PACIFIC COAST

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Almost half the land area of the three coastal states is devoted to grazing and pasture—improvement can pay dividends

THE OUTSTANDING CHARACTERISTICS of a grassland climate are limited precipitation and cold drying winds during the winter season. The limited precipitation is enough to keep surface layers of the soil moist during the late spring and early summer. Moderate temperatures during the vegetative growth period are followed by high temperatures during middle and late summer. Dry conditions, and even drought, occur in autumn, and cold drying winds in winter. Grassland climates have a continental aspect.

In the Pacific Coast region precipitation is periodical, most of it coming during the winter months. The amount of precipitation varies from more than 80 inches in the cool, humid north to less than 12 inches in the hot, arid south.

The topography is rough and generally not favorable to cultivation. The more arable sites are, of course, under intensive cultivation. In recent years, due to the great influx of population, the range and pasture situation has become even more critical as the livestock have been forced off better sites to make room for ever-expanding urban areas.

A brief look at vegetative types in the Pacific coast area also emphasizes the absence of a true grassland type. The following broad vegetative types are encountered: coniferous forest, chaparral, and bunch grass prairie.

Vast acreages of coniferous forest occur in western Washington and Oregon and in Northern California. Included in the forest are large parklike areas of grassland that provide excellent forage, especially for summer grazing. Logged-over areas provide poor forage naturally but when the slash is burned and seeded good forage can be obtained. Chaparral readily invades logged or burned forests making them practically worthless. Although elevations vary from sea level to over 12,000 feet, temperatures are mild, and the precipitation ranges from 50 to 100 inches or more annually. This is one of the most important timber regions in the United States.

Derived from the Spanish word "chaparra," meaning scrub oak, the term chaparral was applied by the early California explorers to the low, shrubby, predominantly evergreen vegetation which they found to be so characteristic of the coast ranges and the foothills of the Sierra Nevada. It occurs in four other regions of the world: Mediterranean, parts of southern and western Australia, parts of South Africa, and Chile. There are three main types: true chaparral, woodland-grass chaparral, and timber chaparral.

The true chaparral consists of numerous shrubby species, many of which are sprouting forms. That is to say, when cut or burned the plants sprout from the crown. The brush forms a dense canopy with little herbaceous vegetation below. It is practically useless for grazing. It has long been considered valuable as a watershed, but some hydrologists are of the opinion that it would be of more value as grassland.

The woodland-grass chaparral is also diverse, but it contains a large percentage of nonsprouting species. It is more open with considerable herbaceous understory. Brush invasion and increase have been marked in this type.

The more open areas in the Pacific coastal region were primarily covered with bunch grasses. Three broad types were recognized: wheat grass sod, wheat grass bunch, and Stipa-Poa bunch grass.

The wheat grass sod is limited largely to the Palouse section of eastern Washington and adjacent portions of Idaho and Oregon. Soils and vegetation are quite similar to those of the northern Great Plains. This vegetation unit marks the best wheatlands of the Pacific Northwest. Sagebrush has invaded a great deal of the Palouse Prairie and has created a problem in revegetation.

The wheat grass bunch comprises the eastern portions of Washington and Oregon, occupying the zone above the sagebrush desert. It is made up of distinct bunches of wheat grass and a rich admixture of other grasses and herbaceous plants.

The Stipa-Poa bunch grass has largely disappeared from California. According to H. L. Shantz it was originally "probably as rich a mixture as found on the bunch grass land of the north." This bunch grass association has given way to a group of annual plants well adapted to complete their life cycle during the early spring months before the moisture from winter rains is exhausted. Most of these species came from the Mediterranean region on the hides of the animals brought in by the Franciscan padres.

The over-all importance of grazing and pasture lands in the Pacific Coast region is attested by the huge acreage devoted solely to livestock (Table I). This amounts to more than 43% of the land area in Washington, 73.7% in Oregon, and 53% in California. Numbers of sheep and cattle in this region in 1953 are given in Table II. The U. S. Forest Service administers grazing permits on 18 national forests in Region 5 (California) and 19 in Region 6 (Washington and Oregon). These include more than 44 million acres or approximately 22% of the land area of the three states. About 3% of the cattle and 10% of the sheep graze part of the year in the national forests (Table III).

