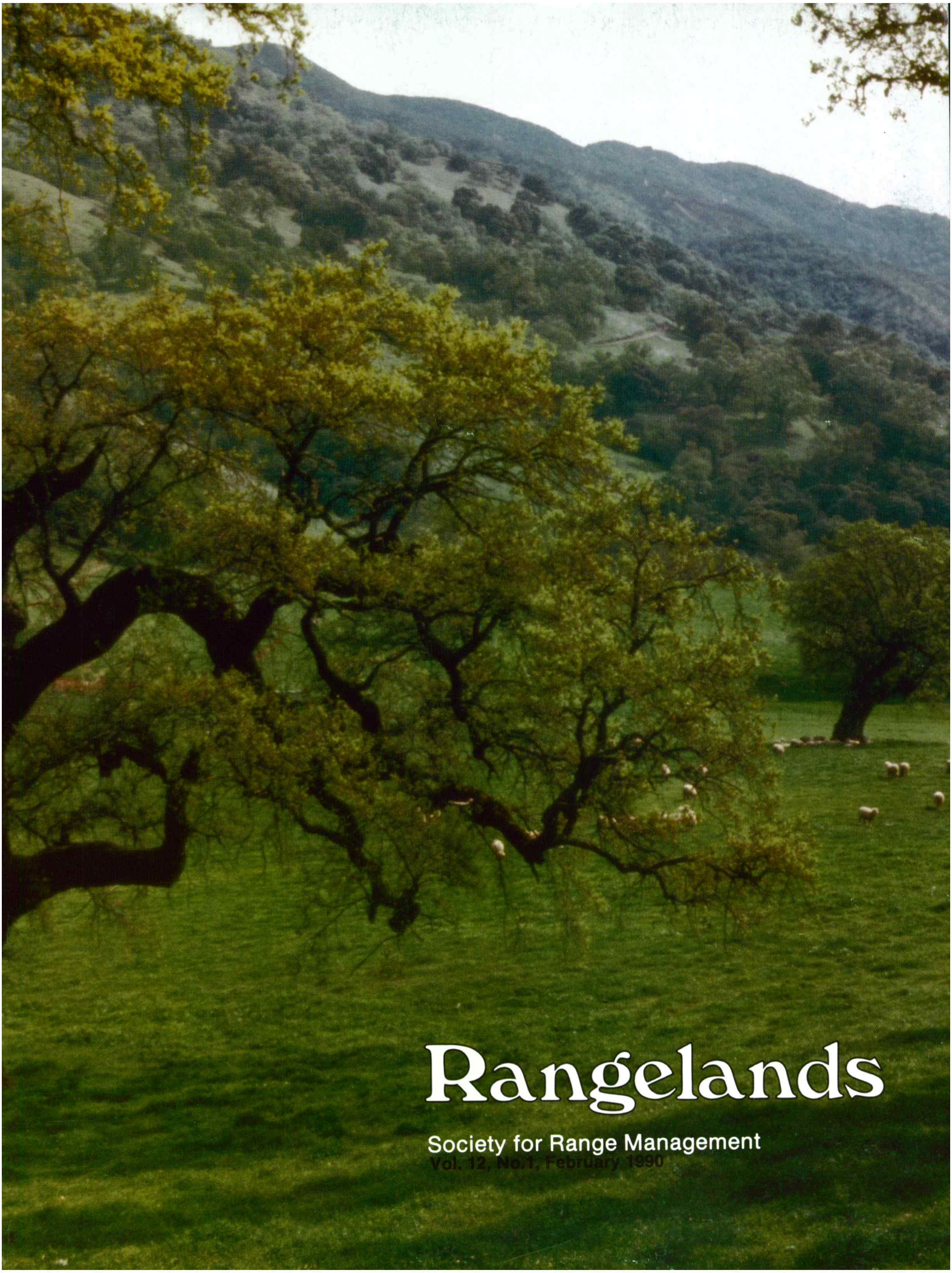

Rangelands

Society for Range Management
Vol. 12, No. 1, February 1990

Rangelands

Volume 12, No. 1
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DEPARTMENTS

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FRONT: Northern California oak woodlands. (See article on page 3.) Photo by John Menke.
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Grazing Systems and Riparian Areas

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The objectives for which the corporation is established are:

—to properly take care of the basic rangeland resources of soil, plants and water;

—to develop an understanding of range ecosystems and of the principles applicable to the management of range resources;

—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;

—to promote professional development of its members.

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Botanical Trends in Northern California Oak Woodland

Tyson H. Holmes

Northern California oak woodland represents an extensive rangeland community enriched with a diverse array of oaks grasses, forbs, and shrubs. It covers nearly 4.5 million acres of typically rolling terrain and is bounded by valley grassland, chaparall, and montane forest. The community occurs on a variety of soils throughout the Coast Ranges and Sierra Nevada Foothills, dominating the landscape between 500 and 2,500 feet in elevation. Seasonal variation in forage biomass is typical of Mediterranean, annual-type systems with growth primarily being limited to October through mid-May.

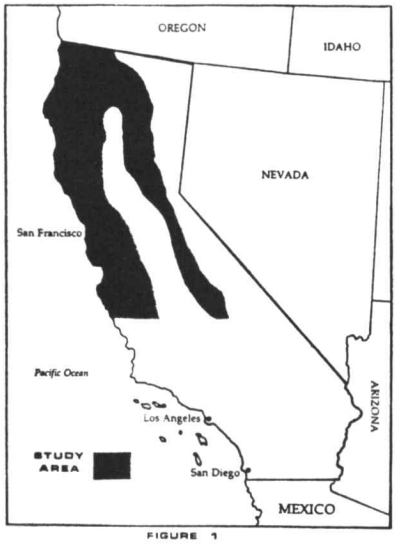

FIGURE 1

Over the past two centuries human activity has markedly affected this community, spurring many shifts in its physiognomy and composition. This article will focus on these shifts, describing general historical trends and causes.

Northern California oak woodland is defined as all oak-dominated communities north of Tulare County (Fig. 1). This designation was chosen to restrict this review to two oak-woodland types; the foothill woodland and the northern oak woodland (Griffin 1977). The foothill woodland is found throughout the Sierra foothills and central Coast Ranges, and about the periphery of the Central Valley. Dominant oak species include blue oak and valley oak. The northern oak woodland occurs from roughly Mendocino County northward. It differs from foothill woodland in that Oregon white oak predominates.


An open oak community near Red Bluff, California.

Each of these oak-woodland types can be generically subdivided into three components: the oak community, the interspersed herbaceous community, and the understory shrub community. The species composition of each is given in Table 1.

Oak Community

This is a diverse and dynamic community. Oak species vary in age and distribution and occur in hybrid, spindly, robust, and scrubby forms. This diversity was shaped by 1) exotic and endemic browsers, 2) woodcutting, 3) vegetation-type conversion, 4) fire manipulation, and 5) urban sprawl.

Browsing

Cattle and sheep have had a major impact on the oak community. Rossi (1980) notes that the Spanish coastal missions, including Santa Clara and San Jose, had acquired approximately four million sheep by 1880 and nearly 1 million cattle by 1890. This undoubtedly created a heavy demand for oak browse. This demand has remained high, especially on coast live oak, blue oak, black oak, and valley oak.

In addition to cattle and sheep, hogs and rodents have been important browsers of oaks and oak mast. Feral hogs have a strong appetite for acorns. Rodents, such as ground squirrels and pocket gophers use both acorns and seedlings heavily. This may be due to recent population increases induced by the removal of rodent predators and the introduction of new and abundant

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The author gratefully acknowledge the assistance of Dr. John Menke and Dr. Charles Raguse, both of the Department of Agronomy and Range Science, U.C. Davis, Calif.

Table 1. Representative species of Northern California oak woodland flora.

Oak and Associated Silva

Black oak *(Quercus kelloggii)* (N)*
Blue oak *(Quercus douglasii)* (N)
California buckeye *(Aesculus californica)* (N)
Canyon live oak *(Quercus chrysolepis)* (N)
Coast live oak *(Quercus agrifolia)* (N)
Digger pine *(Pinus sabiniana)* (N)
Leather oak *(Quercus durata)* (N)
Interior live oak *(Quercus wislizenii)* (N)
Oregon white oak *(Quercus garryana)* (N)
Valley oak *(Quercus lobata)* (N)

Interspersed Herbaceous Community

Grasses

Annual blue grass *(Poa annua)* (I)
Annual fescues (*Vulpia* spp.) (N) & (I)
Annual ryegrass *(Lolium multiflorum)* (I)
Hare barley *(Hordeum leporinum)* (I)
Little quakinggrass *(Briza minor)* (I)
Mediterranean barley *(Hordeum geniculatum)* (I)
Medusahead *(Taeniatherum asperum)* (I)
Nitgrass *(Gastridium ventricosum)* (I)
Pine bluegrass *(Poa scabrella)* (N)
Purple stipa *(Stipa pulchra)* (N)
Red brome *(Bromus rubens)* (I)
Ripgut brome *(Bromus diandrus)* (I)
Silver hairgrass *(Aira caryophyllea)* (I)
Slender oat *(Avena barbata)* (I)
Soft chess *(Bromus mollis)* (I)
Spanish brome *(Bromus madritensis)* (I)
Velvet grass *(Holcus lanatus)*(I)
Wild oat *(Avena fatua)* (I)

Other

Bur clover *(Medicago polymorpha)* (I)
Fiddleneck (*Amsinckia* spp.) (N)
Filaree (*Erodium* spp.) (I)
Geranium (*Geranium* spp.) (N) & (I)
Italian thistle *(Carduus pycnocephalus & tenuiflorus)* (I)
Lupines (*Lupinus* spp.) (N) & (I)
Mustard (*Brassica* spp.) (I)
Popcorn flower *(Plagiobothrys nothofulvus)* (N)
Star thistle (*Centaurea* spp.) (I)
Tarweed (*Hemizonia, Holocarpha, & Madia* spp.) (N)
Trefoils (*Lotus* spp.) (N) & (I)
Turkey mullein *(Eremocarpus setigerus)* (N)

Understory Shrub

Buck brush *(Ceanothus cuneatus)* (N)
California coffeeberry *(Rhamnus californica)* (N)
Chamise *(Adenostoma fasciculatum)* (N)
Manzanita *(Arctostaphylos* spp.) (N)
Poison oak *(Toxicodendron diversilobum)* (N)
Scrub oak *(Quercus dumosa)* (N)
Toyon *(Heteromeles arbutifolia)* (N)
Western redbud *(Cercis occidentalis)* (N)

*Key: N - native
I - introduced

References - Albin-Smith and Raguse, 1984; Munz and Keck, 1959; Sampson and Jesperson, 1981; USDA handbook, 1984; White, 1966a.

food items, especially prolific seed-producing species such as oats and filaree.

Woodcutting

Rossi (1980) discusses the history of oak harvesting. He credits the Spanish missionaries as the first Europeans to harvest the wood, using it primarily as a source of fuel. Later, gold and quicksilver mines required oak for shaft supports. By 1900, oaks were being used for commercial charcoal production or, as in the Santa Clara valley, removed for orchards.

Menke and Fry (1980) note that oak-fuelwood production rose steadily from 1947 to 1953, declined, began to climb again in 1959, and then increased further in 1973. This latest up-swing is the product of a changing market. Recent declines in the profitability of livestock production have increased the value of firewood to hardwood rangeland managers. The fuelwood market for oak has thus encouraged marked removal.

White (1966b) has examined the effects of woodcutting on stand age structure. In central California he found old harvest sites to be comprised of stands averaging 70 to 90 years of age, while areas that have gone uncut contained individuals which had survived for nearly 400 years. White also observed that woodcutting had reduced the occurrence of blue oak at his study site.

Vegetation-type Conversion

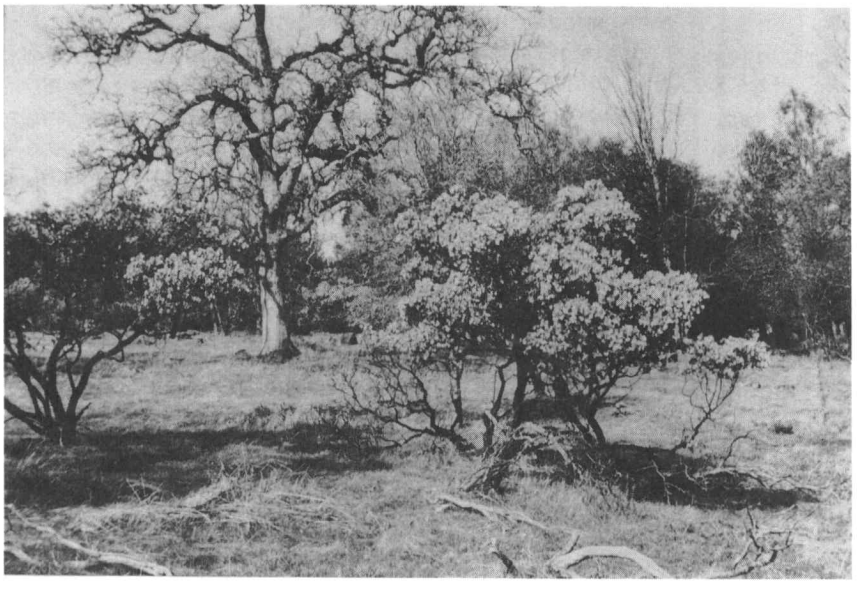
In addition to woodcutting, oaks have also been removed through vegetation-type conversion. Typically this technique has involved the use of herbicides followed by clearing via controlled burning or a process of mechanical removal, piling, and then burning. Vegetation-type conversion has been employed to reduce fire hazards and improve forage and watershed production. Over time such "range modification" has greatly reduced the distribution of oaks in northern California, especially in the Sierra foothills (Rossi 1980). Mayer et al. (1986) cite such activities as being a major cause of the decline in this community.

Fire

Man has also modified this community through the manipulation of fire, a practice extending well back into California's prehistory. Aboriginal burns were widespread (Margolin 1978) and may have maintained the oak community as a fire-climax. With the demise of these primitive cultures, this community was upset. In the northern Coast Ranges, this has produced denser stands of oaks and has favored invasion by Douglas-fir, a fire-sensitive species. This suggests that periodic burns are necessary to maintain open oaks stands.

Fire has also been implicated as a contributor to enhanced oak regeneration. Weeds may reduce seedling success in unburned areas, as they compete with oak seedlings for light and moisture. Periodic wildfires could thus reduce herbaceous biomass and favor improved oak reproduction.

Spring growth of an interspersed herbaceous community.



An unburned area showing characteristic brush encroachment.

Urban Sprawl

Perhaps no factor has had a more noticeable effect on shaping the oak community than urban development. When Vancouver visited the bayshore plain of the San Francisco Peninsula in 1798, he was impressed by the vast, open park of valley oaks that spread away from the bay toward the base of the distant hills (Griffin 1973). Later this area was cleared and planted with orchards. These orchards did not persist, however. Beginning with the close of the 19th century urban areas started spreading rapidly, eventually filling the entire Santa Clara Valley.

Many areas have similarly undergone this change from wilderness to farm, orchard, or ranch lands and then to urban sprawl. Most development has been residential and commercial, although road and free way construction has also contributed significantly. Currently expansion is greatest in the foothills, especially from Nevada and Yuba counties southward to Fresno County. The species that have been impacted most heavily are blue oak, coast live oak, and valley oak.

Interspersed Herbaceous Communities

This community is composed of those grass and forb species that occur in both open areas between oaks and as an understory component. Historical trends in community composition are the product of 1) a massive alien invasion, 2) cumulative effects of short-term grazing impacts, 3) vegetation-type conversion, 4) fire management, and 5) range seeding programs.

Alien Invasion

Theories differ on which native species have been displaced by aliens. It is generally thought that the original community was dominated by perennial bunchgrasses (Crampton 1974). However, Biswell (1956) postulates that in the Sierra Foothills introduced species may have primarily displaced native *annuals*. In addition, Savelle (1977) observed that areas left undisturbed do not return to perennial dominance. Savelle's observation is not compelling, however, as it may reflect the outcome of wildlife suppression. Therefore, most agree that the pre-invasion community consisted of perennial grasses such as purple stipa, pine bluegrass, blue wildrye, California brome, California melic, prairie junegrass, and California oatgrass (Crampton 1974); plentiful perennial forbs such as Brodiaea (Biswell 1956); and a principal contribution from various native legumes (Table 1).

These natives were displaced by alien annuals from Europe, Asia, Africa, South America, and elsewhere. Burcham (1970) lists several factors which contributed to the aliens' success. In comparison to native perennials, aliens have greater climatic adaptability, more rapid germination in the presence of sufficient moisture, more rapid growth to maturity, more prolific seed production, greater seed viability, and broader effectiveness in competing for scarce resources. In addition, alien species were often better adapted to domestic grazing and thrived in the many sites disturbed by cultivation.

Burcham (1970) describes the dispersion of alien species as consisting of four "waves of invasion." These are summarized as follows according to predomi-

nant alien(s) and time period:

1) First wave—Wild oats; 1845-1855
2) Second wave—Wild barley and filaree; 1855-1870
3) Third wave—Yellow starthistle, bromes, other barleys; about 1870.
4) Final wave—Medusahead; about 1900

The forage values of these exotics varies. For instance, medusahead is an aggressive, low quality, unpalatable, range weed. On the other hand, some of the bromes (e.g., soft chess and filaree) are quite nutritious, serving as excellent forage.

Heady (1977) describes some possible reasons for the success of these exotics. The initial arrivals (i.e., wild oats) may have first become established in cultivated fields and later spread from there. Subsequent invasions may have been facilitated by the introduction of domestic livestock. With the displacement of native ungulates such as antelope and tule elk by sheep, cattle, and goats, native perennial communities became more heavily grazed and trampled. This could have opened the pristine community to invasion by grazing-tolerant aliens.

Compositional Response to Grazing

Several studies have examined the impact of grazing on short-term community dynamics. One study varied grazing intensity to determine subsequent effects on botanical composition (Pitt and Heady 1979). The results uncovered a few trends. Soft chess, a desirable species, showed a significant decline with increased grazing intensity. Filaree, bur clover, and silver hairgrass, generally showed the opposite response, increasing under intensified grazing; however, for the latter two, this was true only up to a point. Bur clover and silver hairgrass declined under maximum grazing pressure.

Similar trends were first observed in perennial communities in the Great Plains. This spurred the formulation of the increaser/decreaser/invader classification system (Dyksterhuis 1949). In a northern California study, Heady (1956) subsequently applied this system to the interspersed herbaceous community. His "decreasers", or species which decline under increased utilization, include soft chess, ripgut brome, slender oats, wild oats, and annual ryegrass. Those that increase with increasing stocking rate and ultimately decline at the highest levels of use constitute his "increasers" and include annual fescues, bur clover, filaree, and silver hairgrass. Finally, he describes "invaders", species that persist under heaviest grazing, as annual bluegrass, quakinggrass and some clovers and lupines.

White (1966a), working in central California, found some agreement with the above study, observing filaree to predominate in moderately grazed areas. However, contrary to the work of Heady, he found that silver hairgrass was more of an invader than an increaser. White also lists popcorn flower and fiddleneck as characteristic of the most closely grazed sites.

Vegetation-type Conversion

Grazing is not the only factor that has shaped the interspersed herbaceous community. Vegetation-type conversion has also had an impact. In general terms this practice has had two effects, influencing both the quantity of herbaceous vegetation as well as species composition.

