenal Gutierrez** of Antonio Narro. Also from Antonio Narro was the second place individual, **Mario Manzano,** who scored 971 points. The third, fourth, and fifth place individuals were all from Texas A&M University. **Carolyn Fey** placed third with 970 points. **Mark Francis** and **Carlan Stapper** scored 968 and 967 points respectively.

Schools participating in the contest were University of Alberta, Angelo State University, Arizona State University, Universidad Autonoma Agraria (Antonio Narro), Universidad Autonoma de Nuevo Leon, Brigham Young University, Colorado State University, Humboldt State University, University of Idaho, Montana State University, University of Nebraska, New Mexico State University, North Dakota State University, Oregon State University, South Dakota State University, Sul Ross State University, Texas A&M University, Texas Tech Universty, Utah State University, and University of Wyoming.

Congratulations to each contestant and team coaches on their participation in the contest. Each contestant will receive a certificate from the SRM for participation in the contest.

TTU Honors Busby

Texas Tech University's Department of Range and Wildlife Management recognized Dr. F.E. (Fee) Busby as its Outstanding Alumnus for 1986.

Fee was reared at Nolan, Texas. He received the B.S. degree in agriculture education from Texas Tech in 1969 and the M.S. degree in Range Science from Texas Tech in 1970.

As a student at Texas Tech, Fee was a member of the Plant Identification Team in 1968 that won the national contest. Fee placed second in the individual competition. The same kind of spirit exhibited in the Plant I.D. Contest has been one of Fee's trademarks. After completing the M.S. degree, Fee entered Utah State University, where he earned the Ph.D. degree with emphasis on watershed management. Fee remained at USU as Extension Range Specialist before going to the University of Wyoming. In 1979 Fee was named Head of the Department of Range Science at the University of Wyoming and in 1984 he became Director of Extension at University of Wyoming.

Dr. Henry A. Wright, left, from Texas Tech University, Lubbock, Texas, and Chairman of the Department of Range and Wildlife Management, presents the Outstanding Alumnus Award to Dr. Fee Busby of Laramie, Wyo.

Fee has always been active in professional societies and civic organizations. He pursues any endeavor he undertakes with the same enthusiastic effort. He has served as a member of the Board of Directors of the Society for Range Management and its President in 1986. The Department of Range and Wildlife Management at Texas Tech is proud of Fee's accomplishments and the manner in which he has distinguished himself.

UI Honors Two

Jack Bohning and **Tom Prescott,** received honors from the University of Idaho's College of Forestry, Wildlife, and Range Sciences last month.

John W. ("Jack") Bohning, Prescott, Arizona, a 33-year veteran of the USDA Forest Service, received the Honor Alumnus Award.

The Honor Alumnus Award is given to a graduate whose career-long activities and service have brought him distinction in his chosen natural resources field.

A 1948 B.S. graduate in range management, Bohning retired in 1981 as range and wildlife staff officer for the Prescott National Forest, Arizona. He began his Forest Service career in 1948 as a member of range survey teams in the Pacific Northwest Region, moving to the Roosevelt National Forest, Colorado, for special administrative duties in 1950. In 1951, he moved to the Southwestern Region, where he spent the rest of his career. He worked on the Santa Rita Experimental Range in Arizona, trained Forest Service personnel in inspection of range analysis procedures in New Mexico, and

subsequently served as range and wildlife staff officer responsible for making range analyses and range management plans on the Kaibab, Santa Fe, and Prescott National Forests.

Bohning is author or co-author of a number of publications addressing range management and developed the 1958 edition of the Forest Service Range Analysis Handbook for the Southwestern Region. Besides teaching range analysis procedures, he taught courses at the National Fire Training Center, Narana, Arizona, and lectured to range management and basic ecology classes at Yavapai College, Prescott, Arizona.

An active Society for Range Management member, he has served the sections and parent society in many capacities.

Bohning has never lost touch with his university and college. Said Range Resources Department Head David A. Bryant, "He has a real interest in our graduates and faculty and makes an effort to keep track of their career progress and accomplishments.