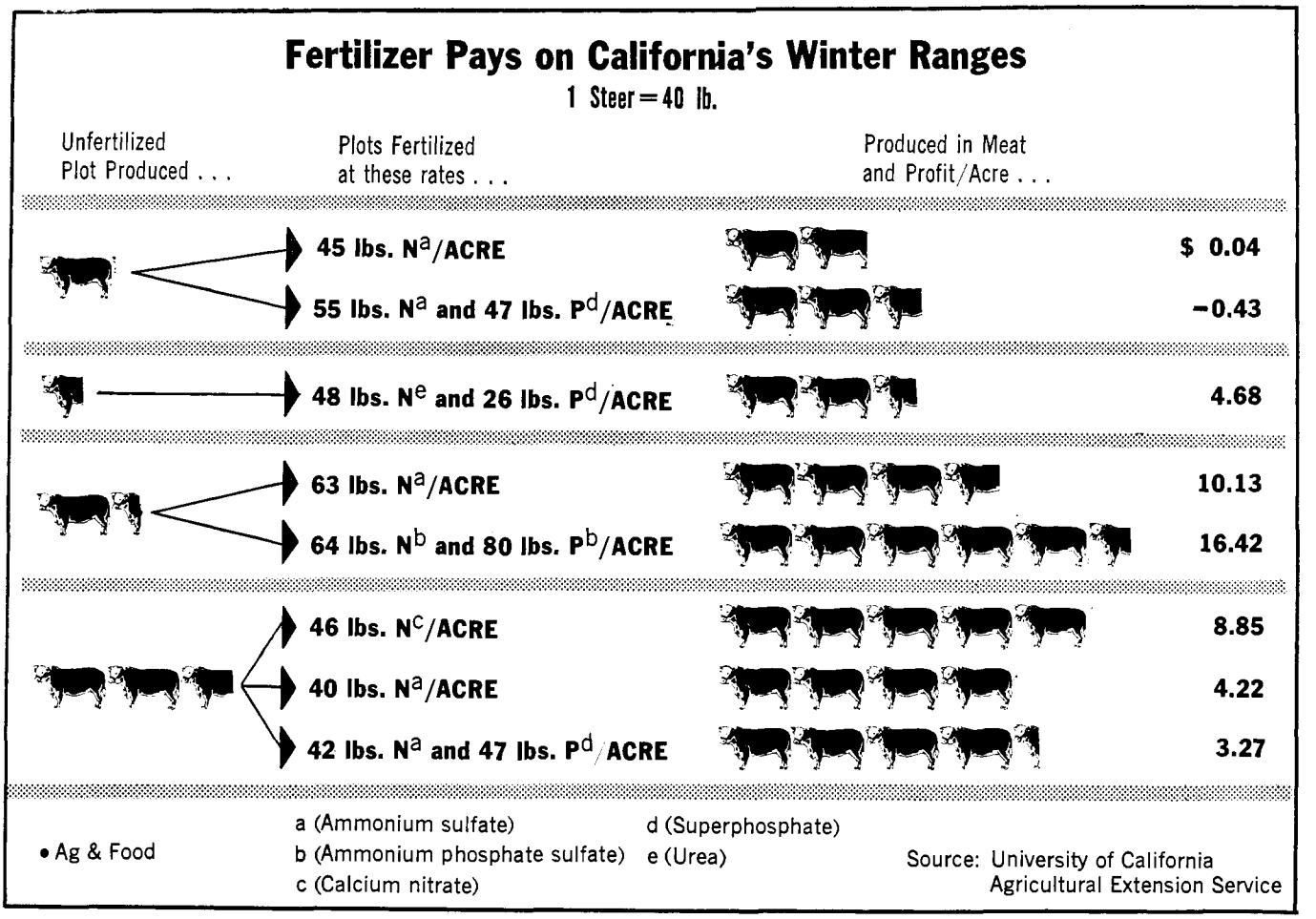
Harvesting—A Problem

Returns per acre are low. It has been estimated that the Pacific bunch grass type requires 4.5 acres to provide sufficient feed for one cow (or 5 sheep) for a month. [This is referred to as an animal unit month (a.u.m.)]. The summer ranges in the open forest average about eight acres per a.u.m. The woodland-chaparral averages about 10 acres per a.u.m. In spite of the low returns per acre, these vast acreages of range constitute a resource of great value to the livestock economy of the Pacific Coast region. Depending on numerous factors, estimates of the possibility of increasing feed values vary from 10% to tenfold if improved practices now in effect on some ranges were

Table I. Nonforested Pasture and Range Land in the Pacific Coast States

	Land Area (1000 acres)	Acreage of Nonforested Pasture and Range (1000)	Acreage Not in Farms (1000)	Rough Wild Lands (1000 acres)	Nonplowable Land (1000 acres	Plowable Pastures (1000 acres)
Washington	42,743	9,532	2,290	903	6,471	771
Oregon	61,642	25,742	14,090	835	10,600	1,052
California	100,314	24,751	4,344	12,397	18,150	2,257
U. S.	1,905,362	706,947	178,481	93,422	420,003	108,463

SOURCE: USDA Misc. Publ. 663, 1945 (table 38).



more generally adopted. A few examples point out the tremendous possibilities of more efficient grassland utilization.

Probably the greatest problem confronting the range operator today is one of developing means of more efficient livestock production. There may be an argument as to whether we need more meat and more wool. There can be no argument against more efficient production per acre. Those ranges operated on a sound economic basis must produce enough pounds of beef or of mutton and wool per acre to provide a profit to the operators.