Quantitative effects vary from site to site. In the northern Sierra foothills, blue oak removal prompted an increase in herbaceous production (Kay 1971). Holland (1980), studying the same process in central California, found instead that blue oak removal created a *decline* a total herbaceous production. These results were at first considered irreconcilable; however, Menke (1987) has offered a solution. The central California site is an open savanna on light-textured, granitic soil. This creates a relatively xeric woodland environment, where moisture limitations strongly constrain herbaceous growth. Shading by oaks thereby serves as an important buffer against transpirative water loss. With oak removal this buffer is taken away and herbaceous production declines. In the north the situation is different. Moisture is not nearly so limiting with more annual rainfall and heavier-textured soils. Oak removal thus enhances herbaceous growth by allowing more sunlight to reach exposed plants.

Shifts in species composition as a result of vegetation type conversion have been examined. The removal of blue oak has been shown to increase soft chess, decrease wild barley, and have no effect on ripgut brome. In addition, removal may prompt the invasion of undesirables (e.g., spanish brome, foxtail fescue, and poverty brome) and the disappearance of various forbs such as hedge-parsley, bur-chervil, and geranium.

Fire

Community composition has also responded to fire management. While prescribed burning has been employed (Schultz and Biswell 1952), much management emphasizes fire prevention. Such protection can produce an increase in the average height of herbaceous cover, with low-growing forbs such as filaree and bur clover being shaded out by taller grasses, such as oats, soft chess, and wild barley (Hervey 1949).

Range Seeding

Species composition has also responded locally to range seeding programs. In the past these have included seeding of desirable perennial grasses such as hardingrass, orchardgrass, and tall fescue, which provide a longer green forage season than do resident annuals. Other sites have been seeded with 1) various annual grasses (e.g., soft chess and annual ryegrass), 2) annual legume mixtures of sub and rose clover, and 3) several species of lupine.

Understory Shrub Communities

Research on the understory shrub component of northern California oak woodland is very limited. Studies typically indicate that prior to colonization of Alta California the understory was apparently quite free of woody

vegetation. Reed and Sugihara (1987) attribute this to aboriginal burns.

Biswell (1954, 1956) reports that oak woodland has become increasingly crowded with native brush species, especially where woodland meets coniferous timber. He feels this increase is partly due to the effects of fires. A single burn tends to increase brush production, possibly by cracking the seed coats of many woody species and/or through reduction of herbaceous litter. Biswell also indicates that close grazing has favored brush abundance. High-intensity removal of herbaceous species releases soil moisture for use by unpalatable brush seedlings.

These studies also indicate that in some areas brush may periodically decline. If one burn follows closely behind another, emerging brush seedlings are often killed. Also, heavy browsing by livestock and deer can effectively suppress brush regrowth. In ungrazed areas, grass species may rob brush seedlings of sufficient light and moisture and thereby reducing seedling survival. Finally, management may actively seek to remove brush through controlled burns, bulldozing, use of herbicides, or some combination of these (Murphy and Leonard 1974).

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Can Western Agricultural Water Users Accommodate Instream Flows?

Jim Magagna

Editor's Note: This speech was given to Trout Unlimited in Jackson, Wyoming, Oct 1989.

In order to better understand the relationship of the ranching industry to instream flow, it is useful to view it as a resource issue devoid of its political implications and legal ramifications. To do so effectively, I would like to momentarily drop the use of the terminology "instream flow". As a rancher I am now talking about an adequate level of water flowing down the stream. It is necessary to provide water for my livestock. It enhances the condition of the forage on the adjacent riparian areas for the same stock. It provides improved habitat for fish and wildlife. All of these are resource values to which I am committed as a livestock producer and steward of the land. I am a beneficiary of these flows.

Now allow me to reintroduce "instream flow" into the equation. Suddenly I become alarmed over the potential threats to my water rights, my property rights and my permits. Suddenly I am concerned about the operational impacts of someone else's decisions on my ability to irrigate my lands and to graze my livestock. The economic benefits of adequate water flows have been transfigured into the economic threat of instream flow. Those of you with whom I share the bond of mutual concern for the management of our great natural resources now become my adversaries in the halls of state legislatures and in the courtrooms.

If, as my previous analysis would indicate, our broad goals are harmonious, opportunities for cooperation abound. Can we agree upon a common approach to dealing with the instream flow issue? Let me suggest some key elements of a workable approach.

First, instream flow must be viewed as a resource management opportunity, not as a multiple use conflict. This approach dictates that we seeks ways to improve the resource that will result in mutual benefits. There can be little real progress if one group's gain is always another's loss, real or perceived. As water becomes an increasingly valued resource in the arid West, our efforts should be directed not toward intensifying the competition for its use, but rather toward enhancing the quality and quantity of water available for all potential users.

Second, we must not fall to the temptation to isolate instream flow as a niche issue. It is but a small part of overall wise resource management. The environmental community seems to have come to a recent realization that many individual resource issues have broad implications for an entire ecosystem. The rancher has long recognized that many of these same issues have broad implications for an entire ranch operation. Far too often we have been the victims of decisions by outside decision-makers who are either unwilling or unqualified to look beyond the immediate direct impact on our complex operations. This is particularly true with respect to the failure to anticipate how sheep or cattle will react to the changes in behaviorial pattern which we choose to impose upon them.

Third, instream flow must remain a state issue. It is intrinsically tied to state water law and regulation. The workable approach will necessarily vary somewhat among states. The National Cattleman's Association has a policy resolution stating that they oppose "Any federal effort to seek the establishment of instream flows on any river or stream in any state." (NCA, 1989 Policy). Both the American Sheep Industry Association and the Public Lands Council support this resolution. To create instream flows by federal law or policy would be a direct infringement upon the states' rights to control the waters within their boundaries.

Fourth, a workable approach should strenuously avoid the use of the judicial system. Court decisions addressing instream flow have produced some clear winners and losers. At the same time they have served to intensify the underlying conflicts. While the rights of the parties involved have been clarified, little attention has been given to principles of wise resource management. This step may well be an admission that we have allowed our own special interests to supersede our commitment to wise use.

Fifth, changes that are sought in legislation should generally be of a permissive nature. We must be careful not to change the basic tenets of the appropriation doctrine which guides water law in most western states. Changes should be those that are necessary to allow us to conduct those activities that are mutually agreed upon as being beneficial to the resource without unacceptable impact on any of the involved parties.

Finally, we must use an on-the-ground, site specific approach that maximizes the involvement of those most directly affected. Proposed actions must be analyzed first for their direct impact on the immediate resource, then for their economic and environmental impacts, both current and long term. We should seek the expertise of those with a long history of involvement with the specific resource as well as those trained in pertinent disciplines.

The ranching industry has often been perceived as being in broad total opposition to instream flow. In reality this opposition has been based on some very specific issues that arise each time there is an effort to impose instream flows by legislation, administrative action or judicial decision. I will review some of the concerns with which I am familiar in Wyoming and neighboring states. This list is by no means all inclusive.

The foremost concern is the preservation of western water law based on the doctrine of appropriation. It includes the principles of historical first use, beneficial use and, in Wyoming at least, abandonment through non-use.

Closely tied to preservation of the law is protection of existing water rights. This concern is, however, much broader than just protection under statute. With new legislation and competing demands comes an increased threat of expensive litigation and unfavorable court decisions. There is also the fear that once hallowed statutes are opened for acceptable revision, third parties may advocate other changes detrimental to agriculture.

The preservation of historical rights does not ensure the preservation of historical use patterns, particularly for irrigation. Any change in a prior upstream right may impact the downstream user through its effect on the timing and seasonality of downstream flows. This is particularly true when water that was previously used for irrigation resulting in a gradual return flow now flows directly down the stream. Indeed, a misguided effort to create an instream flow in one stream segment could potentially destroy an existing adequate flow in another segment.

We remain concerned about the potential impact of instream flow rights on the future needs of municipalities, agriculture and industry. Most existing water rights can shift to the highest and best use as determined by market forces. We view an instream flow right as a relatively permanent withdrawal of water from the marketplace. If the instream flow is only on a segment of the stream, this water may become available for other use, but only beyond that segment.

Our ability to coexist in harmony with instream flow can be threatened by the choice of which state agency will administer the program. This should be done by the same agency that administers the general water laws of the state. Agencies which are advocates for a particular resource use cannot be expected to be impartial administrators.

Several states with instream flow provisions have failed to clarify livestock watering rights. The ability of livestock to drink from any stream to which they otherwise have legal access must be preserved.

Ranchers are also watchful that the amount of water committed to an instream flow is not excessive beyond that which is reasonably needed to preserve a fisheries habitat. Similarly the length of stream segment for which the flow is protected should not be excessive.

Finally, we are concerned about some of the broader implications of creating an instream flow that did not previously exist. Will it result in an excess of game populations in area? Will it lead to increased demand for access across private lands? Ranchers remain skeptical that these related issues will be dealt with appropriately.

There are several tools that can be used successfully in the achievement of mutual goals. Perhaps the most effective is the construction of storage structures. In addition to providing for instream flows, such structures usually provide diverse benefits to wildlife, recreation, industry and agriculture.

Incentives for efficiency and conservation in the use of agricultural waters should be explored. The current "use it or lose it" approach of most western states may be encouraging excess use of water. A policy that would protect the full amount of a water right while permitting the actual use of a lesser amount would encourage projects designed to increase efficiency and conserve water, often resulting in a *de facto* instream flow.

Riparian enhancement and restoration projects are a useful tool for increasing both the quality and quantity of stream flows. Support for such efforts is widespread. Increasing numbers of our members are becoming involved in riparian enhancement on both public and private lands. Many of these efforts are being conducted in cooperation with groups such as Trout Unlimited. While recognizing that much remains to be done, we are proud of our successes.

Instream flow is but one of the many policy debates into which the livestock industry is drawn. The decisions that result from each debate impact our rights as land owners and ranchers just as they do the rights of other resource users. This process is part of the great American system. Meanwhile, out in the country many of you and many of us—we are carrying forward the real efforts that protect and enhance our natural resources. Can we do more?

Where Are the Range Graduates Going?

Charles Butterfield, Scott Bell, and Harold Wiedemann

Employment is vital to range science graduates. Moreover, it determines the success of universities in training these students and ultimately, the future of the Society for Range Management (SRM).

To learn the source of employment of our range graduates, the Employment Affairs Committee of SRM surveyed 32 universities that educate range scientists in the United States. The survey's database of 1,348 employed range graduates represented 69% of the graduating population from the 18 schools that responded. Employment records were requested for the past 10 years; our average was 7.2 years.

Current Employment

Results from the survey indicated that the majority of range graduates (33.1%) are finding employment with the federal government. Within the federal government, the Soil Conservation Service (SCS) hires 9.9% of all range graduates surveyed. The Bureau of Land Management (BLM) hires 8.6%, and the Forest Service (FS) hires 8.3% of the surveyed graduates. Just over 1% of these graduates entered the armed services, 1% find work with the Bureau of Indian Affairs (BIA), and 1% go to work for the USDA's Agricultural Research Service (ARS). The remaining 3.1% of graduates working in the federal government are with the Corps of Engineers, U.S. Fish and Wildlife Service, Bureau of Reclamation, and other federal agencies.

After the federal government, higher education retains the next highest group of graduates, 26.3%. This number is slightly inflated due to the fact that it contains all graduate students, and there may be an overlap between schools over years. However, an important point to consider is that 14.2% of all surveyed range graduates pursue a higher degree. Five percent of all graduates surveyed remain at the university or college level as teachers. University research employs an additional 4.7% of the graduates. The Extension Service employs another 1.4% of the graduates, one-half as state extension specialists and the other one-half as county extension agents. One percent of the surveyed graduates teach at the primary/secondary school level.

Range Science is often viewed as an international discipline. Of the surveyed graduates, 9.5% were foreign students, most of whom return to their respective homelands. The foreign student percentage was third only to graduate school (14.2%) and the SCS (9.9%).

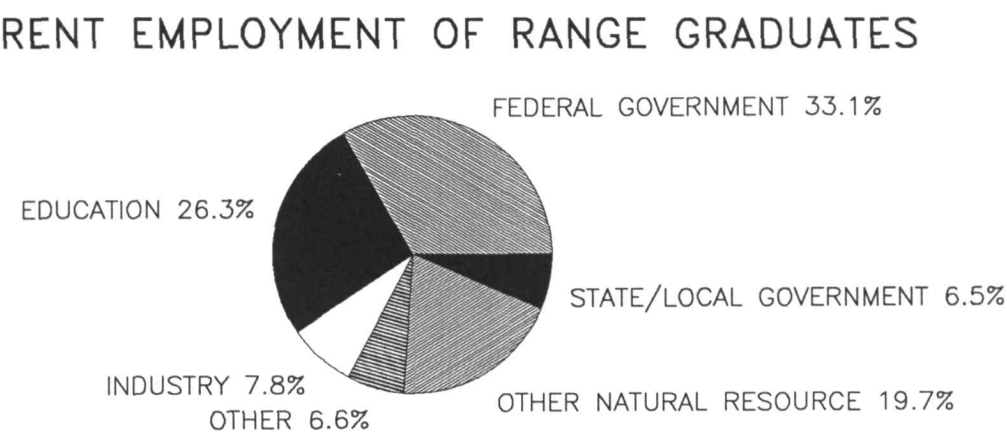
The survey indicated that as few as 4.6% of all range graduates return to the ranch or farm, or find employment as a ranch manager—a low number considering the main target of our profession. We need to ask ourselves why is this number so low, where are these people going? Of the surveyed range graduates, 5.7% are finding jobs in other natural resource occupations (private consulting 2.7%, peace corps 0.7%, nurseries 0.2%, other 2.1%).

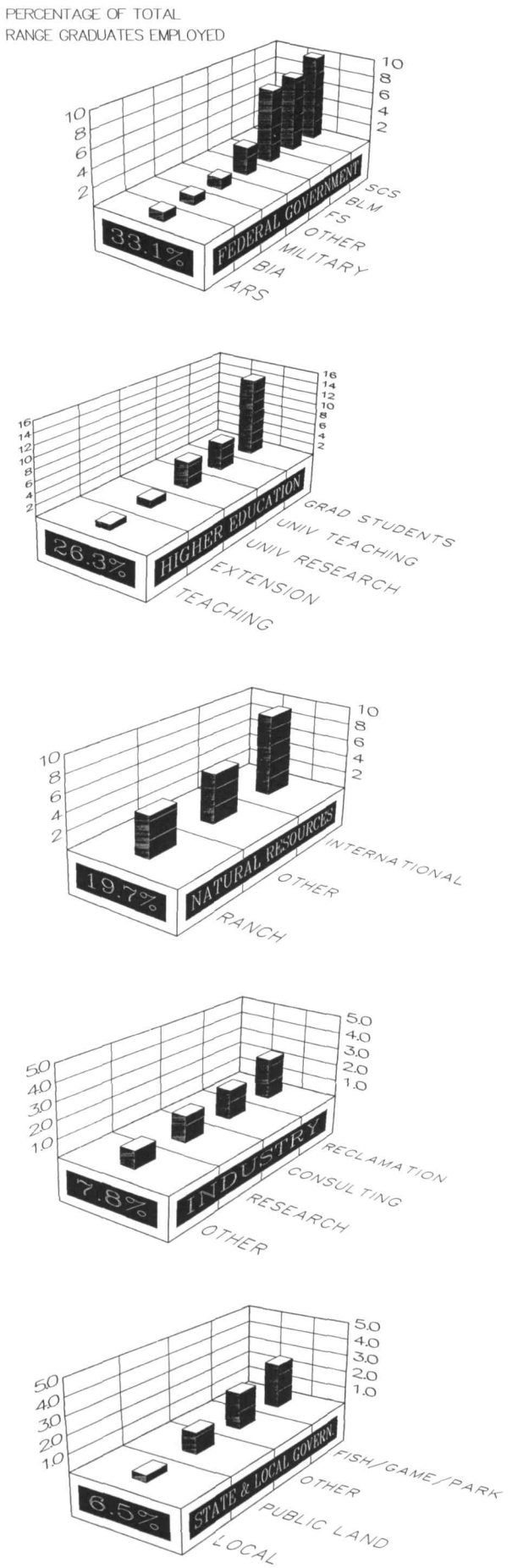
Private industry employs 7.8% of the range graduates. Reclamation accounted for the highest percentage employed in this category (2.4%), followed by consulting (1.7%), reclamation industry research (1.5%), and agricultural product sales (1.2%). The remaining 1.0% are em-

Authors are members of the Employment Affairs Committee SRM, 1989. Questions concerning the article should be directed to the Managing Editor, Society for Range Management.

ACKNOWLEDGEMENT: This article was made possible by the combined efforts of all members, including the 1988 Committee, Chris Call, Chairman, and the 1989 Committee, Harold Wiedemann, Chairman.

SURVEY: An initial and follow-up mailing was sent to all 32 range science education schools in 1988. The SRM Board of Directors reviewed survey data at Billings, Montana. The survey does contain some overlap on individuals that were listed as graduate students at two or more universities as well as an employed graduate.





ployed in banking, railroads, forestry companies, and environmental assessment.

A surprising 6.6% of the graduates found jobs that were not related to the natural resource fields (lawyers, painters, etc.). This number includes some graduates whose employment was listed as unknown. However, graduates with unknown employment status were typically not reported in the survey.

State and local governments employ 6.5% of our graduates: 2.6% find employment with state game and fish/-parks departments and 1.2% with public land administration departments; the remaining 2.7% find their niche with various other state and local departments.

Future Prospects

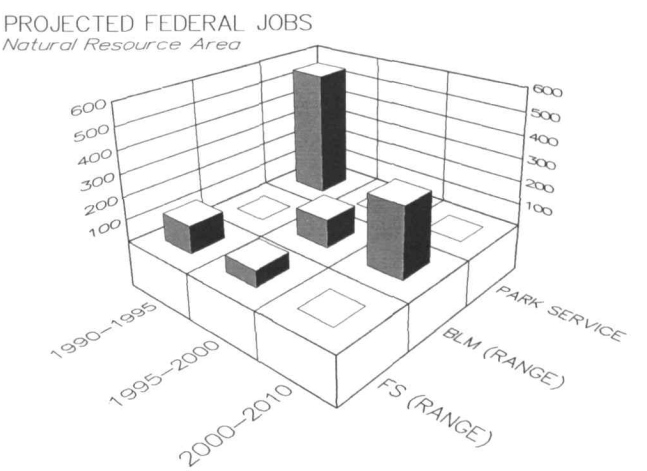
To highlight future job opportunities in range management, the Employment Affairs Committee requested information from five agencies concerning their prospective retirements and projected new hires. Information was obtained from the USDA—Forest Service, USDI—Bureau of Land Management and USDA—National Park Service (NPS). The other two agencies were unable to provide information. There is concern among the agencies that a large number of federal employees in land management are nearing retirement, and there may not be sufficient qualified candidates to meet the future needs.

USDA—Forest Service

As of February 1989, the USDA Forest Service employed 429 Range Conservationist in permanent positions. Of these, 63 will be eligible for optional retirement by 1995 with an additional 29 leaving the Forest Service for reasons other than retirement. It is projected that by 1995, Range Conservationist positions will increase to 451. The Forest Service projects the hiring of 105-123 new Range Conservationists by 1995. This projection does not account for range positions being made available though placement of existing Range Conservationists into non-range positions, i.e. Administration. Between 1995 and 2000, an additional 67 Range Conservationists will reach retirement age.

USDI-Bureau of Land Management

About 8,856 Bureau of Land Management employees



will be eligible for retirement between the years of 1990 and 2000. Of these employees, 413 are in the Range Conservationist series. The BLM estimates that only 25-30% of these employees will actually retire when eligible. As with the Forest Service projections, these data do not include entry level Range Conservationist positions being made available through placement of range personnel into non-range positions. Because the total BLM employees increased from 5,000 to 10,000 employees between 1974 and 1980, the BLM anticipates many retirements between the years of 2005 and 2010.