Tom Prescott, a Jerome, Idaho, rancher, businessman, and civic leader, received the Honor Associate Alumnus Award. The Honor Associate Alumnus Award is given to one who, although not an alumni of the college, has given valuable support to the college's programs.

Prescott has long been a strong supporter of the university and of the Department of Range Resources, in particular, of the grazing management studies conducted at the Lee A. Sharp Experimental Area (formerly Point Springs) south of Burley.

During over 30 years of farming and ranching in the Jerome area, Prescott has received many professionally related and civic awards. An active member of the Society for Range Management, he received the Idaho Section's President's Award in 1969 and Outstanding Achievement Award in 1986. He was cited particularly for his efforts to bring together diverse special interest groups to resolve controversy over public land issues.

A leader of the range livestock industry, Prescott is past president of the Idaho Cattlemen's Association and former director of the National Cattlemen's Association. He is currently chairman of the Shoshone District Bureau of Land Management Advisory Board and a member of the National Lands Council. He has served as president of both the Western Charolais Association and the American International Charolais Association. In 1976 he was inducted into the Southern Idaho Livestock Industry Hall of Fame.

Besides his ranching operation, Prescott is also co-owner of Prescott-Craig Insurance in Jerome. He is past president of the Idaho State Independent Insurance Agent's Association, and in 1964 was named Idaho's Outstanding Agent of the Year.

ARS Honors Lane

Leonard J. Lane was cited by the U.S. Department of Agriculture as one of seven "Area Scientists of the Year."

Lane, a hydrologist at Southwest Rangeland Watershed Research, Tucson, Ariz., developed analytic models that predict chemical and water runoff and soil erosion from agricultural lands, helping solve water conservation problems in the southwestern United States.

Each area scientist award winner receives $15,000 in research support.

Samuel Receives Awards

Marilyn J. Samuel was named "Woman of the Range" at the Wyoming Section SRM meeting in Douglas. The award, presented annually to an individual who has provided outstanding leadership and contributions to the art and science of range management, is the highest award presented by the Section.

Samuel was specificially recognized for her dedicated work in public relations for the Society.

She was publicity chairman for the 1979 SRM meeting in Casper, chairman of the SRM Information and Education Committee in 1981-82, publicity chairman for the 1986 SRM Summer Meeting in Jackson, and now serves on the editorial board of *Rangelands*.

Samuel also received a new award, the "Award of Merit," for the excellent job she did as publicity chairman for the 1986 meeting.

Samuel is a botanist at USDA's High Plains Grasslands Research Station.

How Many Years for You?

At the SRM winter meeting held in Boise, Idaho, the Board of Govenors for the Endowment Fund met to discuss primarily our common desire and hopes for the future of the SRM Endowment Fund. Many of our members have expressed a desire for a plan to fit with their overall estate planning. We are endeavoring to help find ways and means for that long-range plan. However, we also feel there is a need to achieve a short-range plan to come up with "a cushion" presently.

With the approval of our Board of Directors we believe we have a painless, yet effective, method to achieve this initial fund raising. **Please listen:** "For each year that you've been a member of the Society for Range Management, send $1.00." Even if you were a charter member, the amount would be manageable in most cases.

I would like the privilege of initiating this program with my check for $65.00 for both Lyman and me.

Your "$1.00 per year" checks may be sent to the Denver office, 1839 York St., Denver, CO 80206, Attn: Endowment Fund, or to John Hunter, Chairman of the Board of Governors, Endowment Fund, 4510 20th St., Lubbock, TX 79407.

After April 15th we'll all have the dollars again, so let's go!—**Nelda D. Linger**

Requiescant in Pace

Frederic G. Renner, 89, charter and life member, Society for Range Management, died quietly in his sleep early Sunday morning, March 29, 1987, in his home in Paradise Valley, Arizona.

Fred had enjoyed a 41-year professional range career with the government; at the time of his retirement in 1961 he was Chief of the Range Management Division of the Soil Conservation Service in Washington, D.C.

Fred Renner dearly loved the Range Society and worked hard in the early days to get it organized and going. He served as its second president in 1949 and presided at the third annual meeting held in January, 1950, in San Antonio, Texas. While president he and the board of directors established the Life Membership program and he was the first to sign on as a Life Member.