Let us look for a moment at other crops. Any crop involves a soil-crop-harvest complex. This complex is by no means simple with such agricultural crops as barley, cotton, or sugar beets. Cotton will grow better on some soils than on others. It requires a special climate. It is readily recognized that different machinery is necessary to harvest each of these three crops. Time of harvest varies, too.

Through the years our agronomy department has been looking at range management and range improvement from the agronomic standpoint. We have drawn heavily on agronomic philosophy and the applications of research in field crops. With all other problems solved, little is to be gained if correct methods of harvesting and equipment are not used.

The range crop is exceedingly more complex than a single field crop. There is a gradation in control from intensively cultivated, irrigated, and hand picked fruit through row crops, small grains, irrigated pastures, dry-land pastures, to range lands. In all, however, the three fundamentals are present: soil, plants, and harvest. This complex is not a simple one in the case of small grains, or irrigated pastures. In the case of range lands the complexity is so great it is almost lost to view.

In its simplest terms the problem encountered in harvesting the range crop is one of overcoming the tendency of animals to graze an area selectively. Studies have shown that, given the opportunity, an animal will graze one plant, avoiding the one adjacent, and move to another plant, always selecting the ones most palatable. This results in uneven grazing and leads to a thinning out of the more preferred plants and a predominance of the less preferred plants.

This is nowhere better illustrated than on the annual-type range in California. The problem of weeds and weediness is not simple on the range. It is one of

Table II. Livestock Numbers in the Pacific Coast States, 1953

	Sheep and Lambs (1000)	Cattle and Calves (1000)
Washington	301	1,052
Oregon	655	1,374
California	1,787	3,283
Western U. S.	12,646	16,051
U. S.	27,857	93,696

Source: USDA, Agricultural Marketing Service, "Crop Production," 1953.

