Dawson

CALIFORNIA WILDLANDS

An Asset or a Liability?

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This Academic Staff Lecture by Lester J. Berry presents an excellent review of progress in range improvement, research and teaching by the Extension and research staffs of the University of California Division of Agricultural Sciences. The selection of Emeritus Berry to present the lecture on November 8, 1972 was an honor bestowed on him by his Davis campus colleagues, and was the first time an Extension specialist has been so honored by that organization.

Berry's credentials are extensive. He received the Range Man of the Year Award in 1959, was president of the California Section of the American Society for Range Management, and served from 1953 to 1972 --with one break--as the first Extension specialist to be assigned fulltime responsibility in range improvement.

Among efforts he pioneered or strongly supported were county range improvement associations, range improvement by control burning, range improvement by fertilization, and wise selection of legumes and grasses for seeding. He took part in developing an effective California adapted rhizobium to inoculate Rose and Sub clovers.

In his 36 years with Agricultural Extension, he worked closely with many persons and organizations in phases of range improvement. He served as assistant state director for 5 years. In June of 1972 he assumed emeritus status.

Examining a reseeding experiment on the ranges in San Diego County are, left to right: L. J. Berry, Extension range improvement specialist; Victor W. Brown and Robert J. Mullen of the San Diego County Agricultural Extension office; and Cyrus McKell, formerly head of the U.C. Agronomy Department, Riverside Campus.

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CALIFORNIA WILDLANDS - AN ASSET OR A LIABILITY?

L. J. Berry
Extension Range Specialist, Emeritus

Academic Staff Lecture, November 8, 1972

Although more people live in California than in any other state in the Union, they are concentrated on the 14% of its land area that is classed as cultivated and urban. Most of us live either around the San Francisco Bay, on the south coastal plain, in the Los Angeles Basin or in the San Diego area. A fair number of us are scattered throughout the great Central Valley but only a few of us live in the other 86% of California which may be loosely grouped under the classification of wildlands.

A broad look at the vegetation types of the state reveals that over 23 million acres, nearly 25% of the state's land area, are covered with brush. This infestation, varying in intensity from light to extremely dense, includes approximately 10 million acres of chaparral, 5 million acres of Great Basin sagebrush, 3 million acres of coastal sage and related types, and an estimated 5 million acres of brush which has invaded the forest, oak woodland and grassland types. The balance of the state's vegetation types consists of about 23 million acres of forest lands, 10 million acres of oak-woodland-grass, 10 million acres of grassland, 20 million acres of barren and desert lands, and the previously mentioned 14 million acres of cultivated and urban lands.

In discussing the pluses and minuses of California wildlands, I will address myself mainly to those areas that are used primarily for range (the production of livestock forage) the brush infested areas, and to a lesser extent the desert and commercial timber producing areas.

About 30 million acres of California are grazed by livestock and are thus classed as range, but the 3 1/2 million range cattle and 1 million sheep gather most of their forage on the grasslands, on about half of the oak woodlands and sagebrush lands, and on a small percentage of the chaparral and cut over timber land and forest pasture. This is an area of about 20 million acres.

This rangeland area is extremely important to California. It supports most of our upland and big game populations. It produces over a quarter of the state's water and much of its fire wood. Because it lies between the centers of population and most of the timber and publicly owned lands, it provides major recreational outlets for much of the urban population. Its grassy glades, intermingled with park-like woodlands and islands of mixed chaparral, present a year-long variety of scenic beauty for enjoyment of weekend visitors. Besides all this it supports California's vast range livestock industry, contributing about 50 million dollars each year to our economy.

The Mediterranean climate under which most of our range areas are located makes them delightful places to live in but difficult areas in which to conduct a profitable livestock industry.

Our moist and often cold winters and our long, dry and usually hot summers have developed a plant cover that is admirably suited to its environment. Present forage is composed principally of annual grasses and forbs. Perennial forage species make up only a small percentage of California range.

Most of the open range and low-lying portions of the oak-grass woodland are used for the production of green feed in the winter and spring. At higher elevations and along the north coast where fall rains start earlier, range provides some winter feed, but green feed comes principally during

the spring and early summer months. Over most of California range, summer and fall feed is from dry grasses and legumes produced during the spring flush of growth.

Forage production on California rangeland is characterized by:

1. A surplus of feed in the spring followed by long periods of inadequate feed supplies.
2. Poor feed growth in many areas even during favorable moisture and temperature conditions because of low soil fertility.
3. Poor quality dry forage.