USDI—National Park Service

As of February 1987, 28 Ecologists, 170 General Biologists, and 3,157 Park Rangers were employed by the National Park Service. The NPS projects to hire 18 General Biologists and 529 Park Rangers at the entry level within the next five years. These positions are available to range graduates as well as a host of other graduates from general biology to law enforcement. Calculations are based on the number of employees who are eligible to retire and the assumption these vacancies will be filled internally, i.e., sequential advancement would result in six promotion opportunities if all selections are made from internal sources. The actual number of promotion opportunities, then, is overstated. However, attrition from factors other than retirement have not been factored in to help offset this overestimation.

These figures for the various federal agencies, although approximations, do alert the Society for Range Management and universities to future opportunity. Cooperation with these various agencies to provide well-qualified, natural-resource-management trained graduates is a must.

Conclusions

The Employment Affairs Committee is concerned about employment for our graduates. Where will the future jobs be? Will our graduates be trained with the necessary skills? What can the employer do? These are vital questions, and our committee hopes you will use these data to prepare for the future—the graduate's future, the universities' future, SRM's future.

Revegetation of Previously Irrigated Cropland: I. Development of a Research and Demonstration Program

P. Lorenz Sutherland, K.L. Conrad, D.A. Miller, J.A. Knapp, and W.G. Hassell

Colorado has five primary river drainage basins; the Platte, Colorado, Arkansas, Rio Grande, and Yampa/Snake. The Arkansas River drainage basin has historically been one of Colorado's richest agricultural areas yielding a wealth of vegetables and grains for decades. The river basin originates at an elevation of 14,433 feet above sea level and consists primarily of the entire southeastern region of the state east of the continental divide (Fig. 1). The Arkansas River leaves the state at an elevation of about 3,400 feet, the lowest point in Colorado. The basin encompasses approximately 26,000 square miles and is characterized by three general geographic areas: the upper reach (Leadville to Canon City), foothills (Canon City to Pueblo), and the irrigated plains region east of Pueblo.

This diverse agricultural area is now undergoing a major change in land use that will alter the complexion and the way of life for generations to come. Irrigation water rights are presently being sold to Colorado's fast-growing cities. Irrigation water removal from tens of thousands of acres results in large areas of abandoned land.

Historical Perspective

Spanish expeditions first explored the Arkansas Valley between 1760 and 1780. Zebulon Pike, Fremont, and Gunnison explored the area in the 1800s. Farming and ranching settlements were established after Colorado's gold rush of the 1850s. The first three crops grown were alfalfa, watermelon, and cantaloupe (Doll 1987). To support the production of irrigated crops, a network of canals was constructed. Water allocation guidelines had to be developed for orderly water use. The first water right in the Arkansas Valley was decreed in 1861; the last decreed in 1933 under the prior appropriation doctrine of water right allocation.

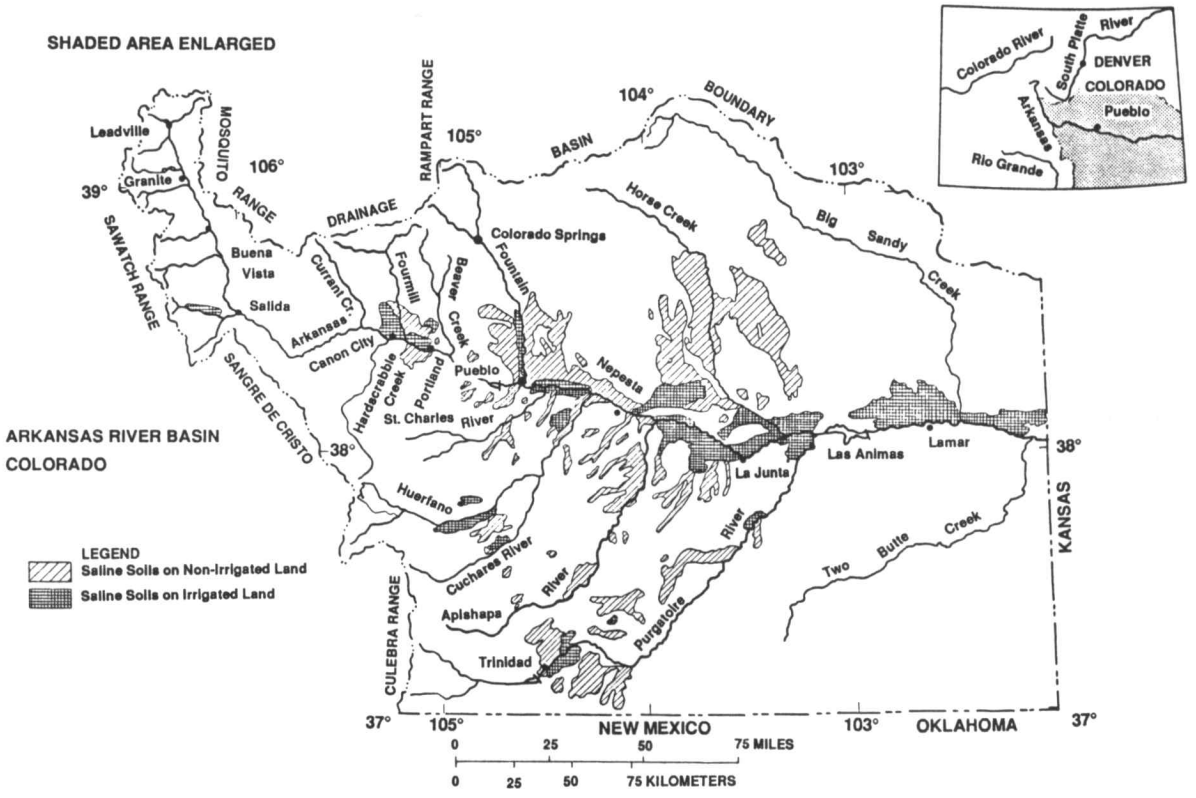
The development of the sugarbeet industry occurred during the early part of the twentieth century. At the height of the sugarbeet industry, as many as twenty-two sugarbeet processing facilities were operated in the lower Arkansas Valley. Beet production began to decline in the 1970's due to low prices and oversupply and subsequently disappeared with the closure of the last processing factory in 1979 (Markoff 1979).

The decline of the sugarbeet industry initiated a period of economic stress in the Valley's irrigated agriculture. Much of the original development, and the ultimate decline of irrigation, has been tied to the sugarbeet industry. Low commodity prices forced further declines in farm economics. Irrigated producers began to look to the sale of water rights as a means of monetary income.

Events and Factors Leading to Land Abandonment

The 1965 sale of Otero Canal Company water rights marked the first major sale of irrigation water in the Arkansas Valley. In the next two decades 58,000 acres out of a total of 304,000 irrigated acres in the Valley were

Authors are Agronomist, Soil Conservationist, District Conservationist, Area Conservationist, and Plant Materials Specialist, USDA-SCS; respectively.



affected by water right transfer. An additional 136,000 acres of irrigated cropland have the potential of future water right transfer and abandonment.

Water right sales and transfers have been the primary factor leading to irrigated land abandonment in the Arkansas Valley. Colorado's front range cities have purchased water rights to meet their rapid growth and development needs.

Problems Associated with Land Abandonment

The unique climate and soils of the area pose major problems for land use changes. Annual precipitation of 12 inches or less coupled with high potential evapotranspiration rates, intermittently high water tables, and soil salinity problems make dryland agriculture impractical. Surface soils of the area are highly susceptible to wind erosion when protective residues are absent (Picture 1). Conversion to permanent rangeland by planting perennial species is the most viable longterm option.

Poor water quality, saline soils, and high water tables provide poor growing conditions and limit plant adaptability. It has been shown that the reach of the Arkansas River between LaJunta, Colorado and Garden City, Kansas, is the most saline water course of its size in the United States. Only 14% of the total salt load can be attributed to agriculture. The remaining 86% of the salt load results from non-agricultural sources (Miles 1977).

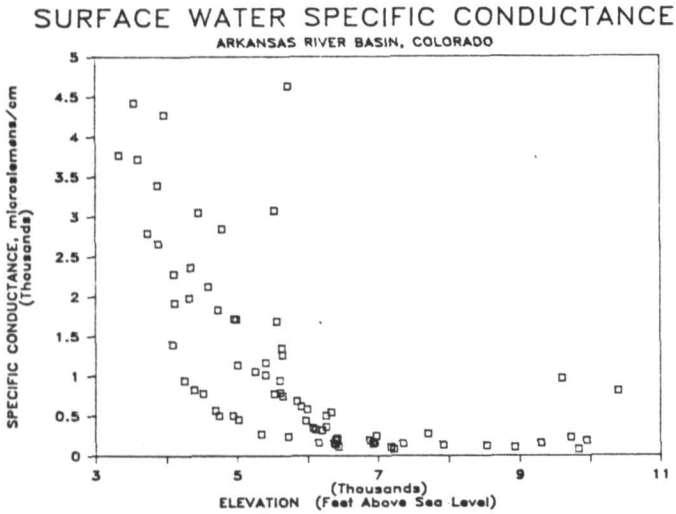
The degradation of water quality by agricultural sources occurs by two processes. First salts are concentrated in the remaining water after water is consumed through crop, phreatophyte, and wetland evapotranspiration.

Soil being removed from a concrete lined irrigation ditch filled by wind erosion from the adjacent field.

Secondly, salts are concentrated by irrigation return flows including salt leaching from soil profiles. Figure 1 shows the location of both non-irrigated and irrigated saline soils in which marine shale formations are found in

the profile substratum contain high concentrations of soluble salts which are easily leached and carried with irrigation water return flows to the river. Coupled with the principle of reuse whereby return flows from one irrigation system contribute to the water supply of downstream irrigation systems, management systems which accord the opportunity to limit the salinity effects are required.

The inherent non-agricultural degradation of water quality in the basin is determined largely by the characteristics of the aquifer. Where the basin is underlain by metamorphic and igneous geologic materials, the water is of good to moderate quality. However, downstream from Canon City, the basin is underlain by Creataceous shales, causing rapid deterioration of ground water quality which in turn increases surface water degradation. Water salinity, as indicated by longterm electrical conductivity measurements (Fig. 2), increases about 50 fold



as one travels from the headwaters of the Arkansas River to the state line separating Colorado and Kansas (Cain 1987). Table (1) shows long-term average values of salinity levels of several selected irrigation canals of the irrigated plains region of the watershed, indicating the severity of both agricultural and non-agricultural related sources.

Salt seeps are becoming more frequent (Picture 2) as water tables within the alluvial river aquifer rise, particularly during years of above-normal mountain snow pack.

Table 1. Salinity levels of water diverted by several selected canals east of Pueblo, Colorado-Arkansas River Basin.

Canal	Irrigated Area Served	Total Dissolved Solids: Volume Weighted Average	Total Dissolved Solids: Maximum
	----Acres----	----------ppm----------	
Bessemer	20,000	300	770
Colorado	43,000	630	900
Highline	24,000	530	950
Oxford	6,000	500	960
Catlin	18,000	720	1,000
Holbrook	16,000	830	1,000
Rocky Ford	8,000	900	1,200
Fort Lyon	93,000	1,540	2,200
Consolidated	6,000	1,560	3,400
Fort Bent	5,400	2,200	4,300
Keesee	1,400	2,400	4,300
Amity	34,000	1,900	3,600
Lamar	6,000	3,000	5,100
Hyde	1,000	2,300	3,500
X-Y & Graham	4,000	2,100	3,600
Buffalo	3,600	3,000	4,700

Salt accumulation on the surface of this irrigated field.

Revegetation on Previously Irrigated Lands

General abandonment of land occurred following the earliest water right transfers. In recent water right transfer cases, the district water court decreed that revegetation is a requirement if water is to be transferred and irrigation water will be available for 1 year to establish permanent vegetation. Unfortunately, information regarding appropriate grass species and seeding techniques is limited.

Research and Demonstration Efforts

Soil Conservation Service (USDA) and university Cooperative Extension Area personnel, combined their efforts and expertise to begin plant materials trials in 1979. Two sites representing typical previously irrigated cropland were selected for revegetation trials. Species evaluated in 1.8-acre block plantings at one site included yellow bluestem, blue grama, alkali sacaton, Atherstone lovegrass, and sideoats grama. Species evaluated at the second site in replicated small plots included: tall wheatgrass, western wheatgrass, Indian ricegrass, switchgrass, Russian wildrye, bristlegrass, galleta, and buffalograss. Irrigation

water was applied once after planting in accordance with the water court degree that one year of irrigation water will be available for grass establishment. 'Arriba' western wheatgrass, commercial Russian wildrye, 'Viva' galleta, 'Hachita' blue grama, and 'Salada' alkali sacaton performed best in the small plot studies. These species were able to compete and survive the heavy annual weed growth. 'Jose' tall wheatgrass, though adapted to salinity, was unable to survive dry conditions after irrigation water removal. Buffalograss stands declined, possibly due to the intense weed competition (Hassell and Knapp 1983). The problems and difficulties encountered in establishing grass at these sites underscored the need for further testing.

Because of the long-term negative effects on natural resources as well as severe social and economic impacts on the community, Soil Conservation District (SCD) Board members felt it was necessary to approach water right buyers and voice their resource concerns. In the fall of 1985 district board members, water right buyers, representatives from the Soil Conservation Service and Colorado State University met to discuss alternatives.

The group recommended a demonstration project to evaluate revegetation techiques of historically irrigated land.

A cooperative agreement creating a demonstration project known as the Arkansas Valley Revegetation project was implemented in December 1985. The project was set up for 5 years with each entity contributing an equal amount of money each year. The Soil Conservation Service agreed to provide technical assistance. Much of the seed for variety trials was provided by the SCS Plant Materials Center at Los Lunas, New Mexico. The 1988 roster of contributing entities includes: City of Aurora, City of Colorado Springs, Foxley Cattle Co., Public Service of Colorado, Pueblo Board of Water Works, Colorado State Soil Conservation Board, and East Otero, West Otero and Timpas Soil Conservation Districts. The Crowley-Otero Association of Soil Conservation Districts, which represents all 4 soil conservation districts in Crowley and Otero counties, administers the project. Major chemical companies have also been strong supporters.

A technical advisory committee consisting of university and SCS personnel was created to set objectives and goals and help design the studies. This committee meets several times each year to help guide the project.

Goals and Objectives

Sutherland and Knapp (1988) concluded that alternate land uses after water right transfer are limited to abandonment, conversion to dryland agriculture, or establishment of permanent rangeland with wildlife and limited livestock uses.

Much of the land affected by water right sale has a history of 50-100 years of irrigation. Soil surface textures range from sandy loam to clay loam. Visible salts at the soil surface are common. Silt content has risen due to deposition from surface irrigation. Years of tillage equipment mixing has changed soil structure. Inherent soil erodibility is high. Abandoned cropland is unstable and subject to soil erosion for years. The natural process of plant succession to perennial cover takes decades.

Project goals were to address both technical and social problems. Because of the social and economic impacts water right sales have on community livelihood, the project was directed at finding an economically viable alternative to irrigated agriculture. Conversion to permanent rangeland is the most viable option. The project has stressed the need to find a forage that is palatable and nutritious to livestock in the hope that the livestock industry can partially replace the income of irrigated agriculture.

An economic potential exists in the Arkansas Valley for wildlife and recreation industries. Wildlife areas and hunting preserves could provide income opportunities after the sale of water. Evaluation of wildlife compatible species are included in the study.

Soil erosion control is of prime importance. Wind erosion is a certainy between the months of February and May given these soil types and low rainfall patterns. Perennial vegetation establishment is a must. Annual vegetation breaks off at the soil surface, fills fence rows and leaves precious topsoil to blow. Establishment of perennial vegetation by natural succession is a slow and uncertain process. Decades of resource and economic devastation by wind erosion are likely before grass reestablishment.

Simply stated, the objectives of the project are to find species that will control erosion, are well adapted to the region, have high value for livestock grazing, and provide wildlife habitat. The project's goals are to find and demonstrate the best plant establishment methodology including planting procedures, weed control techniques, and irrigation practices when formerly irrigated land is reseeded.

Test plots and field demonstrations were initially directed at selecting adapted grass and shrub species. Tolerance of the selected species to weed control practices such as herbicide and mowing are also evaluated. Plant species and weed control methods have been quantified. Project objectives are now shifting to irrigation water management and grazing management evaluations. Research is now directed at formulating complete revegetation guidelines and recommendations.

Information transfer consists of quarterly and annual progress reports mailed to contributing entities, soil conservation districts, USDA personnel, Extension Service personnel, and interested agriculturalists. Two tours with field plot demonstrations are held each year for contributing entities and the public. Local newspapers and Soil Conservation District newsletters regularly feature articles. A narrated slide-tape presentation was made highlighting the projects' origin and soil conservation district involvement. A video tape presentation outlining recommended revegetation species and techniques was completed in the Fall of 1988.

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Significant Tax Savings with Trust for Minors

John Alan Cohan

For various reasons discussed in this article, creating a trust for minor children, grandchildren, or great-grandchildren can be an effective arrangement for taking advantage of various tax benefits. Some type of gift plan to your children and other heirs constitutes an important component of financial and estate planning. Gifts made outright to minors, other than modest gifts, are usually not recommended, since a minor may lack sufficient maturity to deal with significant assests, and state law generally prevents a minor from dealing effectively with funds except through a legally appointed guardian.

At the same time, it is always desirable to transfer gifts to minors in such a way as to qualify for the $10,000 annual gift tax exclusion, and to take advantage of comparable estate tax benefits by transferring assets out of your estate.

For some situations it may be advantageous to transfer gifts fo minors by use of a simple "custodianship." This procedure permits you to conveniently transfer gifts to minors by use of a designated custodian (usually a close friend or relative), who holds and administers the gift until the minor attains the age of 18 or 21. However, not all types of property may be held in a custodianship, and a distinct disadvantage of this procedure is that the gift must be disbursed outright once the minor attains the age of 18 or 21. Also, certain unfavorable tax consequences may result from using a custodianship.

Special rules of the Internal Revenue Code permit you to create a particular type of trust that qualifies for the annual gift tax exclusion, and allows the flexibility and control over gifts that most donors want. There are several types of trusts available, and each can be an effective estate planning vehicle, not only in terms of taking advantage of the annual gift tax exclusion, but also as an income-shifting tool and estate tax savings measure. Under most arrangements, you would select a trustee, who should be a close friend, relative, or bank trust department. The trustee is given authority to expend trust funds for the minor donee under certain standards set forth in the trust instrument. For example, the trustee may be directed to spend trust funds for the minor's "support, care, education, confort and welfare," and for purposes involving "accident, illness, or other emergency."

The trustee can reduce income taxes that would otherwise by paid by carefully timing trust distributions. Any type of property can be transferred into a minor's trust, in contrast to the limitations of a custodianship. Also, the entire value of the gifts to the trust qualify for the annual gift tax exclusion. This type of trust is usually ideal for grandchildren and great-grandchildren. Several trusts for minors can be established in a single document, and all of the funds can be invested and managed together by the same trustee.

The trust procedure also protects any assets placed into trust from claims of the minor's creditors. This type of trust permits you to divest various assets, have them ultimately distributed to minor beneficiaries when they reach a mature age, take advantage of the maximum annual gift tax exclusion *and* reduce the size of your taxable estate.

Other provisions can grant a beneficiary an income interest for a fixed number of years of even for life. The trust can continue for as many years as you may desire rather than terminating when the beneficiary attains majority age. Another type of trust, referred to as a "Crummey" trust, permits the minor beneficiary to demand outright payment of periodic sums in accordance with a limited withdrawal power, which can be exercised by a guardian or parent.