Table III. Grazing Use in the National Forests in the Pacific Coast States

	Acreage			
	Grass (1000)	Under USFS Administration (1000)	Livestock under Permit, 1951	
			Cattle and Horses	Sheep and Goats
Washington	10,747	9,683	18,564	39,965
Oregon	17,378	14,817	69,094	149,701
California	25,078	19,939	104,401	121,599
U. S.	229,165	181,293	1,088,332	3,012,812

Source: U. S. Bureau of the Census, Statistical Abstract of the U. S., 1953.

degree. On much of California's foothill ranges the cover includes the following winter annuals, which may be grouped into two classes:

Undesirable ("*the weeds*")	*Desirable* ("*the crop*")
Nit grass	Broad-leaved filaree
Native fescues	Soft chess
Introduced fescues	Slender wild oats
Wild barleys	Native annual clovers
Red brome	Red stem filaree
Ripgut	Bur clover

Everyone may not agree with this order, but I have placed what I consider to be the most undesirable ones first on the list. Ripgut, a borderline grass, is palatable and nutritious when young, but the ripe panicles are obnoxious because of the barbed awns on the seeds which do not readily shatter. Broad-leaved filaree is not undesirable, but it is not very valuable either.

To the above lists should be added the hundreds of species of flowering plants found on the range. In some fields, particularly abandoned cropland, the undesirable species listed may comprise 90% of the ground cover. What method of weed control can be used to change this balance? It is obvious that no selective chemical will perform this miracle.

Studies of the life cycles of species in the two classes show that, in general, the undesirable annuals mature earlier than the desirable ones. This is true regardless of the spring rainfall pattern. If mowed or very closely grazed in early April (in the Sacramento Valley foothills) the undesirable grasses produce less seed. On the other hand, the desirable grasses and legumes recover from the grazing and set a good seed crop. They also use more of the available soil moisture, which in turn helps inhibit the development of summer weeds such as tarweed and star thistle. This program calls for removal of the stock from the field in question before the last spring rains.

The improvement of a given range area by such means is a slow process, but some progress should be noted each year. Probably three range subdivisions are necessary, so that fields 1, 2, and 3 could be treated in the above manner in a three-year rotation.

In other words, concentrating the animals as much as possible, and moving them from field to field, is an excellent way to harvest the crop. On huge acreages this ideal is difficult to achieve, but even a tendency in the right direction will be very beneficial.

A comparable type of program developed by the California Forest and Range Experiment Station is now under way on one allotment in the Lassen National Forest. The major cover types on this allotment are:

Type	*Acres*	*%*
Grassland	505	1.5
Meadow	1,322	4.1
Sagebrush	4,105	12.7
Conifer	14,713	45.5
Waste	11,707	36.2
Totals	32,352	100.0

There are about 20,645 acres of usable range and the allotment has been subdivided into five fields of approximately equal grazing capacity. The 500 animal units are allowed for four months but instead of allowing the animals to roam the entire area selecting their feed at will, they are to be confined to certain fields for certain parts of the season, and kept out of other fields. Thus, where concentrated, weeds and preferred plants alike will be grazed. Maximum growth will be attained in other fields. The program calls for a five-year rotation cycle. The "pilot" model indicated that carrying capacity can be increased in this manner.

Big game animals are known to compete with livestock on many range areas. It is not so generally recognized that rodents, too, are strong competitors. Studies by California workers showed that, in rodent exclosures, pocket gophers ground squirrels, and kangaroo rats consumed 457 pounds per acre or about a fourth of the average herbage yield. Preliminary field data confirm these results. Subsurface burrows may lead to extensive subsurface erosion, formation of caverns, and even of gullies. There can be little doubt that some such gullying, often attributed to overgrazing, is actually the result of rodent activity.

Attention to the following factors would greatly increase economic returns; maintenance of a high level of soil fertility, use of species best adapted to areas where reseeding is being carried on, and proper seasonal use by livestock. The writer is more familiar with California conditions, but the same principles apply in the rest of the region although details may differ.

Soil Fertility

In Oregon and California applications of nitrogen, phosphorus, and sulfur, alone or in various combinations, are paying dividends in increased yield of higher quality. In western Washington and Oregon lime is needed in heavy rainfall areas to condition the highly acid soils for grasses and especially for legumes. In Washington potash, too, is required on some soils.