The livestock operator has had to develop a management system designed to both make the optimal use of the forage resource when it is most usable, and to conserve and supplement it for use during the remainder of the year. His efforts were directed into three broad groups:

1. Improving range fertility to increase forage production.
2. Introducing and establishing reseeding winter growing annual legumes to improve the quality and volume of forage.
3. Managing brush ranges so as to increase their nutritive value for livestock and game.

The Division of Agricultural Sciences of the University of California has played an important role in developing the information needed for these programs. I shall briefly discuss some of the important developments in each of these areas.

Range Fertilization. For many years, the University of California farm advisors, working in cooperation with the then Department of Agronomy at Davis, carried out field studies with nitrogenous fertilizers in which results were measured in terms of forage clipped from the experimental areas.

The most striking and consistent fact that emerged from this series of tests and demonstrations was that supplemental N stimulated early and continued winter and early spring growth of annual grasses. These responses came during the cold season, when little growth would normally be expected. Nitrogenous fertilizers appeared to be the key to early growth, but they were effective only if adequate P and S were present in the soil or applied in the fertilizers.

The Agricultural Extension Service of the University of California cooperated with ranchers and the California fertilizer industry in a series of field scale grazing trials to determine if the forage gains from fertilizer as measured by clipping were also reflected in increased weight gains in grazing cattle. This statewide series of tests, which compared weight gains of cattle grazed on fertilized and unfertilized areas, involved over 7600 animals and nearly 17000 acres of rangeland. Twenty-eight ranchers in 20 different counties were active cooperators. Several things evolved from this series of tests. Nitrogen fertilization with P or P and S where needed --

1. Increased carrying capacity from 38 to 92 head-days per acre.
2. Increased liveweight gains from 60 to 170 pounds per acre.
3. Each pound of added nitrogen produced from 1.7 to 2.5 pounds of extra beef depending upon whether or not P and/or S was needed.
4. Maximum profits from the use of nitrogen fertilizers occurred in the 13-30 inch rainfall zone.

Fertilization with nitrogenous fertilizer is now an accepted practice on many thousands of acres of winter range and has greatly increased the production of winter feed on the treated areas.

LEGUME ESTABLISHMENT

As previously indicated, California ranges are composed mostly of

annual grasses and non-leguminous forbs. A small percentage of the grassland does have good burr clover concentrations in years of early fall rains. These areas, however, seldom have good clover stands two years in a row. Much of the grassland has relatively insignificant annual clover populations which contribute little to the forage resource or to the classic clover role of nitrogen fixation. The major deficiency of California grassland pasture has been and still is the lack of a dependable high-producing annual legume which makes up an appreciable part of the forage resource year after year.

Recognizing this as a major problem, the University of California channelled the principal efforts of the range programs of its Department of Agronomy and Range Science and its Agricultural Extension Service towards its solution.

Dr. R. Merton Love has been a pioneer in this field. He introduced Rose clover, a "pioneering type" annual legume from the Mediterranean area, in 1944. He, with Dr. William A. Williams and Burle Jones, then Extension Range Specialist, provided the leadership and enthusiasm that alerted range operators to the potential role of the reseeding annual legumes in the California livestock industry.

Subterranean clover, another reseeding annual legume, had been introduced somewhat earlier into the California picture--but because the particular variety imported was late in maturing it was thought to be adapted only to the coastal areas of Oregon and extreme northern California. Its early winter growth characteristics, its high palatability to both sheep and cattle and its ability to establish itself every year were quickly noted and it became an important forage producer in Humboldt County where large acreages were seeded and established on the western slopes of the county.

Over the next several years, many attempts were made to establish mixtures of Rose, Subterranean and Crimson clover, another reseeding annual legume. The attempts were mostly unsuccessful and interest in these clovers seemed to be nearly lost. The enthusiasm of Love, Williams and Jones, however, was able to maintain the interest of a small group of Agricultural Extension staff. They continued trying to find a way to establish these plants because they felt that these legumes offered the greatest potential for improving livestock production in the state.

Eventually, adapted clover varieties were determined and fertilizer programs were developed to satisfy their needs. Successful planting techniques were developed and demonstrated. Last and perhaps most important, effective strains of Rhizobia and new methods of inoculation were discovered and the last major barrier to the establishment of reseeding legumes on over 5 million acres of range land has been removed. These clovers are now a major component of the forage resource on nearly a million acres of range land. It is relished by domestic and wild herbivores alike. Their potential in increased meat production alone, to say nothing of increased game population, is in the neighborhood of 500 million pounds per year. Range operators are now seeding mixtures of Rose and Sub clover at a rate which severely taxes the ability of the seed industry to supply the seed because all Sub and most of the Rose clover seed supplies are imported from Australia.