It is always important to consult a qualified estate planning attorney with experience in living trusts. Many issues will come into focus, particularly if you wish to realize significant estate tax benefits. It is always important to also consider the overall maturity and ability of your beneficiaries to handle particular assets. Finally, the main point to keep in mind in a trust arrangement is the desirability of having an orderly transfer of assets from one generation to the next with minimal red tape and maximum tax benefits.

The author is an attorney based in Los Angeles. He can be reached at: (213) 557-9900.)

Type of Army tank used in the project to obtain the tracked vehicle damage on the existing vegetation. SCS photo taken May 1982.

Revegetating Rangelands after Army Maneuvers

Ben P. Berlinger and LeRoy R. Cammack

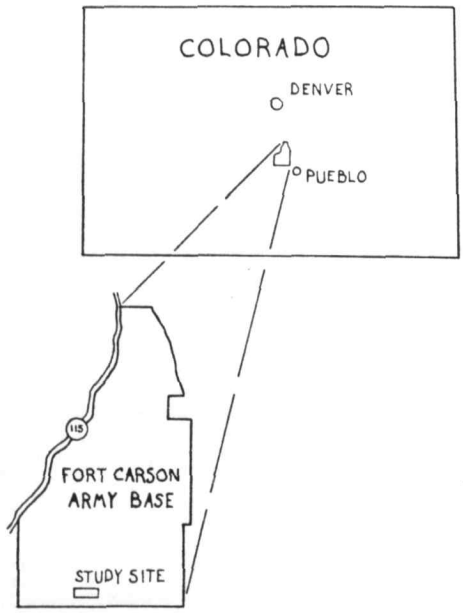
U.S. Army training maneuvers with tracked vehicles (M-60 tanks and armored personnel carriers) destroy various amounts of vegetation. The Soil Conservation Service (SCS) implemented a study to assist the Army in determining: (1) the revegetation treatments most effective in accelerating plant development after tracked vehicle maneuvers and (2) if the effectiveness of the revegetation treatments depended on the degree of vegetative cover destruction.

Authors are range conservationist, USDA, Soil Conservation Service, Hugo, Colorado 80821; and District conservationist, USDA, Soil Conservation Service, Colorado Springs, Colorado 80909. LeRoy R. Cammack passed away on December 15, 1988. This study would not have been possible without Roy's untiring dedication and commitment to see the project to its completion.

The study was funded by Interservice Support Agreement #128B05-78162-001 from the Environment, Energy and Natural Resource Office, DEH, Fort Carson, Colorado, U.S. Department of the Army.

Sampling procedure.

Vegetative litter sampling using the first hit-point method was carried out over a five-year period (1982 to 1986) on the U.S. Army's Fort Carson mechanized training site located in south central Colorado. The semiarid short

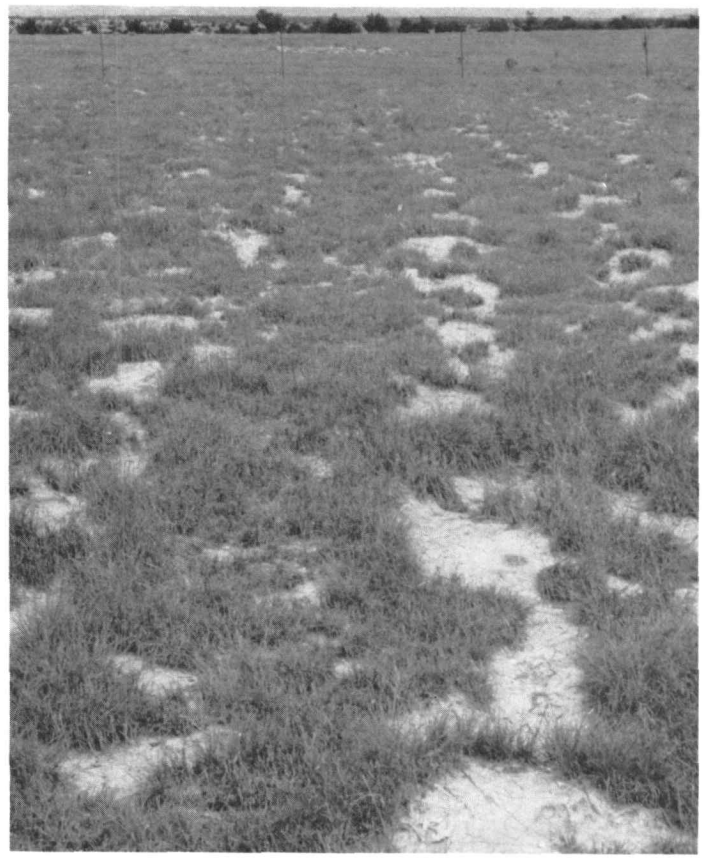


Location map of Fort Carson and the Study site.

grass prairie range site received simulated tracked vehicle (M-60 tank) maneuver activity at a light vegetation damage level (approximately 25% of the existing vegetative cover destroyed by the tank); a moderate vegetation damage level (approximately 50% of the existing vegetative cover destroyed); and at a heavy damage level (complete vegetative cover destruction). Five treatments (see adjoining page) were applied across the light and moderate damage levels. These treatments consisted of: (1) pitting alone; (2) pitting and seeding 'Vinall' Russian wildrye; (3) pitting and seeding a grass mixture[a] native to the range site; (4) pitting, seeding Russian wildrye, and fertilizing with 40 pounds per acre of available nitrogen and phosphate; and (5) pitting, seeding the same native grass mixture, and fertilizing with 40 pounds per acre of available nitrogen and phosphate. The heavily damaged area had the same five treatments applied along with two additional intensive treatments consisting of mechanical seedbed preparation, fertilizing with 40 pounds per acre of available N and P, mulching with native grass hay at a rate of 4,000 pounds per acre, and seeding Russian wildrye and the same native grass mixture.

With only a moderate or light degree of tank activity, the rangeland treatments did not speed vegetative recovery. Sufficient shortgrass vegetation remained so that the application of the revegetation practices provided no substantial benefits. On heavily impacted areas where the vegetative cover was completely destroyed, and if only short-term rest periods (i.e., deferment of maneuvers) of up to two growing seasons can be provided, the pitting alone treatment was just as effective as any of the pitting/seeding or pitting/seeding/fertilizing combination treatments.

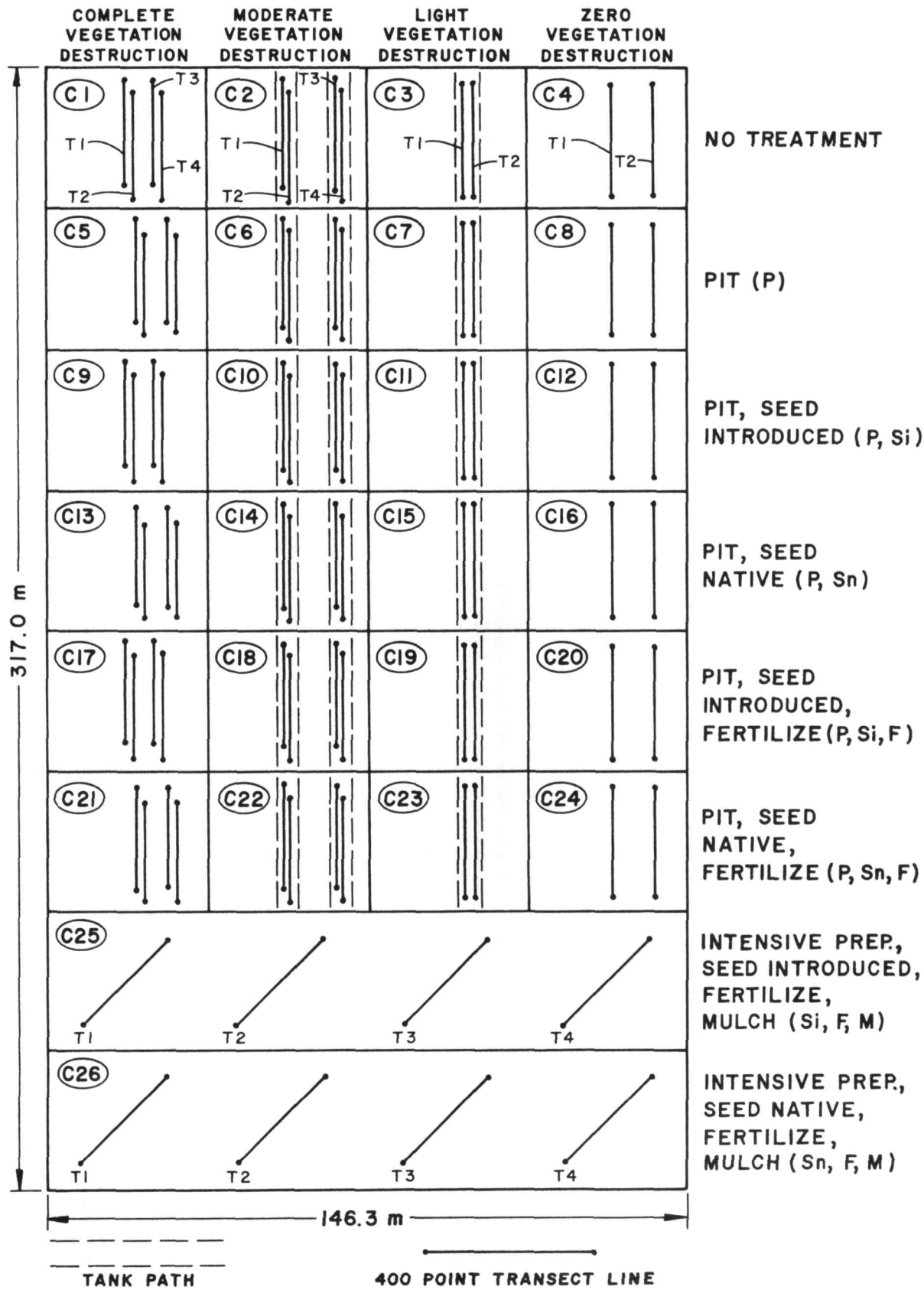
Therefore, pitting alone was the recommended treatment for short rest periods on rangeland that has had the vegetative cover completely destroyed by maneuvers. If longer rest of up to four growing seasons can be provided, then pitting in combination with fertilizing was the most effective revegetative treatment.



Pitting and fertilizing combination treatment taken in September 1986 (the final year of data collection). SCS photo.

Most of the benefits associated with these two treatments (pitting alone, and the pitting/fertilizing combination) came from an increase in the amount of vegetative litter cover (both standing and on the soil surface). Since the approach was to consider any increase in vegetative cover as being desirable from a soil erosion standpoint (both wind and sheet/rill water erosion) these two treatments were determined to be beneficial when 100% of the existing vegetative cover has been destroyed by maneuvers. Pitting is not successful when existing vegetation remains after maneuvers. Additionally, from an ecological condition standpoint, an increase in vegetative litter from the resulting bottlebrush squirreltail and annual/biennial plant cover would not necessarily be advantageous. Viewed in this manner, the treatments discussed above would not be beneficial.

[a]Mixture consisted of 30% "Vaughn" sideoats grama, 20% "Lovington" blue-grama, 30% "Barton" western wheatgrass, and 20% sand dropseed.



Fort Carson study design and layout showing transect (T) and cluster (C) numbers for each treatment

Seeding either introduced or native grasses in combination with the pitting and/or pitting/fertilizing treatments provided no significant revegetation benefits relative to the needs of Fort Carson.

Based upon the information presented, Army personnel are now better able to develop management plans that fit the appropriate revegetation treatment into Fort Carson's overall maneuver schedule, thereby utilizing their finite land area in the most efficient manner.

Pitting only treatment crossing the tank disturbance area. SCS photo taken May 1982.

Pitting only treatment immediately after significant rainfall. Estimated water storage in these pits is approximately 12,000 gallons per acre. SCS photo taken July 1982.

Aspen Regeneration: A Range Management Problem

S. Hawk Greenway

Aspen (*Populus tremuloides* sp.) is an important, dominant tree species across much of the intermountain west. It grows in the moist montane areas (precipitation zones from 16 to 40 inches), between sagebrush communities at lower elevations and conifer communities at higher elevations. Extensive in size, and very productive, the aspen zone is an important one to range managers. In addition to producing habitat for wildlife, forage for livestock, poles and timber, and regulating water runoff, the cool mountain groves are a valued scenic attraction.

Aspen is a relatively stable component of the landscape that we tend to take for granted. In a grove of smooth barked, slim trees, it is easy to assume that they are young and healthy. Yet aspen can appear young for decades, long after they have reached maturity. The appearance of youth is no substitute for the existence of a young, replacement generation. On a multiple use range, young aspen shoots can be at a severe disadvantage. Without management attention, the success of aspen regeneration is in doubt.

The health of the aspen groves have been watched by savvy range managers for decades. As far back as 1954, Houston wrote:

> The presence or absence of aspen reproduction has long been used as an indicator of range condition. If aspen reproduction was present, the range was considered in satisfactory condition, if absent, in unsatisfactory condition (Houston 1954).

In effect, the aspen trees themselves are a visible "indicator" species.

Aspen is usually classified as a seral species. An aspen grove exists as a single step along the path of succession, a period in the progression of a dynamic forest range. It is not a stable climax woodland. An aspen grove dominates an area until either (1), shade tolerant conifers reach a height sufficient to take over; (2), the aspen grow old and decadent, eventually dying out, leaving brush and grass; or (3), the aspen re-establishes itself after a natural catastrophic event, such as a fire, prevents succession from running its course (Shields 1981). The successional shift to conifers or brush directly affects the habitat, forage, water holding, and recreational aspects of the aspen zone. Of special interest to range managers, Harniss (1981) found that: "In the successional path to conifers, the grasses disappeared first, followed by forbs and then the shrubs as the conifers became established.... With the demise of aspen, wildlife habitat and diversity would tend to decrease in decadent aspen stands". On the lower, drier edges of the aspen range, aspen may be replaced successionally by sagebrush-grass communities to the detriment of livestock and big game.

Aspen trees grow in separate groups of genetically identical clones, connected through the root system (Schier 1981). This is why in the fall you see certain clumps of aspen change color before their neighbors, or notice tree trunk characteristics differing from clump to clump (clone to clone) under similar growing conditions.

Aspen regenerates by two methods, through seeds and through shoots or root suckers. Seedlings require very steady conditions of moisture for the first few years, and so usually do not survive the summers in the intermountain west under the current climate (McDonough 1979). Most, if not all, intermountain aspen regeneration occurs through sprouting root suckers.

Suckering, however, is inhibited by auxin translocated to the roots from growing shoots and leaves, a phenomenon called apical dominance. Disturbances that damage, cut, or kill stems will reduce the flow of auxin into the roots and result in aspen regeneration (Schier 1981).

Where cattle or big game have access to the shoots that do begin to grow, browsing and trampling can lead the conversion to sagebrush and grassland. One scientist stated:

> In relatively recent years man has had considerable impact on the western aspen habitat: (1) His livestock have overgrazed many ranges, which decimated young suckers, especially if they occurred sporadically as advance regeneration in the understory. (2) He has managed big game (deer, moose, and elk) populations to maintain relatively stable numbers near the carrying capacity of the ranges: again, aspen suckers were browsed back repeatedly on many areas. And, most important, (3) he has prevented wildfire from periodically killing the forest, and thus, favoring extensive aspen sprouting.
>
> As a result of these impacts, aspen on millions of acres will be replaced by conifers or by brush and grass within a century (DeByle 1976).

One area where the aspen regeneration is easy to observe is along the streams and around the springs where beaver have been active. Beaver are restricted to about a hundred yards from water in their harvesting of aspen, and can entirely devastate (or clearcut) a watercourse.

With proper management, causing a break in beaver colony occupation, the aspen will tend to regenerate itself. Without some form of beaver population control, or reprieve from browsing, denuded streamsides will result.

In today's environment of focused attention upon the health of the riparian zone, the effects of these beaver-denuded streamsides and watersheds upon the ecology of the stream cannot go unnoticed. Stable streambanks with growing vegetation are found to be essential for good fish habitat.

Conifers invading an aspen grove. Approximately 9500 ft in western Colorado. Note lack of aspen regeneration.

Decrepit aspen being replaced by brush at lower edge of aspen zone. Approximately 8000 ft in western Colorado.

Beaver themselves are not the problem. Managed colonies have a positive effect upon small trout streams and their attendant wildlife (Kirby 1975). The key is reestablishment of the streamside vegetation (in this case, aspen) after beaver have harvested it.

Various methods have been used to stimulate aspen reproduction. The Forest Service has used fire, herbicide and clearcutting to remove or kill the above-ground portion of the aspen. This often leads to extensive aspen sprouts from the root systems. In some areas clearcut by humans, as many as thirty to fifty thousand sprouts can be found per acre (DeByle 1976). "Clearcutting" consistently produces the greatest success in regenerating aspen. (Shields 1981).

Fenced off areas are not a prerequisite for aspen regeneration.

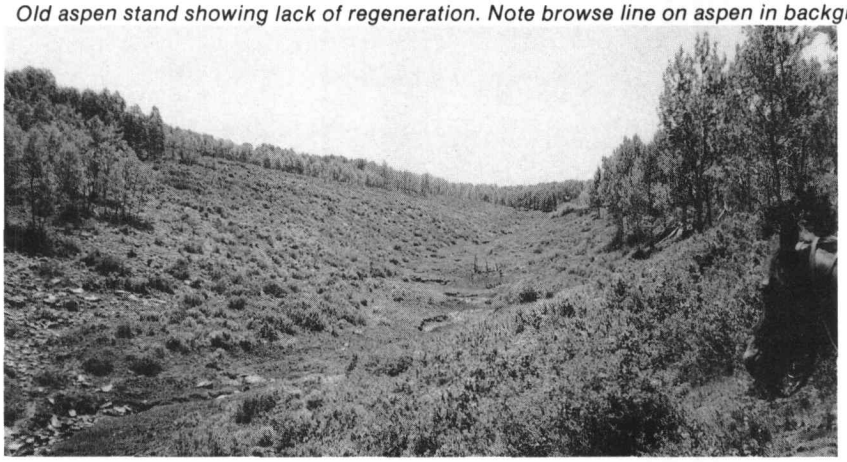
Old beaver clearcut with aspen shoot showing browse damage.

Aspen is important to the range manager not simply for its own sake, but also for the entire community it fosters. Without management attention, the aspen-dominated western range will change away from aspen to either conifer-dominated communities or brush and grass communities. The health and vitality of aspen groves cannot be taken for granted.

Maintenance of aspen range productivity demands a long-term perspective from the range manager. The producer primarily worried about this year's forage production must consider the implications of range with seriously depleted aspen groves. Management of the browsing pressures upon aspen regeneration is necessary.

The range manager should pause occasionally and look around for aspen regeneration. In live standing aspen, regeneration will be limited due to apical dominance. Around disturbances, either by fire, clearcutting, or around old beaver ponds, aspen shoots should be abundant. If they are not, over-browsing should be suspected. Reduced or removed livestock from local areas for the first five to

Old aspen stand showing lack of regeneration. Note browse line on aspen in background.



Drainage showing combined effects of beaver use and heavy browsing pressure. Note sagebrush incursion.

Old beaver pond lacking established aspen regeneration 10 years after beaver were removed.

ten years after a disturbance, as well as wildlife control measures should see successful aspen regeneration.