At the University of California's Range Field Station near Hopland, yearling ewes on fertilized, seeded, dry-land pastures gained about a third of a pound a day during January through June compared with a tenth of a pound daily gain on unfertilized, unseeded range. Nitrogenous fertilizer not only increases total feed but also results in earlier feed, an item of great economic importance.

The California Agricultural Extension Service conducted five comparisons on unimproved ranges last year in as many counties. These trials involved 693 animals on 1118 acres, 520 of which were fertilized. Nitrogen and combinations of nitrogen and phosphorus were used. In four tests, returns in added meat per acre equalled or exceeded costs the first year. On the best lands meat yields were doubled and on the poorer soils production was increased fivefold. This indicates that a "second look" should be taken at "ranges that return so little the operators cannot afford to spend money on improvements." In California, grasses will grow in the winter. Nitrogen is the means of doing this if enough sulfur and phosphorus are available to make the nitrogen effective.

Use of Species

On lands that can be reseeded, spectacular results are at hand on the use of well-adapted plants. One example is the use of annual trifoliate (or true) clovers on two extensive soil types on the eastside foothills of the Sacramento and northern San Joaquin Valleys.

It was long known that the Placentia and San Joaquin soils were very deficient in phosphorus. The interesting fact is that no amount of additional phosphorus would help bur clover grow on these soils. However, when rose, crimson, and subclovers were seeded on phosphated plots, yields of forage (dry) jumped from less than 1000 pounds per acre to more than 4000 pounds and protein was increased 6.25 times. Rose clover was first tried in California by the Agronomy Department in 1944. It was certified in 1947. In 1954, 400,000 pounds of seed were produced. Crimson and subclover are good companions for it.

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On sabbaticol leave from the university from July 1948 to July 1949, Dr. Love went to Brazil at the request of the Ministry of Agriculture to set up a cytogenetic laboratory for cereals and forage crops. Author of about 60 publications on cytogenetics ond range improvement, Dr. Love received the American Society of Agronomy's Stevenson Award in 1952 for his outstanding work on range improvement.

Table IV. Seed Production in the Pacific Coast States, 1953

	Red Clover			Alsike Clover			Alfalfa		
	Acres	Yield/Acre (lb.)	Production (1000 lb.)	Acres	Yield/Acre (lb.)	Production (1000 lb.)	Acres	Yield/Acre (lb.)	Production (1000 lb.)
Washington	4,500	170	765	...	...	...	24,000	525	12,600
Oregon	12,500	175	2,188	10,000	440	4,400	4,000	315	1,260
California	200[a]	320[a]	64[a]	4,800	425	2,040	93,000	475	44,175
U. S.	1,412,500	59	83,237	64,300	193	12,432	941,700	141	133,226

[a] 1952 data.
SOURCE: USDA, Agricultural Marketing Service, *Crop Production*, 1953.

Table V. Hay Production in the Pacific Coast States, 1953

	All Hay		Alfalfa		Clover and Timothy		Grains Cut Green for Hay		Wild Hay[a]		Other Hay	
	Acres (1000)	Yield/Acre (tons)	Acres (1000)	Yield/Acre (tons)	Acres (1000)	Yield/Acre (tons)	Acres (1000)	Yield/Acre (tons)	Acres (1000)	Yield/Acre (tons)	Acres (1000)	Yield/Acre (tons)
Washington	798	2.02	334	2.25	210	2.20	103	1.50	52	1.30	99	1.80
Oregon	1,031	1.78	234	2.70	114	1.90	192	1.65	337	1.15	154	1.85
California	1,890	3.13	1,017	4.50	...	...	555	1.55	142	1.30	176	1.70
U. S.	73,918	1.42	20,269	2.19	20,761	1.44	2,831	1.20	14,416	0.82	7,882	1.15

[a] Includes prairie, marsh, and salt grasses.
SOURCE: USDA, Agricultural Marketing Service, *Crop Production*, 1953.