The process by which these reseeding annual legumes have become established is an outstanding demonstration of what can be accomplished when researchers and Extension staff team up with agriculture and agribusiness interests.

BRUSH REMOVAL

For almost as long as we have had a livestock industry, range operators have been engaged in a conflict to reduce the invasion of brush into areas used for livestock production. Expanding residential and industrial use of prime agricultural lands has dictated that more productive lower elevation range lands be shifted to more intensive agricultural uses. This has forced the livestock operator to move his operation "farther up the hill" so to speak and he has had to turn to intensive brush removal practices to maintain the livestock industry.

From time immemorial, fire has been the traditional tool for brush removal. Prior to 1945 there was no formal permit system for range improvement burning and "wildfires" were largely depended upon for range improvement. Some ranchers used periodic late fall or winter burns to reduce brush concentrations but most of the uses of fire for brush control were usually in violation of fire prevention and control regulations. In 1945 a uniform permit system for range improvement burns was put into effect. This system, under the administration of the California Division of Forestry, in addition to permitting burns, also provided for technical assistance to ranchers on the one hand and set up areas of rancher responsibilities and liabilities resulting from control burns on the other.

Rancher organizations, known as Brush Range Improvement Associations, were developed to assist each other in control burn operations and to develop and enforce policies for the conduct of control burns among their members. These organizations were highly successful in improving working relationships between C.D.F. personnel and ranchers. They worked with U.C. research and Extension staff in improving the effectiveness of fire in brush control.

Early control burns were quite unsophisticated. A fire line was placed

around the area and the brush was burned on as hot a day as the permit agency would allow. There was little attempt at management after the burn. Natural grass regeneration and resprouting brush were depended upon for the increased feed supplies.

As research and Extension results and practices improved and pointed the way, control burning techniques underwent striking changes and improvements. Seeding of burned over areas became more common. The wise use of herbicides to control brush seedlings and reduce sprouting increased. Preburn treatment of brush by mashing or bulldozing one to three years before burning became more common. Today, the typical control burn is a highly organized and efficient operation conducted by ranchers who are well trained, well equipped and privately financed. A large percentage of the control burns now have as much of the area as possible pretreated before burning and more intensive reseeding practices are used. Herbicide and mechanical treatments are used to retard regrowth. A much better job of planning of the burns is being done and, in general, the size of burn has been reduced so that the necessary post-burn management practices can be carried out.

The net effect of this control burn program has been a 300% increase in meat production on the treated areas. Water yield has been increased by about 50% and deer and quail habitat has been greatly improved. In fact, increased deer numbers have seriously affected reseeded areas in many cases.

Since 1945 over 8500 range improvement burns have been conducted on nearly 2.5 million acres. Of these, three-quarters of a million acres have been reburns leaving a net of about 1.8 million acres of new or improved range created by the control burn program. This activity has added many millions of dollars in new wealth to California's economy and has averaged about 7 1/2 million dollars each year.

THE WILDLAND PROBLEM

Until now I have talked primarily about the most "domesticated part" of our wildland, primarily the rangelands -- what we are doing with them and what they are doing for us. From now on, I want to talk about the untamed, largely unmanaged and mostly publically owned part of our wildlands, our great expanse of brush -- what we are not doing with it and what it is doing to us.

As has already been mentioned, nearly 25% of the state is covered with brush. It occurs on a ring completely surrounding the Central Valley and varies in width from 15 to 50 miles. Its major area is over 600 miles long with fingers extending north nearly to Oregon and south to Mexico.

The climate over most of the brush area is reasonably moist and relatively warm during the winter and early spring, and extremely hot and dry throughout the longer summer and fall periods. The topography is gentle to steep and the soils are thin and of low fertility by grassland standards.

The brush species which make up this chaparral complex are admirably suited to this environment. They grow rapidly in the spring and early summer. Their thick leathery leaves and bark keep water losses low during the summer and their vigorous root systems explore the cracks and crevices of rocks to great depths in search of water. Their fertility requirements are lower than those of most grasses.

California chaparral is a fire climax cover. The plants are readily flammable when dry. Most of them depend upon fire to trigger the germination of their seed. Others depend upon their rapid resprouting ability to recover after a fire. This dependence upon fire for regeneration is the reason why most brush fields are of uniform age and height.