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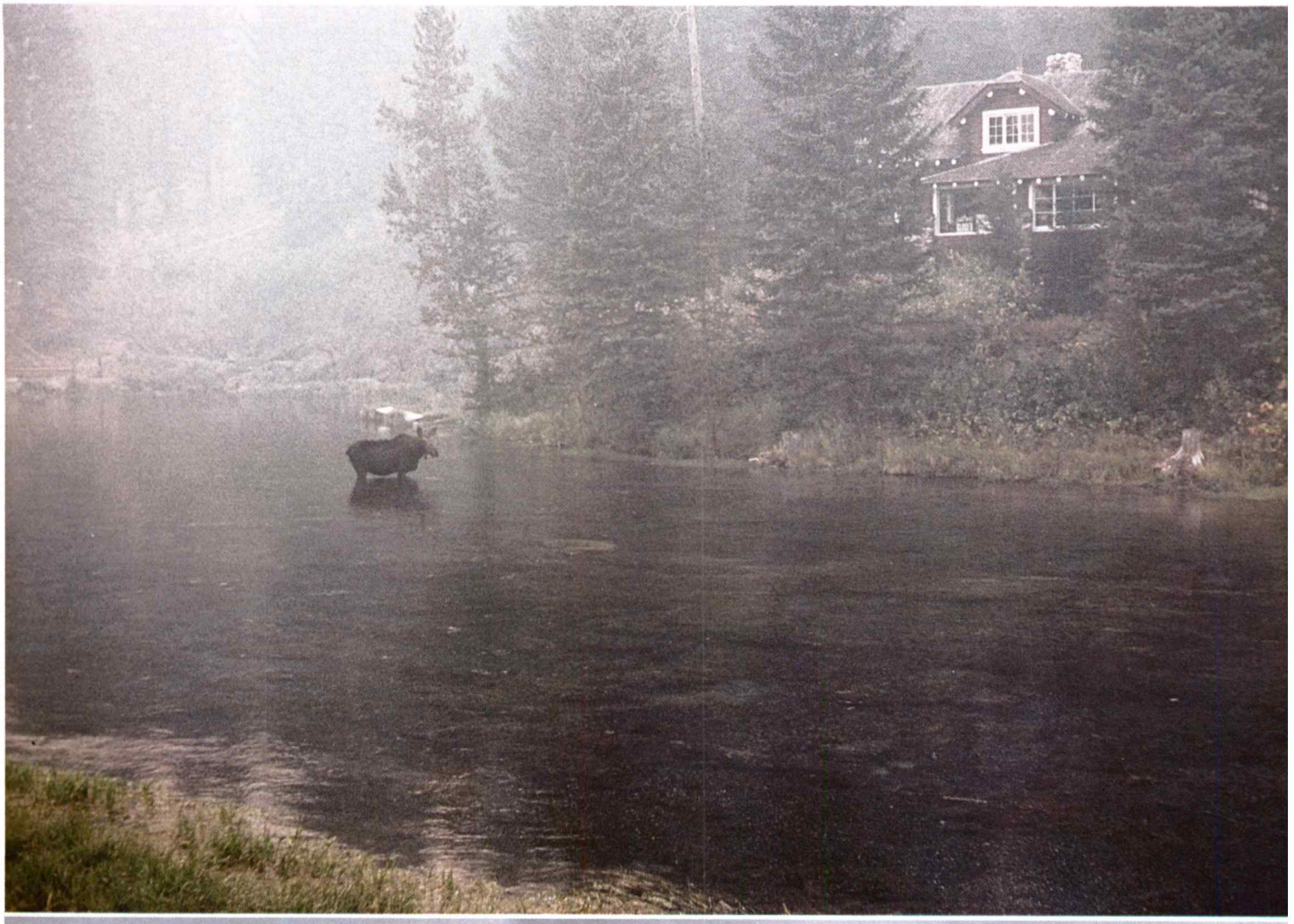


A Smokey Summer at Yellowstone

Larry S. Allen

After several years vacation from fire suppression, Larry Allen of SRM's Arizona Section was re-activated for the nation's worst-ever fire season. Following are one range man's impressions of the fires in and around Yellowstone National Park.

At times the smoke blotted out the sun at West Yellowstone.

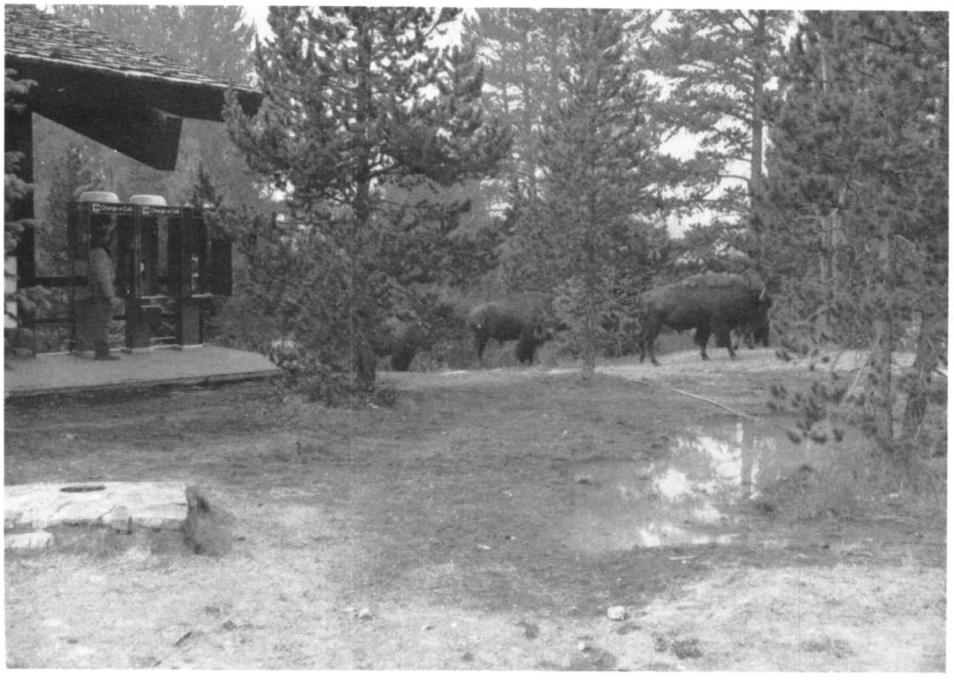
(above) A North Carolina fire crew gets a taste of fire fighting Rocky Mountain style.

Blow-down timber from a previous storm provided fuel to an already hot fire.

(facing page, top) A moose takes refuge in the creek at Big Springs, Idaho. (bottom) The Wolf Creek Fire did not slow down much when it reached the grass and sagebrush.

(left) Bulldozers were used effectively to construct fire lines where terrain and environmental constraints allowed. (right) Heading in.

A group of farmers from southern Idaho brought in irrigation systems to protect towns and structures from spot fires.

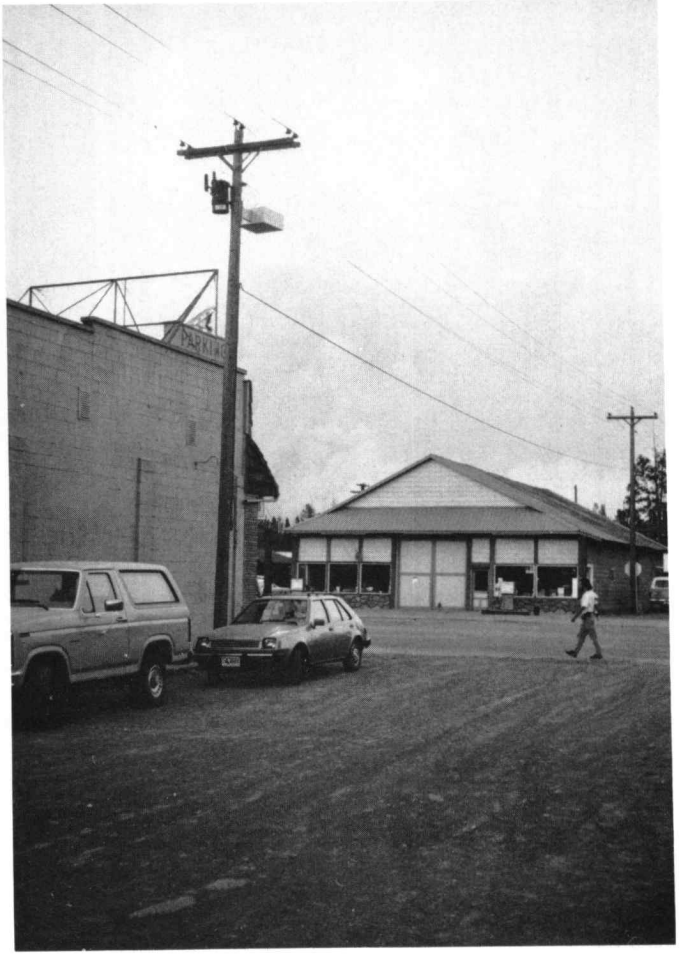


A firefighter calls home, while three bison listen in.

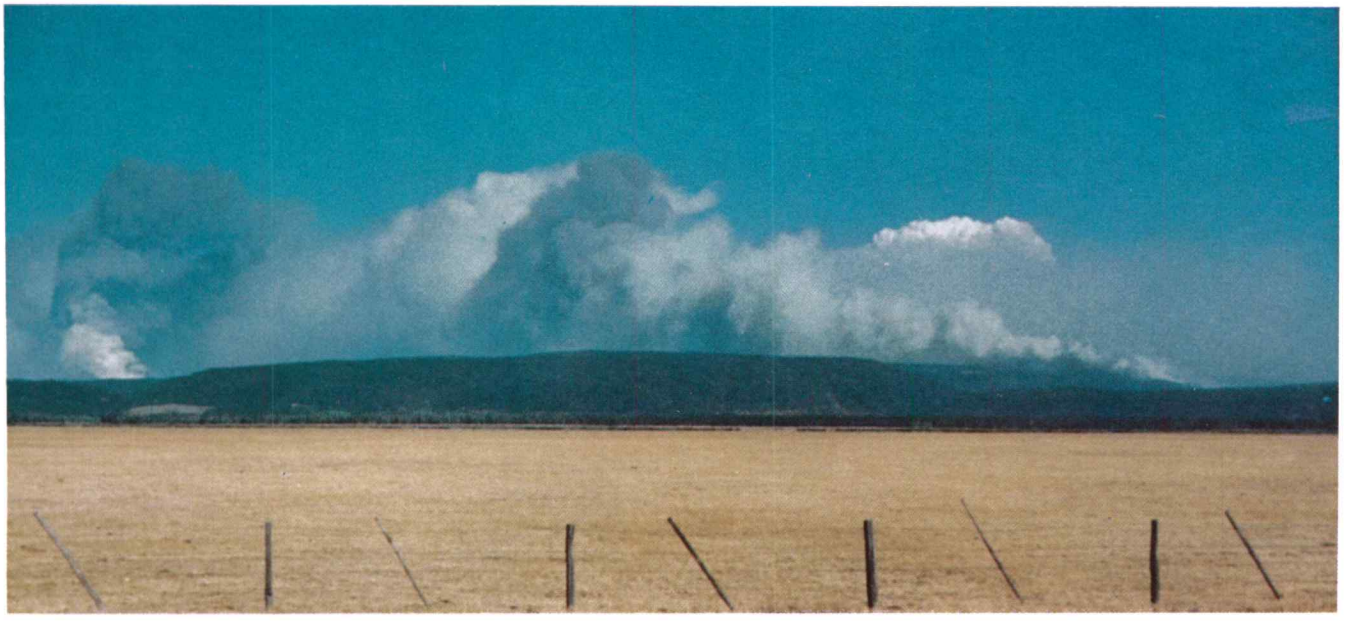
Equipment at a staging area on the Targee National Forest.

North Fork Camp—Madison Junction.

Wetting the roof at Canyon Village.



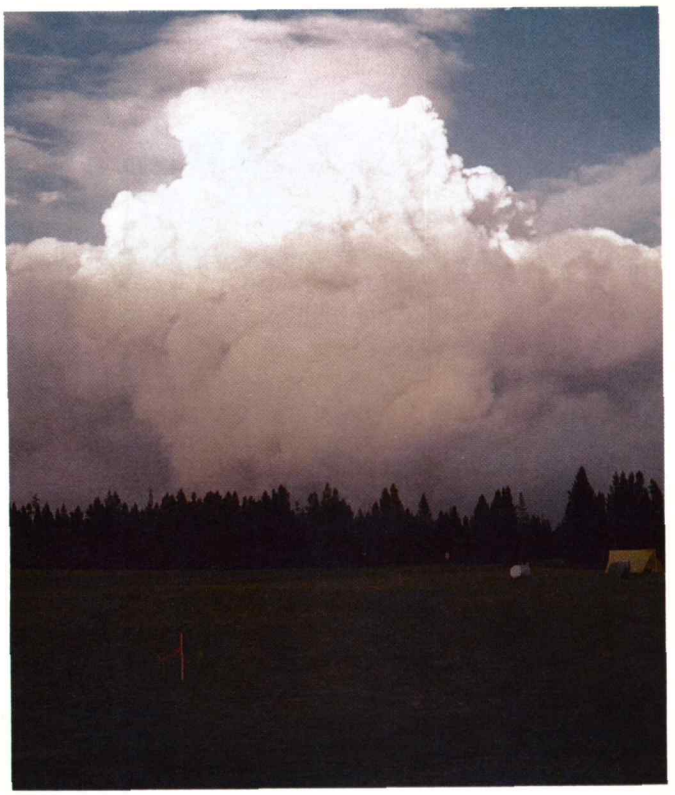
At times the smoke column was too close for comfort at West Yellowstone.



Multiple smoke columns as seen from Island Park, Idaho. One of these threatened West Yellowstone and another made a run at Old Faithful.

Fire approaches Old Faithful.

Most structures survived at this picnic area on the Gibbon River, but the atmosphere was drastically altered.



North Fork Fire approaches West Yellowstone Airport.

ıally the snows came.

Observations on Spotted and Diffuse Knapweed Invasion into Ungrazed Bunchgrass Communities in Western Montana

John Lacey, Peter Husby and Gene Handl

Spotted knapweed *(Centaurea maculosa)* and diffuse knapweed *(C. diffusa)* were introduced into the Pacific Northwest from Eurasia around 1900 (Roché and Talbott 1986). They vigorously compete with native vegetation. Whereas spotted knapweed has invaded about 4.7 million acres of Montana's range and pastureland, diffuse knapweed infests less than 15,000 acres (Lacey 1987). Most of the infestations occur in the foothills and mountains of western Montana.

The knapweeds are competitively superior to native plants on many sites. Their competitiveness is attributed to prolific seed production, high seed viability, ability of seeds to germinate during fall and over-winter as rosettes, the absence of natural enemies, and the selective grazing of desirable forage plants. Knapweed invasion is most common on sites disturbed by excessive grazing, logging, rodents, or off-road vehicles. However, disturbance may not be a necessary condition for knapweed to invade some grass communities (Myers and Berube 1983, Morris and Bedunah 1984, Tyser and Key 1988).

The rapid invasion of weeds into rangeland is often blamed on man's management. But a question which is rarely asked is whether the knapweeds are able to invade climax bunchgrass communities. This report provides an evaluation of spotted and diffuse knapweed invasion into climax bunchgrass communities in western Montana.

The Study

The study was done at two locations on the Blackfoot-Clearwater Game Range near Ovando, Montana, and a third location near Helena, Montana (Fig. 1).

Ovando Observations

Spotted knapweed invasion into rough fescue communities was measured on a silty range site. Although the fescue communities were surrounded by a grass hay meadow, a few patches of spotted knapweed occurred between the meadow and the rough fescue (Fig. 2). Spotted knapweed infestations were about 200 × 30 ft and 50 × 10 ft at Sites 1 and 2, respectively. The knapweed infestations were a potential seed source for the rough fescue. Seed dispersal was suspected to be aided by prevailing westerly winds. Although the meadow was cut annually, the knapweed was not mowed. The area was lightly grazed by deer and elk. Livestock grazing had been excluded for 30-40 years.

A permanent stake was placed within the knapweed infestation, approximately 3 ft from the rough fescue at each site. A steel tape was fastened to the stake and stretched 300 ft into the rough fescue (Fig. 3). One permanent 8 × 20-in plot was located 7 ft from the stake and 20 additional plots were located at 14-ft intervals along each transect. Spotted knapweed plants in each plot were counted annually from 1984 through 1987. The relative importance of other species was determined using the canopy-coverage method (Daubenmire 1959). Thus, the rate at which spotted knapweed moved into the grass community was recorded.

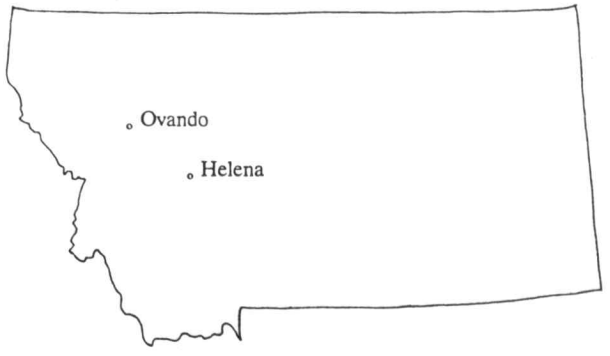


Fig. 1. *Location of study sites for observation of spotted and diffuse knapweed invasion into climax bunchgrass communities.*

On August 14, 1986, two seed traps were located parallel to the transects at each study site. They were 11 ft by 0.5 ft, constructed from discarded aluminum printing plates (Fig. 4). Petroleum jelly was smeared onto the plates to ensure that the seeds would "stick" to the surface. The collection plates were fastened to the soil surface with spikes. Seeds were collected twice, on September 3 and October 12. Although some seeds remained in the seed heads, the seed traps were removed on the 12th. Nighttime temperatures were dropping to 15° F, which caused the petroleum jelly to lose its effectiveness.

Helena Observations

Diffuse knapweed invasion was measured on a shallow range site at 4,100 ft elevation (Fig. 5). Annual precipita-

Fig. 2. *Patches of spotted knapweed were located between the grass meadow and rough fescue communities near Ovando, Mont. (Photo taken from the edge of the meadow).*

Authors are extension range management specialist, Montana State University; District Conservationist, Soil Conservation Service, Baker, Montana; and Range Conservationist, Soil Conservation Service, Bozeman, Montana, respectively.

Fig. 3. *A metal stake near the edge of the spotted knapweed infestations marked the location of the permanent transect which extended into the rough fescue community near Ovando, Mont.*

Fig. 4. *Seed traps, constructed from aluminum printing plates, were used to trap seeds.*

Fig. 5. *Bluebunch wheatgrass dominated the shallow range site near Helena, Mont.*

tion averages 10 in. at this site. The site was dominated by bluebunch wheatgrass and was used by Soil Conservation Service personnel as a relict area to evaluate ecological succession. It had not been grazed by livestock for at least 20 years. Diffuse knapweed was established along the banks of an irrigation canal that formed the south edge of the site. Herbage production was clipped and weighted from 1979 through 1987.

The Knapweed Invasion

Ovando Sites

Spotted knapweed moved 14 ft into the rough fescue community at Site 1 during the 4-year study (Table 1). Density of spotted knapweed increased 6-fold (at the 7-ft mark). The conditions responsible for the increase are not known. Spotted knapweed invaded 7 ft at Site 2. Difference in rates of invasion between the study sites may be related to the size of the respective knapweed infestations. The infestation at Site 1 was about 7 times greater than the one at Site 2.

Results from the seed trap indicated that knapweed seed dispersal was concentrated near the infestations. About 50% of the total seed was disseminated within 2 ft

Table 1. Invasion of spotted knapweed into rough fescue communities during a 4-year study at Ovando, Mont.