Fred Renner's obituary in the April 1, 1987, *Arizona Republic* mentioned two things about Fred which few remember: "He developed snow surveys for predicting spring runoff, a practice now common in the Western mountains.

"Mr. Renner was chief of the mission for the U.N. Relief and Rehabilitation Administration after World War II. His pilot program in Greece became a model for Marshall Plan relief projects."

He was an avid fan and lover of Charlie Russell and his Western paintings and while president of the Range Society had the Russell Trail Boss approved as the official logo or emblem of the Society.

Then, in 1961 he persuaded the U.S. Postal Department to issue a Range Conservation Commemorative Stamp with the Trail Boss emblem on it. This came to pass, and the First Day Cancellation was held in Salt Lake City, Utah, during the SRM annual meeting in session there that year.

Fred established the prestigious SRM Fred Renner Award in 1971. He presented a $10,000 cash gift to SRM to establish this Award. His request was that the Award be given annually for significant and outstanding accomplishments in the field of range management and to carry an honorarium of the annual interest from the fund. The first Renner Award was given in 1972 to Peter V. Jackson, III at the 25th annual meeting of the Society, held that year in Washington, D.C. His wishes have been carried out faithfully each year since, with Jack Bohning receiving the Award in 1987 at Boise.

After his retirement from government service Fred spent the rest of his life tracking down, collecting, and identifying Russell paintings, bronzes, and water color sketches. He was a world-wide authority on Russell works. At the time of his death he had in his home more Russell paintings than could be found anywhere else. His fascination for Russell began during his boyhood in Great Falls, Montana, where he was born in 1897.

His parents and the Russells were good friends, and as Fred once said, "I had trespassing and watching privileges in Charlie's log cabin studio in Great Falls."

Fred cataloged over 4,200 original Russells and had in his files at home more than 3,000 photographs of the artists's works.

During Fred's government career and afterwards he received many honors and citations. His most recent ones were in 1983, an Honorary Doctorate Degree from Carroll College in Helena, Montana; and in 1984, an Honorary Doctorate Degree from the University of Montana at Missoula.

For further information about Fred Renner, his life and work in the Range Society,please refer to page 30, *Rangeman's Journal* for February, 1976, and page 47, *Rangelands* for April, 1980.

For those who want to contribute something to Fred's memory, a fund has been established for the Frederic G. Renner Memorial Library at Charlie Russell Museum in Great Falls.

In accordance with his wishes he was cremated and his ashes were interred next to those of Charlie Russell in Great Falls.

Benjamin B. Heywood, 71, a charter and life member of the Society for Range Management, passed away on April 1, 1987 in his home in Logan, Utah. He was born October 1, 1915 in Panguitch, Utah.

Benjamin Heywood attended the University of Utah and received a Bachelor of Science degree in forestry and range management from Utah State University in 1938. He was a veteran of World War II, serving in General George Patton's Third Army, where he was awarded two purple hearts. In 1951 he was recalled to active duty to serve with the United Nations Army in Korea, where he was awarded the Distinguished Service Medal.

Before and after his military service, Benjamin Heywood worked for the USDA Soil Conservation Service as a range management specialist in New Mexico, Colorado, and Utah. He was an active member of the Society for Range Management and promoted various programs to control sagebrush in the Western States.

William B. Picket, *Deseret News* Farm Editor, wrote of Ben in his "Farm Roundup" feature column: "Ben is an olt-timer, not in years but in experience. He grew up in Southern Utah with the idea that conservation of our natural resources is our only salvation in this dry state of Utah, and he preached this sermon constantly..."

James L. Jacobs, 78, charter member of the Society for Range Management, died Thursday, February 26, 1987, at the University of Utah Hospital. James served in the U.S. Forest Service for 40 years on nine National Forests and the regional office of the Intermountain Region. At the time of his retirement in 1968 he was branch chief of range management.

James Jacobs was born April 20, 1908, in Raymond, Alberta, Canada, and was a graduate of Utah State University in the School of Forestry. In 1959 Utah State University awarded him their Distinguished Service Award.