Much of the brush--perhaps a third--occurs on terrain that is too rough, too steep or too stony to do much about. It is the best cover for this type

of area. Most brush needs to be properly managed for it to provide protection for watersheds, cover and feed for wildlife, and scenic enjoyment and recreation. However, when brush is left unmanaged these values are greatly reduced and in most cases disappear entirely. In general there has been little or no management of California brushlands other than that by brush range livestock operators. Following a fire, public opinion has required that the brush be allowed to regenerate--to grow rapidly for about 10 years, then to slow as it reaches maturity and to become decadent and choked with dry leaves and dead branches. In that stage, it has become a vast organic garbage dump. In about 20 years the field becomes so concentrated with dry fuel that a major wildfire almost inevitably occurs. This is the reason that the history of our brush fields indicate recurring fires every 20 to 25 years. Our brush field management has done little to change this cycle.

It is little wonder, then, that the most costly effect of this great expanse of brush is its contribution to one of California's major economic problems--wildfires. California has the foremost fire fighting agencies in the world, yet we still have major wildfires. The natural dryness of our brush, its structure and dense growth present a continued fire hazard which becomes extremely critical during the summer and fall months when our hot, dry winds occur. Our population has expanded and continues to expand into and around the brush areas. This increases the opportunity for accidental ignition of fires and compounds the damage resulting from them. When major fires develop, particularly in steep, rugged areas, the efforts of all of our fire fighting machinery are of little or no effect until the wind and weather conditions moderate and the fire reaches an accessible area of low fuel concentration. Frequently these brush fires run into timber stands--which in many cases have also been allowed to become

organic garbage dumps-- and control costs and damage are greatly increased. The annual cost of wildfire suppression and property damage is about $10 million more than the annual income from range livestock. It is a sad commentary that wildfires cost us 20% more out-of-pocket each year than we gross from our livestock ranges. When this is added to the loss of resources and human life, the cost is staggering and of such magnitude that California should not continue to absorb it year after year.

It is apparent that one of California's most serious environmental problems is that of fuel management. We must learn how to break up our vast brush fields into manageable units so that we can either keep fire in or out of any unit, whichever we need to do. We need to learn how to:

1. Keep brush growing vigorously.
2. Keep it relatively non-flammable.
3. And keep it environmentally and aesthetically acceptable.

In order to do this there must first be a marked change in public opinion regarding brush management. There should be general recognition that brush, not only in California but in the country as a whole, is a public problem, and its management is a wise use of public funds.

It should be apparent that our present "no management" brush program is not good business. It contributes to our annual tax bill a staggering fire suppression cost and huge public expenditures to restore fire and resultant flood damages. It seems, however, that this fact has not yet been recognized because the general public still readily issues a blank check for wildfire control and the restoration of resultant damages, but is unwilling to commit the use of public funds for sound brush management programs to prevent regularly recurring fires. Thus, our brush fields remain as a major liability rather than as an environmental asset.

Assuming that public opinion will change--and there are signs that it is already changing--and that more public funds will become available for fuel management and hazard reduction programs, what can we do?

We already have a great deal of technology that can be used. The brush control techniques used by ranchers to improve feed supplies are just as effective for the reduction and management of fuel and the regeneration of decadent wildlife ranges as they are for the production of livestock feed. The 2 1/2 million (plus or minus) acres of brush that ranchers already have under some type of management program have been and are important in our present wildfire control programs. The Bureau of Land Management has had an excellent brush management program in operation on several thousand acres in cooperation with their livestock permittees. The California Division of Forestry and United States Forest Service have already constructed several hundred miles of a proposed statewide network of fuel breaks. Both of these agencies have conducted, either by themselves or in cooperation with other agencies and private landowners, large-scale experimental or demonstration brush control projects. These projects have all utilized and depended upon the research information developed by state and federal experiment stations operating in California.

Fuel management research has not been confined solely to the brush fields. Dr. Harold Biswell of the University of California School of Forestry and Conservation has devoted a lifetime to research in the management of fuel in mixed conifer and pine forests. Timber interests, both private and public, are following his work and at least two national parks are engaged in fuel reduction programs on their lands in California.

As imposing as the list of accomplishments may seem --and it is imposing --we have scarcely started on the job that has to be done. Remember that

only two years ago California experienced the worst wildfire losses in its history.