Year	Distance from the knapweed (ft)[1]	Number of knapweed plants per plot (8 × 20 in) Site 1	Site 2
1984	7	7	0
	21	0	0
	35-287	0	0
1985	7	11	1
	21	0	0
	35-287	0	0
1986	7	10	1
	21	0	0
	35-287	0	0
1987	7	42	1
	21	2	0
	35-287	0	0

[1]The first plot at each site was located 7 ft from the stake marking the transition between the knapweed and grass communities. Subsequent plots were located at 14-ft intervals.

Table 2. Number of spotted knapweed seeds trapped at two sites in 1986, Ovando, Mont.

Distance from knapweed front (feet)	Site #1				Site # 2			
	September 3		October 12		September 3		October 12	
	Trap 1	Trap 2	Trap 1	Trap 2	Trap1	Trap 2	Trap 1	Trap 2
0-1	26	39	6	12	3	7	2	3
1-2	18	31	6	10	2	3	0	2
2-3	9	35	3	16	0	1	0	0
3-4	5	26	2	10	0	2	1	0
4-5	5	9	0	2	0	1	0	0
5-6	1	3	0	1	0	0	0	0
6-7	5	4	0	3	1	0	0	0
7-8	5	1	3	1	0	0	0	0
8-9	0	2	0	4	0	0	0	0
9-11	0	3	0	3	0	0	0	0
	74	153	20	62	6	14	3	5

of the knapweed infestation (Table 2). Only 12% of the seed was recovered more than 5 ft from the edge of the infestation. Average number of seeds recovered ranged from 43 seeds/ft^2 adjacent to the infestation to less than 1 seed/ft^2 at a distance of 10 ft. Greater seed fall at Site 1 than Site 2 was attributed to the larger knapweed infestation. Seed dispersal would be affected by wind and animals. It is not known if 1986 was a "typical" year.

The knapweed seeds trapped in the grass community (Table 2) indicate that the seed bank was capable of supporting a faster rate of invasion than what was observed. The relatively slow rate of knapweed encroachment may be related to the status of the climax plant community. Annual herbage production approached 2,000 lbs/ac at the Ovando sites. Canopy cover averaged 90% for litter and 66% for rough fescue. Bare ground averaged 2.7%. Thus, exposed soil was minimal. Under these conditions, the rough fescue climax community was fairly resistant to knapweed invasion.

Helena Site

Total herbage production ranged from 215 lbs in 1985 to 885 lbs in 1986 (Table 3). In 1982, a severe hail storm knocked down the grass, and made it impossible to clip. The hail also physically "impacted" the soil surface.

Diffuse knapweed was not present on the site prior to 1982. However, it invaded the bluebunch wheatgrass after the hail storm. From 1983 through 1987, it contributed from 7 to 49% of the annual herbage production. Once established, it has persisted in the bunchgrass community.

Table 3. Production of bluebunch wheatgrass, diffuse knapweed, and other species of the Helena, Mont. site from 1979-1987.

Year	Bluebunch wheatgrass	Diffuse knapweed	Other species	Total
	----------lbs/ac----------			
1979	400	0	140	540
1980	445	0	120	565
1981	570	0	155	725
1982	Hailed Out	—	—	—
1983	245	125	245	615
1984	240	95	65	400
1985	135	15	65	215
1986	320	430	135	885
1987	225	235	130	620

Management Implications

Our study indicates that the invasion of climax bunchgrass communities by knapweed invasion may be insidious or rapid. A rough fescue climax community—in the absence of disturbance—appeared to be fairly resistant to spotted knapweed invasion. However, even in the absence of grazing, diffuse knapweed rapidly invaded a bluebunch wheatgrass community. Therefore long-term protection from grazing is not recommended as a deterrent to weed invasion.

The knapweed threat emphasizes the need for ranchers to practice good range management. Spotted and diffuse knapweed invasion onto range is favored by soil disturbance, bare ground, and lower succession stages. Until the ecology of the knapweeds is understood, the following grazing management practices are recommended: 1) alter the season of use, 2) do not overstock, 3) rotate livestock and allow plants to recover vigor before regrazing, 4) leave adequate leaf area (stubble height) following grazing, and 5) allow litter accumulation. Herbicide treatments should be applied as soon as the initial knapweed plants are detected.

Implications from our study clearly support the need for additional research to quantify the relationship between ecological class, rangeland use and invasion of noxious weeds. Cause-and-effect relationships need to be better understood. Our range resource deserves an answer.

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Optimal Vegetation Conversion—How Much, How Often?

John A. Tanaka and John P. Workman

Some of the more difficult aspects of planning and analyzing rangeland improvements involve predicting forage response, how long the improvement will last, what value the forage has in each of its many uses, and whether benefits from the improvement outweigh costs. Range ecologists typically have focused on the first two questions while economists have emphasized the last two.

Research into the biology of overstory-understory relationships in a wide variety of ecosystems will allow reasonable estimates of the economic feasibility and optimality of given vegetation conversion projects. The economist attempts to answer two basic questions. First, is it rational to allocate limited resources of a ranch business (e.g., land, labor, capital, and management skills) to a particular range improvement project? Second, if it is, then how much should be invested in vegetation conversion and how often should it be repeated?

This paper examines these questions for the suppressive effects of big sagebrush overstory on crested wheatgrass understory production in the intermountain region of the western U.S. The described approach could be applied to any overstory-understory vegetation project. As in any economic analysis, the underlying assumptions are important in terms of the results and conclusions, and must be specified.

A Typical Ranch—The Analytical Basis

A typical Utah cow-calf-yearling operation was used as the basis for this analysis. The typical ranch runs 206 brood cows with a 15% replacement rate, a 24:1 bred cow:bull ratio, and an 82% calf crop based on Jan. 1 brood cow inventory. The feed sources are native foothill range, crested wheatgrass foothill range, hay meadows, crop aftermath, federal grazing permits, and private range leases (Capps and Workman 1981, Dickie and Workman 1987).

Most of the early spring forage is provided by crested wheatgrass that was seeded following sagebrush control. Two factors combine to make this a key range improvement: first, controlling sagebrush and seeding grasses is expensive, and second, because crested wheatgrass grows during the most limiting season, it can control herd size. To keep the economic analysis relatively simple, average production rates and prices are used.

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The Overstory-Understory Model

The conversion of big sagebrush in the 1950s and 1960s to crested wheatgrass range has had varied success. In some areas, sagebrush has not re-established itself and does not appear likely to re-establish in the near future. In other areas, it is difficult to find a crested wheatgrass plant among the sagebrush. Explanations for this variation in response can be grouped into two categories: ecological and management. Ecologically, if the controlled sagebrush occupied a marginal sagebrush area, the establishment of a vigorous grass cover could prevent the reinvasion of sagebrush. However, if the controlled area was a prime sagebrush site, re-establishment is expected to occur. In terms of management, if the seeded grass is grazed each year during a critical growth period, reestablishment of sagebrush is enhanced. But if the seeded grass is carefully grazed, it may be possible to maintain the health of the grass even on a prime sagebrush site. In many cases, a combination of these two factors likely determines whether big sagebrush will become re-established.

The "How Often" Question

In areas where re-establishment does not occur under any management regime, sagebrush conversion can be a one-time decision. But if re-establishment is known to occur, the recurring question becomes: how *often* should the sagebrush stand be converted to crested wheatgrass in order to maximize profits? The important assumptions are: (1) the typical ranch includes a crested wheatgrass stand that is subject to big sagebrush re-establishment, (2) cow herd size is constrained by limited spring forage, and (3) the manager must decide under what conditions it is feasible to control big sagebrush.

The "how often" decision hinges on several factors: percentage of the big sagebrush stand initially killed, subsequent stand management (season of use, utilization rate), and kind and class of animal grazing the grass. In applying research results, it must be recognized that these factors are interactive. Thus, the combined effects of all factors may be different than the sum of the individual effects.

The "How Much" Question

Hull and Klomp (1974) studied the effect of initial percentage kill of big sagebrush re-invading an established southern Idaho crested wheatgrass stand. Prescribed burning, 2,4-D spraying, and hand grubbing were used to reduce stands of basin big sagebrush and Wyoming big sagebrush by 0, 50, 75, and 100%. Crested wheatgrass

response was measured over 6 years. Figure 1 shows the relationship between crested wheatgrass production and percent kill of basin big sagebrush averaged over the last four years of their study. There were no statistical differences between treatments in the first two post-treatment years compared with the control. Yield was converted to usable forage by applying a utilization factor and an availability factor (i.e., a percentage reduction). Hull and Klomp concluded that killing the final 25% of the big sagebrush resulted in 135% more grass production than did killing the first 75%.

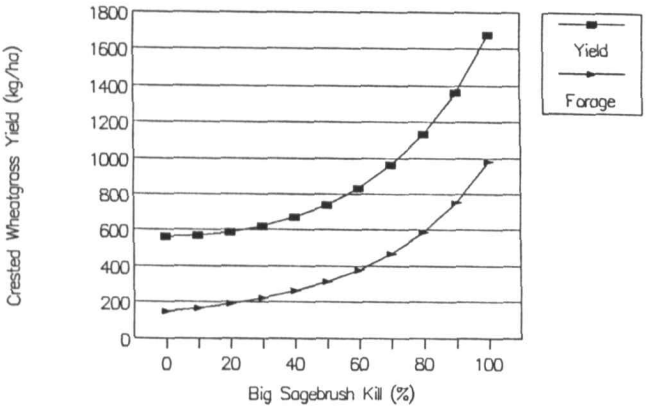

Fig. 1. *Estimated annual crested wheatgrass and usable forage yields at big sagebrush percent kill levels.*

The fact that grass production increases at an increasing rate as sagebrush is reduced has a significant effect on initial investment feasibility. It may also be an important determinant of project life (project life is defined as the point at which no additional production is realized from the treatment). If complete control is attained, a significant sagebrush seed source for the re-establishment is removed. Less than complete control allows a seed source to remain in the stand and effective project life may be shortened. Other influences on the rate of sagebrush re-establishment include deferment length, initial range condition, post-treatment grazing management, big sagebrush subspecies, density, height, age, associated species, topography, soil type, slope, aspect, precipitation, kind of grazing animal, and treatment method.

Economic Optimization

The goal of economic optimization is to identify solutions where the cost of increasing the intensity of input use is just equal to the benefits that are added from that increase. Analysis of vegetation conversion consists of balancing the variables (e.g., initial kill, utilization rate, and project life) to find the profit maximizing solution. Each variable can be examined independently by holding the others constant.

Beginning with the case of a ranch short on spring forage, and with an existing stand of crested wheatgrass being overtaken by sagebrush, the first question is whether retreating sagebrush is the best alternative to alleviate the forage shortage. Other options may include leasing additional pasture, buying more land, or feeding hay during the spring green-up period. Once it has been determined that retreating sagebrush in the existing crested wheatgrass stand is the best alternative, the remaining questions are what percentage of the sagebrush should be killed, how many acres should be treated, and what the forage utilization rate should be in future years?

The economic analysis requires valuation of both additional forage and the investment to obtain that forage. Forage can be valued in several ways depending on seasonal ranch need and how additional forage is used in the operation (Workman 1986). Most forage valuation techniques involve either a direct application of the market value of leased forage and substitute feeds or the forage is priced in terms of how much additional new revenue it provides. The second method accounts for differences between ranch operations. Termed "derived demand" by economists, this method recognizes that each individual ranch has a specific need for forage based on available resources, herd size, and herd composition.

The final part of the analysis is to balance the initial cost-of-kill with the expected time path (relationship of yield to time from project implementation) of increased forage value to determine the profit maximizing combination of kill rate and utilization rate. Forage utilization rate affects project life as well as livestock performance. Figure 2 shows the expected relationship between spring forage utilization and steer production over time when

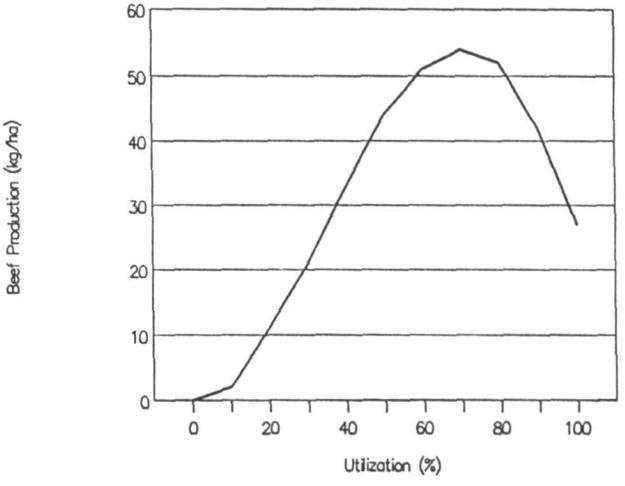

Fig. 2. *Estimated beef production as a function of percent forage utilization assuming 90-95 percent initial big sagebrush kill. Adapted from Torell (1984).*

sagebrush was reduced by 90–95% (Torell 1984). Beef production reached a maximum at a forage utilization rate of 75–80%.

The model is further complicated by introducing the effects of initial investment level on project life and expected returns. Figure 3 illustrates estimated time paths for yields of crested wheatgrass grazed at 65% utilization for four initial kill levels. Two relationships are evident. First, the higher the initial kill level, the higher the expected grass yields. Second, the higher the initial kill

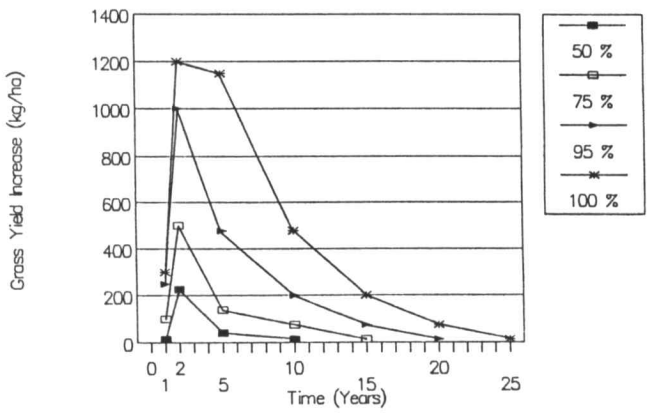

Fig. 3. *Estimated crested wheatgrass production through time after selected big sagebrush kill levels.*

level, the longer the expected project life.

Figure 4 shows the cost-of-kill functions for prescribed burning, 2,4-D spraying, and tebuthiuron application. The burning and tebuthiuron curves show that costs increase at a decreasing rate at low kill levels (due to spreading of set-up costs) and increase at an increasing rate as kill approaches 100% (due to the difficulty of achieving high kill rates). If we consider initial kill rate and utilization rate together, the situation is much different. Sagebrush will increase in a heavily grazed crested wheatgrass stand, especially when grazed in early spring. This could eventually occur even if a 100% sagebrush kill was achieved and no sagebrush seed source was initially available.

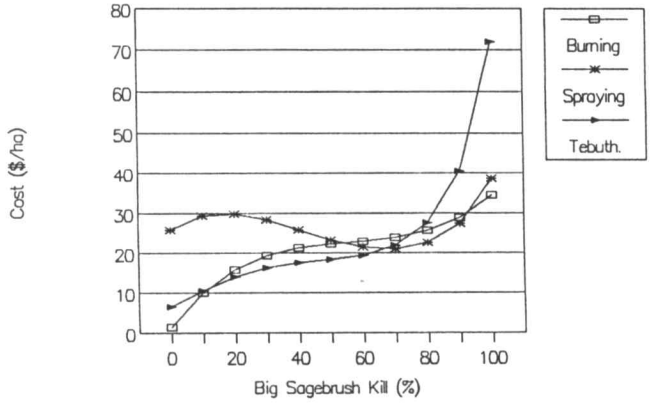

Fig. 4. *Cost of killing big sagebrush as a function of big sagebrush kill percentage (Tanaka and Workman 1988).*

The appropriate sagebrush kill percentage depends on expected returns. For example, holding utilization rate constant and using estimated project lives shown in Figure 3, killing 98% of a sagebrush stand with tebuthiuron with a life of 23-years would return 12.49 times the net present value as would killing 50% with a life of 10-years (Tanaka and Workman 1988). Even if the project lives are equalized (i.e., doing the 50% kill project 2.3 times), the higher kill rate results in 7.87 times more in net present value. The concept of project life is important when calculating project benefits. For example, at a discount rate of 10%, $1,000 to be received 10 years from now is worth $386 today. The same $1,000 received 50 years from now is worth only $9.

All factors may be combined to estimate the economically optimal retreatment (rotation) period. If each factor remains constant through time, a model may be developed that specifies the appropriate retreatment schedule. Model results are only predictions and no better than input data, but they do provide a reasonable guide to the appropriate retreatment schedule and a basis for economic analysis and decision-making.

Formal economic analysis of retreatment scheduling requires a complex approach designed to determine if waiting an additional year to retreat costs more in terms of the present value of lost benefits than retreating now. However, a simpler model may be used with factors that the manager can control—initial big sagebrush kill percentage and subsequent grazing use. Both factors impact optimal life of the project and expected returns. For example, making a large initial investment to obtain a high sagebrush kill will likely extend project life as will conservative grazing after treatment. But it may not be economically possible to recoup the initial investment at a low utilization rate. However, while an increased utilization rate may decrease project life, it may also increase the present value of returns over time. Benefits obtained early in the project life are worth more today than benefits received later. Taking more of the benefits early increases the likelihood of profits, but this advantage must be balanced against the disadvantage of a shorter project life. The analysis can become complicated even considering only these two factors.

Answers to the *combined* "how much" questions (how much of the sagebrush stand to kill and how much of the resulting crested wheatgrass to graze annually) can be obtained by several approaches ranging from complex optimization models to simple comparisons of net returns produced by a few reasonable levels and combinations of initial kill percentage and forage utilization rate. Electronic spreadsheets on microcomputers are useful in the latter approach. Of course, reasonable assumptions of initial kill, utilization rates, and project lives must be specified for each combination tested.

Estimating the optimal retreatment schedule (answering the "how often" question) requires a complex mathematical model (Torell 1984) and a large amount of data. With the number of factors that could depart from original expectations over project life, the specified optimal retreatment schedule is only an estimate, but a useful one for planning projects. Project life is of crucial importance in the analysis because of the "time cost" of money. A project with high annual benefits early in the project life is worth more in present value terms than a project yielding the same returns later. The longer the project life is extended through low utilization rates or higher initial

kills, the less the *additional* returns will be worth in present value terms.

Summary

Planning range improvement practices involves predicting forage response, expected improvement life, value of additional forage production, and whether improvement benefits outweigh costs. Key questions that range economists attempt to answer include how much should be invested in vegetation conversion (i.e., the optimal kill rate) and how often the investment should be repeated.

This paper examines these questions for the specific case of reducing big sagebrush overstory to release crested wheatgrass understory production. A typical Utah cow-calf-yearling operation is used as the basis for analysis and an overstory-understory model provides the required biological information. The appropriate sagebrush kill percentage depends on the costs and returns of an additional kill percentage.

Using a model, such as the one described, in project planning can lead the decision-maker through a series of necessary steps. Thinking through the interrelationships may be more important than coming up with the exact solution. In any biological relationship, risk must also be incorporated into the analysis since the chance of project failure or success can have as large an effect on the results as any other factor considered above.

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Dickie, A., and J.P. Workman. 1987. Economics of improved production on Utah cattle ranches. Rangelands 9(4):171-173.

Hull, A.C., Jr., and G.J. Klomp. 1974. Yield of crested wheatgrass under four densities of big sagebrush in southern Idaho. USDA-ARS Tech. Bull. 1483.

Tanaka, J.A., and J.P. Workman. 1988. Economic optimum big sagebrush control for increasing crested wheatgrass production. J. Range Manage. 41(2):172-178.