One rancher began this clover-phosphate program on 50 acres in 1950. By 1953 he had 1100 acres treated. He increased his carrying capacity from one a.u.m. per acre during the spring season to three a.u.m. per acre at any time of the year. He called it the "three-storey pasture"—the tall crimson, the shorter rose, and the subclover on the ground.

In a large test last year another beef producer seeded 350 acres. He ran two comparable lots of steers. One lot of 700 spent 50 days on the 350 acres, the other remained on unimproved range for the season. The first lot averaged 46 pounds greater gains, for a profit of $9.20 a head. An additional benefit was the feed saved on the unimproved area while these animals were on the clover pasture. These are reseeding annuals, and additional phosphate is required about every three years. There are three million acres of these two soil types. So it can be seen that as the increased urban population in this region pushes the livestock back, more efficient use of the land can maintain the livestock numbers necessary to fill that "fifth plate."

Another example of the outstanding job done by a well-adapted species is the use of big trefoil. It is a rhizomatous perennial legume first noticed about 30 years ago in several areas of the Pacific Northwest, including Rosburg, Wash., and Loon Lake, Ore. It withstands heavy flooding and shade of bracken so, where seeded, it eventually becomes dominant in logged-off areas. Tests have shown that 10-year-old stands of grasses and big trefoil produce three times as much feed as comparable stands without this legume.

Irrigated Pastures

The development of irrigated pastures in the Pacific Coast states has been nothing less than spectacular. Furthermore, it has given great stability to the livestock industry. It is rather difficult to obtain exact data on the acreage devoted to irrigated pastures. However, current estimates by the Agricultural Extension Services in the three states give the acreage as follows:

Washington	200,000
Oregon	450,000
California	785,000

Seed Production

Another phase of grassland agriculture of extreme importance to the Pacific Coast States is the production of forage seeds for use elsewhere in the nation (Table IV). Half the alsike clover seed produced in the United States comes from Oregon and California. One third of the alfalfa seed is produced in California alone, and about one tenth in Washington. Acreage yields in these states is two to three times higher than the national average. In 1953 California produced 5.5 million pounds of Ladino clover seed, and Oregon, 1 million pounds of the national total of about 7 million pounds. This seed alone was a $2 million industry in California in 1953.

A high proportion of the nation's cover crop seeds are produced in Oregon. In fact, the Willamette Valley in Oregon produces tremendous quantities of vetches, field peas, crimson clover, and common rye grass seed.

In addition, the states have a substantial seed industry of production for local use alone. California, for example, has several thousand acres devoted to the production of seed of such forage species as burnet (a member of the rose family), harding grass, prairie brome, smilo, Goar tall fescue, and rose clover—species hardly recognized beyond its borders.

Hay production of all types also makes a significant contribution to the livestock economy of the states (Table V).

Brush

Brushlands constitute one of the major problems confronting the livestock industry. The sagebrush areas will not be discussed here since that has been done in the paper on the Intermountain Region. The problems in logged-over coniferous forests were referred to earlier in this paper in connection with use of big trefoil.

The California chaparral is a problem area rather specific to California. Estimates of its area vary from 10 to 20 million acres. Certainly, as it stands, it is of little value for grazing. State legislation has been enacted whereby ranchers may obtain permits from the State Division of Forestry to burn brush. Local forest rangers and extension service personnel cooperate with rancher groups,

A three-step program has developed: brush removal, seeding, adjusted livestock use. Brush is removed by fire, mechanical equipment, spraying with herbicides, and by combinations of all three. Seeding of adapted species is done on foot, horseback, or by air. A seasonal rotation grazing program, together with follow-up spraying to kill brush sprouts and brush seedlings, helps to guarantee success.

We have defined the agronomic phase of range improvement as "the process of replacing a relatively undesirable population of plants with a more desirable type of forage." It can be seen that this applies to brush areas as well as to open grasslands. It is an ever-continuing process. A program resulting in improvement from the livestock production standpoint automatically takes care of the conservation of this renewable resource.