What then do we need to do to make better use of the information we already have? Certainly we need a well-developed, publicly understood and publicly accepted plan for fuel management that sets priorities of operation but is flexible enough to capitalize on yearly removal of brush by wildfire. Certainly we need a great deal more coordination of the brush control operations that are presently occurring. Most of these projects are carefully planned and well thought out on an individual basis but, with the exception of the fuel break work by the C.D.F. and U.S.F.S., little thought is given to coordinating these into an overall plan. Part of this, of course, is because we don't have a plan. The full potential of the private landowners must be explored and understood. For example, the livestock operators of the state constitute a potent group who are concerned about brush control and therefore fuel management on about 50% of the brush areas of the state. Their needs to maintain feed supplies are both consistent and compatible with the state's need to reduce fuel supplies--and they do it at private expense. Careful studies need to be made concerning the legitimate exploitation of this potential and the possibilities of more closely coordinating it with a general public-supported fuel management program.

We need an expanded research and Extension program to develop new information and find new ways to use the information we have and will develop. We are rapidly running out of areas where our available techniques are applicable, and also facing the prospects of losing the use of our most effective herbicides.

The University of California has an opportunity and an obligation to provide this expanded research and Extension program and the state is ex-

pecting it to do it. Of those things that need to be done, some fall clearly into the responsibility of the Experiment Station and others are more properly the responsibility of Extension. The Experiment Station should lead in developing information and Extension has the expertise to get it into practice. However, we do not have time to follow the classic pattern that we have always followed--that is, research developing information and Extension picking it up several years later when the public is ready to use it. On this problem, research and Extension must work so closely together that results can be put into practice almost as soon as they are developed. Administrative procedures must be revised and streamlined where necessary to permit and require this kind of operation. The programs must be adequately financed and the University should aggressively seek the necessary funds.

What kind of research information do we need? I will mention several areas, not necessarily in order of importance, where our brush control information needs to be strengthened.

1. We need new and safer techniques for the use of our present herbicides.
2. We need new herbicides that will replace our present ones, if they are no longer available, and that will be more effective against harder to control species.
3. We need new mechanical means of brush control--far out machines--some type of all-terrain vehicle on which we can hang a variety of brush manipulators, spray equipment and fire control apparatus as needed.
4. We need to learn more about handling fire--how to make brush burn when we want it to burn, not when it wants to burn.

5. We need to develop techniques for using domestic animals and wildlife for brush control.

6. We need to know more about the physiology of the chaparral. How often can we "prune it back" either mechanically, by fire, or chemically, to keep it low growing and green without destroying it?

Now, what are the Extension needs of the program?

First, of course, we need to develop programs to demonstrate the practicability of new research findings as they are developed and combine them with our present knowledge.

Secondly, a most important need is that of coordinating the effort of private and public wildland managers. This is probably the most difficult and critical aspect of the whole program. There are no less than 17 public agencies plus innumerable public utilities, timber companies and individual land owners all performing some kind of land management in California and doing it the way they want to and when they want to. The Agricultural Extension Service can play a leading part in this phase because, since it has no land of its own to manage, it has no axe to grind and it can look more objectively than any other agency at the needs of a statewide program.

Third, neither domestic nor game animals have been used to their potential in controlling brush regeneration. There are many examples, several on large scales, of the effectiveness of animal grazing in keeping brush growing vigorously yet holding it well within the grazing height of the utilizing animals. This points to the need of promoting intelligent and acceptable use of livestock as brush control agents, particularly on public lands including state and national parks. Likewise, realistic wildlife management programs must be developed to maximize use of game animals as brush control agents.

Both of these programs will require tremendous educational effort because they propose departures from traditional resource management and will meet strong resistance. However, if we are ever going to keep our managed brush fields growing vigorously, and therefore less flammable than they now are, it will be by making maximum use of our grazing animal resources to consume brush rather than letting it accumulate as highly flammable fuel to be consumed by wildfires.

Fourth, just as we need to marshal our animal resources for this effort, so must we make maximum use of our human resources in performing certain critical brush control operations that can be accomplished in no other way except by intelligence and hard labor. The benefits of the civilian conservation corps program of 30 years ago are still evident. This summer I saw striking results of the efforts of several volunteer crews--largely retired people--in fuel management work in the intermountain states. We need to take a hard look at these kinds of programs and take steps to restore and encourage them.

Lastly, Extension must work with every agency with brush management responsibilities (including fire control) in a public information program which will result in fuel management becoming a high priority use of public funds.

This matter of fuel management is not only a major problem of the state, it is also a major challenge and opportunity for the University of California. This then is our challenge--we must learn to keep brush growing vigorously, to keep it relatively non-flammable, and to keep it environmentally and aesthetically acceptable. This will require the maximum cooperation and inputs of several colleges as well as the Agricultural Experiment Station and the Agricultural Extension Service.

The time to do this is now.

Public opinion is ready to be influenced.

The question is--are we in the University going to be ready to do our part of the influencing?

I think we are!