Torell, L.A. 1984. Economic optimum stocking rates and treatment schedule for sagebrush stands. PhD. Thesis, Utah State University, Logan, Utah.

Workman, J.P. 1986. *Range Economics.* Macmillan and Co., New York. p. 147.

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Pine Hollow Exclosures—a 19-year Record of an Aspen Stand Treated with 2,4-D

Roy O. Harniss and Dale L. Bartos

Data from old Forest Service administrative studies can provide information and insight into current management problems. Photographs of the Pine Hollow aspen exclosures on the eastern edge of the Taylor Mountain Plateau on the Ashley National Forest in eastern Utah provide a look at the effects of 2,4-D, wildlife, and cattle on plant succession in an aspen ecosystem over a 19-year period (Fig. 1-6).

This area is summer range for livestock but is also used by elk year-round and deer in the spring and fall and during winters with low snowfall. Heavy grazing before 1950, primarily by sheep, resulted in poor range condition. In 1950, rest rotation grazing was implemented to improve the range condition. Livestock grazing has been moderate and wildlife numbers have not been high since the 1950's.

The resource managers believed these sites were not producing their full potential in resource products and anticipated that removing the aspen overstory with the herbicide 2,4-D would increase the vigor and production of grasses and aspen suckers. In June 1965, some 100 acres of aspen were sprayed by helicopter with low volatile 2,4-D ester at a rate of 2-lb acid equivalent per acre with a diesel carrier. Depicted in the figures are the two exclosures, one built to exclude both livestock and wildlife grazing and the second built to exclude livestock but to allow wildlife grazing. These exclosures were compared with the outside sprayed open range.

The site was evaluated in 1984, 19 years following spraying. Exclusion of both wildlife and livestock grazing allowed the aspen to sucker and return to the site (Fig. 1-3). Exclusion of livestock grazing but with use by wildlife caused aspen suckers to be spotty and less vigorous in appearance (Fig. 4). Outside the fence where grazing by both livestock and wildlife occurred there were no aspen suckers (Fig. 4-5). Apparently, in scrubby aspen stands such as this where ungulates are not excluded, spraying with herbicides is not recommended if aspen regeneration is the primary goal.

These photographs show that aspen can reestablish on a site treated with herbicide if complete protection from browsing is provided. Where livestock were excluded, aspen were essentially eliminated from the site by deer and elk. In the open area (no protection) few aspen survived, and those that did were repeatedly browsed.

For a detailed analysis of this study see Bartos and Harniss (1989).

Authors are range scientist (retired) and operations research analyst, Intermountain Research Station, Forest Service, U.S. Department of Agriculture, 860 N. 12th E., Logan, Utah 84321.

Literature Cited

Bartos, D.L. and Harniss, R.O. 1989. Pine Hollow Exclosure: Effect of Browsing on an Aspen Community Sprayed with 2,4-D. West. J. Appl. For. (in process).

Fig. 1. *1965. Before spraying with 2,4-D in the wildlife and livestock exclosure. Note the sagebrush and open scrubby aspen stand.*

Fig. 2. *1968. Same view as Figure 1, 3 years after spraying. Note the abundance of grasses and few shrubs and forbs among the dead aspen stems.*

Fig. 3. *1984. Twenty years after spraying in the wildlife and livestock exclosure. Note the return of the scrubby aspen and a mosaic of shrubs (primarily sagebrush), forbs, and grasses.*

Fig. 4. *1984. Fenceline contrast between the sprayed exclosure with no wildlife or livestock grazing (on right) and the sprayed outside range open to grazing (on left). No grazing by wildlife or livestock enhances the return of the aspen stand. Grazing appears to have inhibited aspen and promoted sagebrush.*

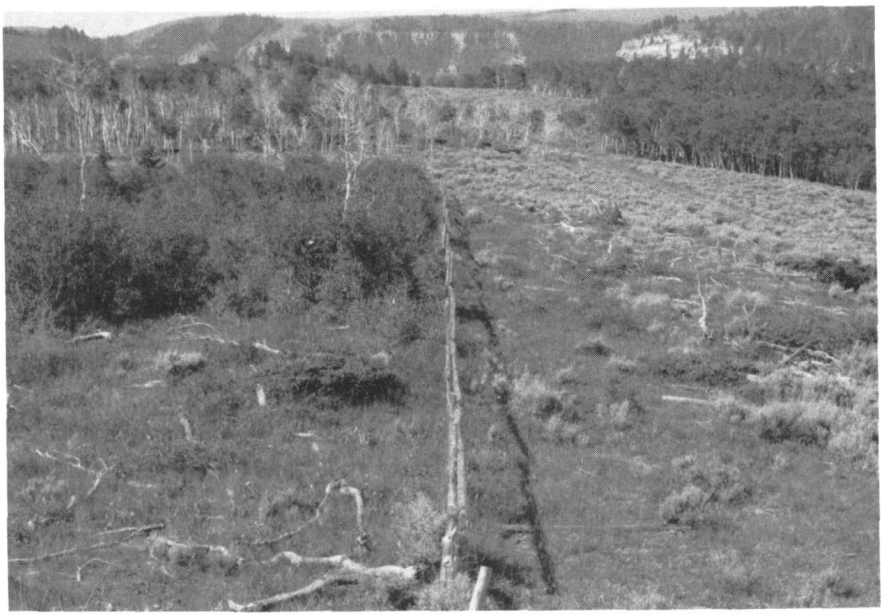


Fig. 5. *1984. Fenceline contrast between the sprayed exclosure open to wildlife but closed to livestock grazing (on left) and the outside sprayed range open to grazing (on right). Aspen occurs on less than a quarter of the exclosure, and its distribution is attributed to different soil type (Davis, personal communication, 1989). Grazing by wildlife appears to inhibit aspen reproduction.*

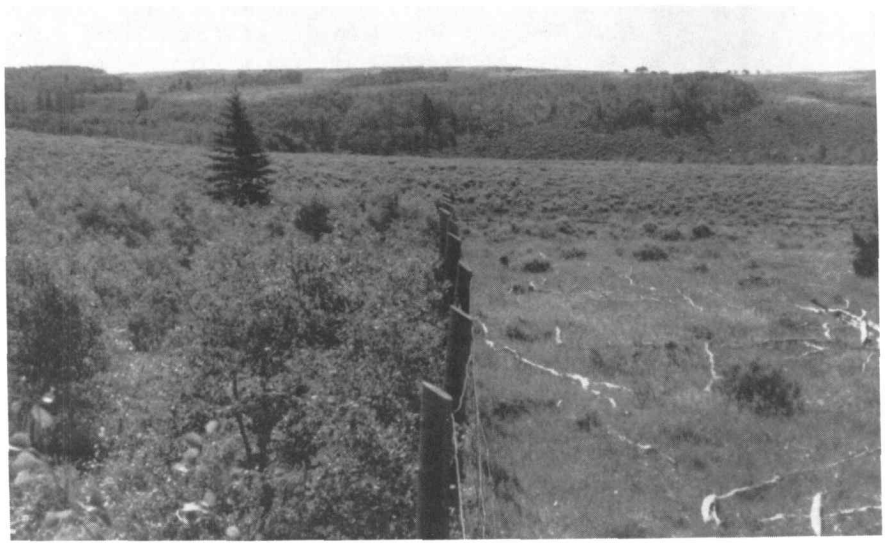


Fig. 6. *1984. Fenceline contrast between exclosure closed to all use (left) and the exclosure closed just to livestock (right). Note the difference in aspen stems between the two sites. Area on right is in the same exclosure as area on left in Figure 5.*

Current Literature

This section has the objective of alerting SRM members and other readers of *Rangelands* to 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 parentheses for each citation).

Alfalfa Persistence and Regrowth Potential under Continuous Grazing; by S.R. Smith, Jr., J.H. Bouton, and C.S. Hoveland; 1989; Agron. J. 81(6):960-965. (Dept. Agron., Univ. Ga, Athens, Ga. 30602) Their plant breeding research suggested that (1) level of total nonstructural carbohydrates was directly related to tolerance of heavy, continuous grazing and (2) that tolerance could be selected for while maintaining good forage productivity.

Beef Cattle Report, 1990; by Univ. Neb., Agric. Res. Div.; 1989; Neb. Agric. Res. Div. Misc. Pub. 55; 105 p. (Neb. Agric. Expt. Sta., Univ. Neb., Lincoln, Neb. 68583) Includes reports on integrated reproductive management, irrigated pasture grazing, and crop residue grazing.

Cold-Tolerant Rose Clovers; by Daniel J. Drake, Roger W. Benton, Harry Carlson, and Walter L. Graves; 1989; Calif. Agric. 43(6):16-19. (ANR Pub., Univ. Calif., 6701 San Pablo, Oakland, Calif. 94608) Naturalized strains of rose clover were found more tolerant of cold, dry conditions than commercial varieties and showed promise for seed increase and release for seeding on cold, mountainous rangeland.

Composition and Variability of Desert Bighorn Sheep Diets; by Gary D. Miller and William S. Gaud; 1989; J. Wildl. Mgt. 53(3):597-606. (Biol. Dept., Univ. N. Mex., Albuquerque, N. Mex. 87131) Concluded that the diverse and variable diet of bighorn sheep was dictated by the availability and quality of plants resulting from the unpredictable climate of the Sonoran Desert.

The Conservation Reserve Program and Its Effect on Land Values; by Robbin Shoemaker; 1989; USDA Agric. Info. Bul. 554; 5 p. (USDA, Econ. Res. Serv., Washington, D.C. 20250) Concluded that CRP increased the values of enrolled land by 7% in 1986 and 1987, thereby somewhat cushioning the general decline in farmland values during this period.

Deer and Cattle Diets on Heavily Grazed Pine-Bluestem Range; by Ronald E. Thill and Alton Martin, Jr.; 1989; J. Wildl. Mgt. 53(3):540-548. (USDA, Southern For. Expt. Sta., Box 7600 SFA Station, Nacogdoches, Texas 75962). Concluded that moderate cattle grazing from late spring through early fall had little negative effect on deer forage availability but that both moderate and heavy cattle grazing during late fall and winter reduced the availability of evergreen browse and herbaceous winter rosettes.

Effect of Timing of Grazing on Soil-Surface Cryptogamic Communities in a Great Basin Low-Shrub Desert: A Preliminary Report; by James R. Marble and Kimball T. Harper; 1989; Great Basin Nat. 49(1):104-107. (Dept. Botany & Range Sci., Brigham Young University, Provo, Utah 84602) Concluded that cryptogamic ground covers were less damaged by early than by late winter grazing at the same grazing intensities.

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

Effect of Winter Burns on Forbs and Grasses of the Texas Coastal Prairie; by Julie A. Hansmire, D. Lynn Drawe, David B. Wester, and Carlton M. Britton; 1988; Southwestern Nat. 33(3):333-338. (Welder Wildlife Found., P.O. Drawer 1400, Sinton, Texas 78387) Total forb yields were favored by early winter prescribed burns while winter burns favored grass yields.

Effects of Herbivory on Twig Dynamics of a Sonoran Desert Shrub *Simmondsia chinensis* (Link) Schn.; by Bruce A. Roundy and G.B. Ruyle; 1989; J. Appl. Ecol. 26(2):701-710. (Univ. Ariz., 325 Biol. Sci. E. Bldg., Tucson, Ariz. 85721) Periodic spring rest or controlling annual growing period defoliation of jojoba to no more than 40-50% were recommended to maintain shrub size and total production.

The Effects of the Spatial Pattern of Defoliation on Regrowth of a Tussock Grass. I. Growth Responses; by W.G. Gold and M.M. Caldwell; 1989; Oecologia 80(3):289-296. (Caldwell: Dept. Range Sci., Utah State Univ., Logan, Utah 84322) Compared the effects of defoliation on crested wheatgrass plants before and after meristem elevation in relation to regrowth rates, peak standing biomass, and aboveground biomass production.

Ellis Ranch Project: A Case Study in Controlled Burning; by William E. Frost; 1989; Calif. Agric. Tech. Inst. CATI/891002; 11 p. (San Joaquin Expt. Range, 24075 Highway 41; Coarsegold, Calif. 93614) This study in mixed chaparral and oak demonstrated the importance of crushing and felling in dense canopies prior to prescribed burning; benefits were greater under dense canopy (over 60%) than light canopy cover (under 40%).

Evaluation of 7-Day Grazing Periods for Short Duration Grazing on Tobosagrass Rangeland; by Jeffrey C. Mosley and Bill E. Dahl; 1989; Applied Agric. Res. 4(4):229-234. (Dept. Range Resources, Univ. Idaho, Moscow, Ida. 83843) Seven-day grazing periods were sufficiently short to prevent detectable changes in diet botanical composition or declines in diet quality, forage quality, or forage availability.

Experimental Prevention of Bitterweed *(Hymonoxys odorata)* Poisoning of Sheep; by M.C. Calhoun, B.C. Baldwin, Jr., S. W. Kuhlmann, and K.L. Kim; 1989; Amer. J. Vet Res. 50(9):1642-1646. (Texas Agric. Expt. Sta., Agricultural Res. & Ext. Center, San Angelo, Texas 76901) The addition of commercially available antioxidant ethoxyquin to a 20% crude protein diet provided complete protection against the adverse effects of bitterweed/hymenoxon on liver and kidney function.

Grazing Behavior Response of Free-Ranging Beef Cows to Fluctuating Thermal Environments; by M.L. Prescott, K. Olson-Rutz, K.M. Havstad, E.L. Ayers, and M.K. Petersen; 1989; Amer. Soc. Anim. Sci., West. Sect. Proc. 40:458-460. (Agric. Expt. Sta., Mon. State Univ., Bozeman, Mon. 59717) Exposure to declining temperatures reduced daily grazing time less in winter than in the fall, apparently resulting from increasing adaptation to both low and unstable temperature during winter.

Implications of Dietary Overlap to Management of Free-Ranging Large Herbivores; by M. Vavra, M. McInnis, and D. Sheehy; 1989; Amer. Soc. Anim. Sci., West. Sect. Proc. 40:489-495. (Ore. Agric. Expt. Sta., Eastern Ore. Agric. Res. Center, Burns, Ore. 97720) Reviews factors that influence dietary selection by free-ranging large herbivores and discusses management implications of convergent dietary habits.

Improving Forage and Livestock Production on Seeded Foothill Ranges; by C.A. Call and J.C. Malechek; 1989; Utah Sci. 50(2):124-132. (Dept. Range Sci., Utah State Univ., Logan, Utah 84322) Highlights several research projects dealing with establishment, utilization, and renovation of seeded foothill range in northern and central Utah.

Landscape Ecology: Study of Mediterranean Grazed Ecosystems; by W. James Clawson (Ed.); 1989; Proc. of Man and the Biosphere Symposium, Nice, France, October 7-8, 1989; 174 p. (Order from: Agronomy & Range Sci. Ext., Univ. Calif., Davis, Calif. 95616) Papers of a symposium held at the XVI International Grasslands Congress pertaining to Mediterranean-type grassland ecosystems of California and southern Europe.

Losses on Private Land Due to Big-Game Animals; by D.B. Nielsen and K. McBride; 1989; Utah Sci. 50(2):79-87. (Bulletin Room, Agric. Expt. Sta., Utah State Univ., Logan, Utah 84322) An evaluation of damage costs and present and possible future compensation of private landowners.

Management of South Texas Mixed Brush with Herbicides; by C.J. Scifres, B.H. Koerth, R.A. Crane, R.C. Flinn, et al.; 1989; Texas Agric. Expt. Sta. Bul. 1623; 66 p. (Bulletin Room, Agric. Exp. Sta., Texas A&M Univ., College Station, Texas 77843) A synthesis of available research information for initial and maintenance control of brush, game and livestock habitat improvement, and evaluation of economic performance of alternative herbicides.

The Market Value of New Mexico Ranches, 1980-88; by L. Allen Torell and John P. Doll; 1989; N. Mex. Agric. Expt. Sta. Bul. 748; 42 p. (Bulletin Room, Agric. Expt. Sta., N. Mex. State Univ., Las Cruces, N. Mex. 88003) Ranch values declined 50% from 1982 through 1987; 80% of the variation in ranch values was due to dependence on public land grazing, ranch size, rangeland productivity, and value of houses and buildings.

Opportunity and Challenge: The Story of the Bureau of Land Management; by James Muhn and Hanson R. Stuart; 1988; USDI, Bureau of Land Mgt., Washington, D.C.; 303 p. ($12; Supt. of Doc., U.S. Govt. Print. Offic, Washington, D.C. 20402-9325) This comprehensive history of the BLM, written in 5 chapters, explores the broad aspects of public land policy and its growth into a multiple use management agency; interspersed within the text are numerous short articles written by present and former BLM employees; additional readings suggested for each chapter.

Predator Biology and Livestock Depredation Management; by Frederick F. Knowlton; 1989; Amer. Soc. Anim. Sci., West. Sect. Proc. 40:504-509. (USDA/APHIS/S&T, Utah State Univ., Logan, Utah 84322) Discusses patterns in coyote abundance, coyote demographics, and patterns in coyote behavior and predation as the biological basis of depredation control programs.

Reducing Larkspur Poisoning in Cattle on Mountain Ranges; by M.H. Ralphs, J.A. Pfister, J.D. Olsen, G.D. Manners, and D.B. Nielsen; 1989; Utah Sci. 50(2):109-115. (Bulletin Room, Utah State Univ., Logan, Utah 84322) Summarizes the nature, magnitude, and toxic effects of larkspur when ingested by cattle and recommends preventative measures.

Secondary Succession and the Evaluation of Rangeland Condition; by W.K. Lauenroth and W.A. Laycock (Eds.); 1989; Westview Press, Boulder, Colo. ($26.50; from publisher, 5500 Central Ave., Boulder, Colo. 80301) Comprises seven chapters written by individual authors; discusses the current concepts for evaluating rangeland condition, the utility of these concepts, and the alternatives and future ideas for describing rangeland condition.

Short-Duration Grazing Versus Continuous Grazing for Stocker Beef Animals; by G.D. Mooso, D.G. Morrison, C.C. Willis, and J.E. Miller; 1989; La. Agric. 32(3):8-10. (Ag Bulletin Room, La. State Univ., Baton Rouge, La. 70893) Compared continuous and short-duration grazing on ryegrass-crimson clover and bermudagrass pasture at the Rosepine Res. Sta. Concluded short-duration grazing will increase profits if producers are willing to provide the extra inputs, labor, and management required.

Capital Corral

Ray Housley
Washington Representative

Our accomplishments tend to be inversely proportional to the recognition we seek or receive.

Range management consultants in the international arena will be interested in a new law requiring environmental impact study before the U.S. may support international lending agencies such as the World Bank and the Inter-American Development Bank in lending money for Third World development projects. This provision is the result of an amendment by Senator Frank R. Lautenberg (D-NJ) to the National Environmental Policy on International Financing Act of 1989. The bill was signed into law by President Bush in late December.

Cause and effect? We heard no reports of meetings or new initiatives on the "Greenhouse Effect" during the near-record cold weather that chilled much of the country in December.

William J. (Dub) Waldrip, long-time SRM member, chairs the National Cattlemen's Association Environmental Planning Group which has produced a Strategic Plan on the Environment, along with a "White Paper" on the environment. A number of technical papers on environmental issues impacting cattle production are being contracted to academic specialists and technical experts for delivery in the first half of 1990. The stated objective of these papers is to present objective, current analysis of the scientific background for these issues.

NCA is also preparing an "Environmental Management Checklist" to encourage producers to use sound management practices to optimize environmental conditions on their operations. A Stewardship Award to recognize producers for outstanding contributions to environmental stewardship is planned for presentation at NCA's midyear meeting next summer. SRM has joined with other professional and conservation organizations to suggest criteria and process for judging the award.