In addition to being a long time supporter of the Society for Range Management, James Jacobs had been an officer of the Society of American Foresters, Kiwanis Club, National Federation of Federal Employees, the Sons of Utah Pioneers, Weber Historical Society, and the Morman History Association.

Requiescat in Pace

Robert Lee Lang (1913-1987) was born in Ely, Missouri, was raised on a dryland farm in southeastern Wyoming, and served as instructor, assistant professor, associate professor, and professor of agronomy (including range management) at the University of Wyoming from 1936 to 1978. He died in Mesa, Arizona.

Dr. Lang received B.S. (1936) and M.S. (1941) degrees from the University of Wyoming, and his Ph.D. (1955) from the University of Nebraska. His memberships included Sigma XI, Phi Kappa Phi. Gamma Sigma Delta, Alpha Zeta, and the Society for Range Management. He was a consultant on a Wyoming Research team, USAID, in Somalia, Africa, in 1966. In 1972 he spent a sabbatical leave studying mine spoil reclamation in western North America, as well as England, Norway, Denmark, and West Germany. In 1953 he was recipient of the conservation award presented by the Woodmen of the World. Dr. Lang was active in the Wyoming Section (Chairman in 1953) and the Society (his various committee assignments included Publicity, Resident Agent, Civil Service, and Scholarship).

Dr. Lang was a range improvement specialist whose productive years, as measured by the bibliographic record, stretched from 1938 to 1982, 44 years of relentless devotion to the management problems at hand. Dr. Lang authored or co-authored approximately 75 publications in the fields of range improvement, reclamation, range management and agronomy. His most influential work (based on citations in the *Journal of Range Management*) was Lang and Barnes (1942) "Range forage production in relation to time and frequency of harvesting"; followed closely by Lang, Barnes and Rauzi (1956) "Shortgrass range grazing effects on vegetation and sheep gains."

About one third of Dr Lang's 75 publications were written as single author, and the other two thirds (50) were co-authored. These co-authors numbered 34, the most frequent partner being Rauzi followed by Barnes, Becker, and Beetle.

Coming to range with an economic background, Dr. Lang assessed the range with a practical (will it pay?) philosophy and did not hesitate to change any status quo by whatever means to prove his point. Among his many experiments one can point to his use of a wide variety of range manipulation practices: (1) the grazing animal, (2) fire, (3) reseeding, (4) pitting, (5) fertilizers, and (6) plant selection.

In his later years Dr. Lang sacrificed his own research work to aid, through able administration, others in theirs. Coworkers remember his pleasant personality, sense of humor, and steadfast loyalty to the field of range management which he helped to develop. This report has been prepared by his friend for 50 years (1937 to 1987), Alan A. Beetle.

Idaho Declares Rangeland Week

Jack Lavin presents Governor Andrus with a bota bag after the governor signed a proclamation designating the week of February 8 as Idaho Rangeland Week. The week coincided with the SRM Annual Meeting in Boise.

Range Plant Spelling Bee

The official rules of the "guardians" of the Society for Range Management's Range Plant Identification Contest specify that up to THIRTY PERCENT (!!!!) of the points possible to score in the test MAY BE LOST through careless misspelling errors. In view of this emphasis on spelling, a teaching-aid was developed to challenge students to simply spell the scientific names of the plants and their associated tribes or families. Hence the *Range Plant Spelling Bee* was written.

Four programs were written to handle the task. The programs run on IBM-PC type microcomputers equipped with BASICA or GW-BASIC. They pick plants at random from the current long list of possibilities. The student is prompted with simple cues which accept only one correct answer. He/she receives instant feedback for correct answers and is encouraged to try and try again when incorrect. If he/she does "give up", the correct answer is displayed with an encouragement to try another plant. Another convenient feature of each program is the integrated score-calculator which automatically displays the number of plants tested and percent correct when the student finishes a session.

The *Spelling Bee* may be purchased for $16 postpaid from SDSU Chapter/SRM, Dept. Animal/Range Sci., SDSU Box 2170, Brookings, SD 57007. Please designate "SDSU Foundation: Range Judging" on your check/money order.

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