Kathleen Hartnett is staffing the environmental project from the Washington, D.C., office of NCA.

Former Agriculture Assistant Secretary George Dunlop is now President and CEO of the United Fresh Fruit and Vegetable Association, according to an announcement mailed out by the Association. He joins a number of other former Assistant and Deputy Secretaries into the association management/lobbying field.

"Wildlife Management Institute Seeks Range Coordinator" was the headline on an *Outdoor News Bulletin* item that grabbed out attention. It turns out WMI is looking for a *shooting* range coordinator, which pays $25K to $32K. We've seen no ads for kitchen range experts lately, however.

BLM's new Colorado State Director is Bob Moore, a career professional who started with BLM in 1955. His move was an easy one, since his old job was Director of the Denver Service Center. Moore replaces Neil Morck, who retired.

The 1990 Conservation Directory is now available from the National Wildlife Federation for $18 plus $3.50 shipping. The directory is a rather comprehensive listing of organizations, agencies, and publications dealing with natural resources.

Another NWF publication (in cooperation with the Natural Resources Defense Council) met with little enthusiasm at BLM. The document purports to be an update of the similar 1985 "Our Ailing Public Rangelands". BLM points out that the report is based upon a sampling of allotments rather than the complete data set for BLM rangelands, that there is a basic difference in interpretation as to what constitutes satisfactory condition, that long-term trend is not fully recognized, and that it fails to take into account strengthened direction since the change in administration at USDI. One of the report's points is that the agency lacks adequate funding and professional personnel for the range job, but neither NWF nor NRDC have been among the more outspoken advocates of increased budgets for range in testimony before appropriations committees. Presumably that stance will change in 1990. BLM planned comprehensive briefings on range condition and trend early in the new year.

The Public Lands Foundation, the activist organization of BLM retirees, has chosen Irv Senzel its President-elect for 1990. George Lea continues as President; Smokey O'Connor, Blanche Skinner, Arnold Petty, and George Turcott are Directors. PLF has gained (501)(c)(3) (tax exempt) status after nearly two years.

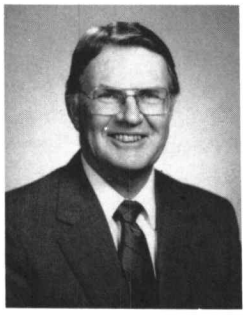
Don't be surprised if Larry Werries makes a job change soon—maybe by the time you read this. He came to Washington as USDA's Director of Intergovernmental Affairs. Still active in Illinois agriculture, he has gained a reputation as an effective, knowledgeable operator, according to farmers and agency field people.

Don Knowles, who accepted a job as Deputy Undersecretary at USDI, received strong support from wildlife organizations to be Assistant Secretary of Agriculture for Natural Resources and Environment. He was an advocate of increased wildlife management funding for FS and the Interior agencies during his stint on the Senate Appropriations Committee staff.

Patty McDonald, another reported candidate for the Agriculture job, is leaving the National Cattlemen's Association and Public Lands Council for the private sector at the end of February.

The most significant struggle in the second session of the 101st Congress as far as renewable natural resources

are concerned—will deal with the shifting of appropriations from Defense to domestic programs and foreign aid—or simply to deficit reduction. Natural resources have starved for budget resources over much of the last decade, receiving a tiny fraction of discretionary funding. Social program advocates are lining up their big guns to garner support for housing, health and education, and the potential support needs in the newly democratic Eastern European nations will demand attention. But natural resource organizations have been low-key about conservation needs and strategies for meeting them have not become apparent, partly because of diverse interests within the conservation community. It should be clear that the first order of business is to get a larger share of the budget pie for natural resources, and *then* work on its allocation.



President's Notes

The past year has gone by all too rapidly. This last installment is being written with mixed emotions. On the one hand, I will be able to return to being a full-time Extension Specialist with many things that need doing. On the other hand, I have enjoyed the challenges and opportunities of being SRM President and am sorry to see the term come to a close. The year has provided me the opportunity and experience to present SRM to others as well as to meet and visit with more of you than otherwise possible. For this I am very grateful and hope that I have met at least some of your expectations.

By the time this issue appears, I will have participated in four more Section annual meetings—Southern, Idaho-Utah, Nevada, and Arizona. Coming to your Section meetings is as exciting as coming to the SRM annual meeting; it is just on a different scale. Both similarities and differences exist among Sections, but the common bond of rangeland importance and the management of those resources for society's benefit pervades throughout each meeting.

The Society continues to take advantage of opportunities. These opportunities do not just come along; we make them happen. Two of them which are not related are the opportunity (1) to work with the U.S. Forest Service 1998 RPA Assessment process and (2) to be proactive regarding the continuation of permanent cover on the over 30 million acres of cropland planted through the Conservation Reserve Program.

The Forest Service has the responsibility every 10 years to assess *all* the nation's range and forage resources regarding the supply and demand for various products and services. They also do an interim 5-year update. SRM asked for and received the opportunities to submit substantive recommendations as to the format, components, and characteristics of the next assessment.

We met in Denver in two separate sessions in 1989 (August and December) to discuss how we might interact with the RPA assessment group of the Forest Service. At the December meeting, I asked that the Society of American Foresters and the Wildlife Society participate and they both did. We submitted four substantive recommendations to the Chief of the Forest Service and hope to have continuing dialogue if they so desire.

The Society has gone on record as recommending that the maximum feasible amount of CRP land remain in permanent cover after the 10-year contracts expire. However, unless some of the current provisions are changed, there is more incentive to plow out than to keep in cover. Several national groups are interested in this, as we are. However, we felt something must be done *now* before the first acres are scheduled to come out in 1996. To that end, the CRP Task Group under Harold Goetz's leadership and I formulated a strategy to examine which steps might be most productive. Many ideas exist, but we were not certain which ones were most practical. We found out on December 5 when a special meeting was convened in Denver that included a number of farmers who hold contracts, the SRM Executive Committee and other members of the Society, governmental representatives, and several other special group representatives. It was a very productive meeting. Farmers came well prepared to share their perspectives and I, for one, am most grateful to them.

We have a three-phase approach. The first is very straightforward but apparently not simple. We have requested the Secretary of Agriculture to use his authority under the 1985 Food Security Act to extend contracts to 15 years. Offering this option to contract holders would have several advantages because there would not have to be changes in legislation in the 1990 Farm Bill since the first land would not be scheduled to come out until 2001. The second phase is a series of recommendations for the 1990 Farm Bill and the third phase is a series of administrative recommendations. In all three phases, Ray Housley, our devoted Washington, D.C., representative, works very closely with others in the Capitol. These opportunities allow the Society not only to provide leadership but also to gather support since coalition efforts are almost always more effective than single group efforts.

Committees are the working limbs of the Society and they have been most active this year. Some exciting things will take place because of their good work. My thanks to all of you who take your time to work on SRM's behalf. You make the Board's job, if not easier, at least much more clearcut and responsive.

Lastly, a big welcome to our new Second Vice-President Jack Artz, and Directors Murray Anderson and Will Blackburn. Marilyn Samuel, Ken Sanders, and I have had a wonderful three years on the Board. Please give our President Rex Cleary your wholehearted support. He has a full agenda and welcomes your help.—**Thomas E. Bedell**, President, SRM

Executive Vice-President's Report

Holidays are a wonderful time to visit with friends, enjoy the grandchildren, and get reaquainted with the family. My daughter and her family visited us during the New Year's complete with the youngest named Will, who is suffering from the Terrible Twos at about nineteen months of age. Now that represents a real challenge, but it has to get better, I hope.

Perhaps the most interesting and impressive thing that happened was a discussion I had with my son-in-law. Jerry is a fine young rancher who enjoys the out-doors and traditional things. He told me about his taking part in the Montana Centennial cattle drive, which he, his father and his son rode in for six days. His observations were interesting to say the least, and one about various horse-drawn wagons really had a message for all of us. It went something like this: You could certainly tell the difference between the drivers who just participated in parades and those who really knew how to handle a team of horses.

He said, "Why, I nearly wore out my horse tying my lariat rope to the end of the tongue on a lot of those wagons to pull them over the hills that we had to climb." I asked why that was needed for I know they usually only have a couple of suitcases, a tent, and a sack of oats in the wagon. Well, the reason for all the mix up was that the inexperienced or poor managers (teamsters) would arrive at the hill, start to shout, and whip their teams into a run. All they accomplished was to have a tired, confused team of horses who had not worked together and were only half way up to the top.

But on the other hand, the driver who knew what to do stopped at the bottom of the hill and got his horses all organized with their shoulders into the collars. Then with a quiet "Let's go, boys" they all pulled together up the hill, over the top, and out of sight without a problem. Then it struck me that was just a good example of Coordinated Resource Management (CRM) that he was telling me about—another instance where working together under good leadership makes high, steep hills into gentle slopes.

I'm looking forward to the new decade with great expectations. The SRM has recognized the need for team work with our great emphasis on CRM. If we all get in there and pull together, we can accomplish a lot of important things, especially with the leadership we have on hand for the coming years. Our new President Rex Cleary has a world of experience in solving problems by using the CRM process, and I hope we all take advantage of his knowledge. It's a wonderful opportunity.

Some old sage said things certainly slow down during the holiday season. Well, whoever said that never was around our Society. Between Thanksgiving and Christmas I participated in two excellent meetings sponsored by the SRM at our Denver office considering the Conservation Reserve Program (C.R.P.) and Resource Planning Act (R.P.A.) Many experts from the society and other organizations were invited in to give us the benefit of their wisdom on these extremely important issues. I was impressed to say the least and I feel certain our future input into these programs will have a long-term effect on the future direction they will follow.

But it didn't stop there. I still succeeded in including visits to the New Mexico, Colorado, and Wyoming Section meetings where the attendance was just excellent. I just can't help but continue my harping on the importance of joint meetings with other groups. Without question, it was the presence of the wildlife folks in Wyoming and the cattlemen in Colorado that made those meetings standing room only during their joint sessions. Of course the program agenda has a lot to do with success. New Mexico had a superb panel which kept people standing around in little groups discussing the matter long after the meeting was adjourned.

If I had to make a choice on the outstanding action at these meetings, and I'm certainly glad this is not required, I would point to the Wyoming Section. They have made a giant step forward in my opinion. The Section now has an Executive Vice-President position. When their person is on board will be the continuity of the organization, giving it stability and not the up and down process that so often happens as the leadership is transferred from one to another. I certainly hope other Sections besides Nevada and Wyoming will consider this move. It's not that hard now that the ice is broken. There are lots of fine, capable people who for a wide variety of reasons would happily fill the position at a very nominal cost, perhaps just to be involved.

Final item in this report. Perhaps you have already heard, but we are ahead in our membership in 1989 over '88—in fact over 3% ahead. Isn't that wonderful? On December 31st our membership stood at 5,189 members. We must be doing something right. I know of a lot of other groups who are barely hanging on or are losing ground.

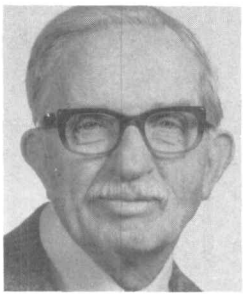
But this certainly represents a challenge for 1990. We can't rest on our oars now or we will just start going backward again. How about 5,250 for this year. That's not impossible, and don't forget the 5-dollar rebate for new members against your dues.

Before I forget, thanks so much for all your help in 1989; it was appreciated so much by everyone and especially by me.—**Peter V. Jackson,** Executive Vice-President, SRM

Orville N. Hicks—Life Member

was inadvertently left off the previous list. Our apologies to Mr. Hicks.

Requiescat in Pace



The profession of Range Research and Range Management lost one of its pioneers on November 7, 1989 when **Dr. Robert "Bob" S. Campbell** passed away in Quincy, Illinois, after a lifetime devoted to developing improved practices in these fields.

Born near La Harpe, Illinois, August 15, 1904, Campbell attended high school and junior college in Kansas City, Missouri. He received a Bachelor of Science degree in botany, zoology, and education from the University of Chicago in 1925, graduating with honors including membership in the honorary society Phi Beta Kappa. He earned his Master's degree in 1929 and Doctorate Degree in 1932 from the same university.

Campbell was employed in 1925 by the U.S. Forest Service on the Jornada Experimental Range in southern New Mexico. He was placed in charge of the Jornada Experimental Range in 1927 and served in that position until 1934 when he became assistant to W.R. Chapline, Chief of Range Research for the Forest Service. In 1936 Campbell was assigned to organize the westernwide Range Utilization Standards project which was directed toward developing standards of uses to be made of the numerous western range ecotypes. In 1943 he transferred to the Southern Forest Experiment Station, headquartered in New Orleans to organize and carry out a research program to develop improvement and management methods for southern ranges, including proper coordination of livestock grazing and timber production in the southern pine forests. Bob retired from the U.S. Forest Service in 1963. He published 115 articles, reports and bulletins in forest and range grazing, ecology, and forest and range management.

Campbell was interested in the establishment and success of the Society for Range Management formed in 1948. Publication of a range journal was one of the major objectives when forming the Society. To develop and publish such a journal, a committee was appointed early. Campbell served on this committee. He also served on the Editorial Board that produced the first journal (Volume 1 of the *Journal of Range Management*). He served as Editor of the *Journal* from 1950 through 1952 and from 1965 to 1969.

Dr. Campbell was a charter member of the Society. He served on the Board of Directors of the Society in 1949 and was Vice-President in 1957 and President in 1958. In appreciation for his contributions to range management he was given three awards by the Society: 1) Outstanding Achievement Award in 1967; 2) Citation for Editor's Services in 1969; and 3) Fellowship Award in 1977.

Dr. Campbell belonged to many other professional, scientific and local organizations in addition to his strong affiliation with the Society for Range Management. He was a member of the Unitarian Church. He is survived by his wife, Margie James Campbell, two sons, two daughters, a step-daughter, four grandchildren, eight great-grandchildren and one step-grandchild.

Frasier's Philosophy

There has been considerable discussion in the past concerning the role that the Society for Range Management should play in providing advice on the proper management of our natural resources. On almost any issue, there is a wide disparity in what should be done. A good share of this disagreement is due to the fact that the Society is made up of many individuals with a wide range of interests, backgrounds, and goals. There seems to be an undercurrent of thought that because of this diversity, we can not come to a consensus.

A couple of commonly expressed "misconceptions" about the member makeup of the Society are: (1) SRM is a "cowboy" outfit concerned only with "running" more livestock on the land; (2) SRM is an "academian" organization that has lost touch with "reality" as shown by articles in the *Journal of Range Management* which are "unusable" to the practical world. Everyone can probably come up with a name of someone who has made one of these statements. In truth many of these statements come from people outside our organization who use these "myths" to promote their own interests.

I find it very hard to believe that these are the beliefs of most SRM members. If an individual truly has these ideas of the Society, why does that person belong? A person who does not believe in the aims and goals of the Society would not spend the money to join and participate in the SRM activities. This does not mean that there is not a difference in opinion among members in how we achieve our goals, but the goal of most SRM members is still primarily concerned with the proper management of our natural resources.

Let us keep our diversity—it is our strength—and continue to promote our goals. We are the group that has the most comprehensive understanding of the proper management and utilization of our natural resource heritage. Let us continue to be the best in this area.

Now and then it's good to pause in our pursuit of happiness and just be happy—Anonymous

Nominations for 1991 Awards

Instructions for Nominators: 1. Nominations for 1991 awards of the Society for Range Management will be accepted through **April 30, 1990.**

2. Nominations are to be completed in the new format, maximum of 5 pages, emphasize *major* accomplishments.

3. Each Section of the Society has a copy of the new revised Awards Committee Handbook.

4. Award nominations are the responsibility of the *Nominator.*

5. A nomination will be evaluated by the Awards Committee only if nomination materials meet requirements set forth in the Awards Committee Handbook.

6. Nomination materials, especially item #8, Justification Statement(s) of nomination form, must be consistent with the requirements of the specific award.

7. Awards Committee members may be contacted for information and preparation assistance.

8. All awards receive a suitably embossed certificate.

9. Awards of the Society are:

a. **F.G. Renner** the premier Society award, requires SRM membership and sustained accomplishments (10 yrs.) in Range Management, receives honorarium.
b. **W.R. Chapline Land Stewardship** requires SRM membership and effective maintenance or improvement of range resources with lasting effects, receives honorarium.
c. **W.R. Chapline Researcher** requires SRM membership and sustained research related to maintenance and restoration of rangelands, receives honorarium.
d. **Fellow** requires SRM membership, continuous for at least 10 years for service to the Society, may be awarded to as many as 0.1% of Society membership annually.
e. **Outstanding Achievement** does not require SRM membership, awarded for at least 5 years outstanding professional performance in any range management related area, any number may be awarded annually.
f. **Outstanding Young Range Professional** requires SRM membership, not having reached the 40th birthday by Jan. 1, 1991, for recent performance and expected superiority and leadership in any range-related area.
g. **Special and Distinguished Service** does not require SRM membership, for outstanding accomplishment in any range related area.
h. **Outstanding Newsletter Editor** requires SRM membership, monitored and selected by I&E Committee and other professionals in communications.
i. **Outstanding Teacher** requires SRM membership, selected by SRM/RESC committee.

10. Submit all nominations to the Chairman of the Awards Committee prior to *April 30.*

SOCIETY FOR RANGE MANAGEMENT
Award Nomination Form *Date* _____

Nomination of _____ for the _____

_____ award (insert complete name of nominee and the specific award name)

NOMINEE: a. date and place of birth (optional)
b. address with zip code

c. Occupation, Profession, Employer

d. Phone number
e. Member SRM? ____ How long? _____

NOMINATOR: a. name
b. address

c. phone number

NOMINEE EDUCATION, TRAINING, AWARDS
NOMINEE ACTIVITIES IN SOCIETY FOR RANGE MANAGEMENT
NOMINEE PROFESSIONAL CONTRIBUTIONS TO RANGE MANAGEMENT
(*list only major contributions and citations)
NOMINEE ACTIVITIES/MEMBERSHIP IN OTHER ORGANIZATIONS
OTHER NOMINEE BIBLIOGRAPHIC INFORMATION JUSTIFICATION STATEMENT(S) FROM NOMINATOR(S)

Send nomination materials to: **John E. Mitchell, Rocky Mountain Forest and Range Experiment Station, 3825 E. Mulberry, Fort Collins, CO 80524.**

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Certified by the Society for Range Management

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Call for Papers

IVth INTERNATIONAL RANGELAND CONGRESS

22-26 April 1991
Montpellier, France

The IVth INTERNATIONAL RANGELAND CONGRESS will convene in MONTPELLIER (FRANCE), under the aegis of AGROPOLIS (International Complex for Research and Higher Education) and the ASSOCIATION FRANÇAISE de PASTORALISME (AFP-French Association for Range Management).

The official languages of the IVth IRC will be French and English; permanent simultaneous translation will be available, including during field trips.

The Scientific Committee wishes to emphasize issues related to the mediterranean and subtropical isoclimatic zones, but other subjects will be addressed. In particular, general issues of methodologies and management techniques and problems pertaining to other ecoclimatic zones are envisaged.

Registration fees are 2500 FF (approx. 400 US$) before Oct. 31, 1990 for full members and 1500 FF (approx. 250 US$) for associate members.

Deadlines for contributions are as follows:

* Title and 50-100 words synopsis : March 31, 1990
* 500-word summary : May 31, 1990
* Full paper (4 pages of *Journal of Range Management,* i.e. approx 4000 words): July 31, 1990

For further information on the IVth IRC, please contact:

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