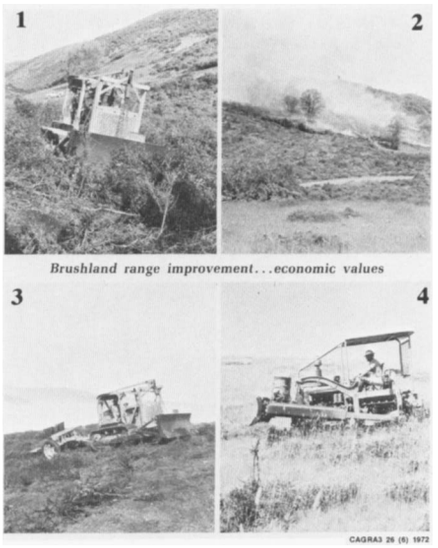
BRUSHLAND RANGE IMPROVEMENT

. . . *economic values*

A. H. MURPHY • D. T. TORELL



Brushland range improvement . . . economic values

Cover photos show brushland range improvement steps at Hopland Field Station: (1) crushing or railing brush with dozer blade in late fall; (2) burning crushed brush the following spring while grass is still green; (3) seeding burned brush areas with rangeland drill mounted on dozer; (4) brush sprouts spraying in followup treatment with equipment mounted on dozer blade.

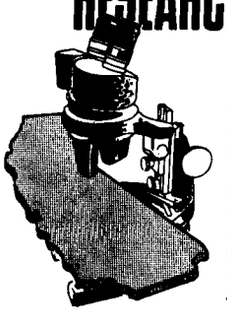
BRUSH-COVERED LANDS in California are a challenge to the landowner; they may be a blessing or a problem, depending on the management. If the brush cover is manipulated to produce animal feed then value is received from the land; however, if the plant cover becomes a dense thicket, it not only produces little feed but is a fire hazard during dry summer months.

Research has provided many useful methods for the landowner to keep brush areas in a safe productive condition. In the management of brushland a key element is whether "it pays"; this economic study was directed toward evaluating the cost factors.

At the Hopland Field Station in Mendocino County, in a region that is typical of California's fourteen and a half million acres of chaparral and grass-woodland areas, a brushland management study was initiated to categorize the various cost components inherent in improving this type of land. The 865 acres of selected range (consisting of 13% grass, 44% brush, and 43% trees) were subdivided into three fenced pastures, J-I, J-II and J-III, of 226, 252 and 387 acres, respectively. In planning the study it was determined that the 387-acre J-III pasture would be improved first while the other 2 fenced pastures, J-I and J-II, would be untreated but pastured with livestock; then at a later date they would be improved.

The selected 387-acre pasture ranged between 1,600 and 2,700 feet elevation, transversed by steep drainage canyons with interspersed slopes and flats and covered with either brush species or trees. Many

RESEARCH PREVIEWS



A continuing program of research in many aspects of agriculture is carried on at University campuses, field stations, leased areas, and many temporary plots loaned by cooperating landowners throughout the state. Listed below are some of the projects currently under way, but on which no formal progress reports can yet be made.

CONIFER SEED PROTECTANTS

Vetebrate ecology researchers in the Department of Animal Physiology at Davis are searching for substitutes for endrin, which is now used by the forestry industry as a conifer and seed protectant against small rodents, particularly deer mice. Working under a Bureau of Land Management contract, laboratory studies of several thiourea derivatives have shown promising results as repellents. Further laboratory studies are underway and field evaluations are in the planning stage for next fall and winter.

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SHEEP VACCINATION

A vaccine developed by the School of Veterinary Medicine at Davis appears to be effectively controlling one kind of epididymitis of rams. Research continues into problems of reduced ram fertility.

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Seeded area (foreground) showing good pasture grass in contrast with 3-ft-high brush growth in background.

acres of brush were so thickly covered with plants that it was impenetrable for livestock, wildlife, or man. Some of the tree species, such as madrone, contributed little to the productivity of the land and crowded out the more useful plants.

The plan of improvement was to change some of the brush areas to grass, where the soil indicated a good prospect for establishing grass, and in the tree areas to reduce cover density of the less useful species to encourage the herbaceous vegetation. The shrubs and trees growing on better types of soil, such Laughlin, Josephine or Sutherlin soil series, offered good prospects for conversion to grass while areas of Maymen and Henneke soils were usually considered to be marginal prospects.

Most of the brush area conversion was achieved by crushing the brush in place with a dozer blade in the fall or early winter, burning the dry crushed brush in the spring, while the grass was still green, seeding with adapted grasses and legumes, then discouraging regrowth of sprouts and seedlings by spraying with 2,4-D and 2,4,5-T.

Trees were selectively thinned-out by using the cut-surface method whereby cuts were made around the lower part of the tree trunk and the herbicide 2,4-D placed in the cuts. This treatment when applied in the winter or spring generally killed the tree within six months. Selectivity was based on leaving those oaks that had good potential for acorn production and removing the trees that contributed little towards animal feed. Grass seeds of harding and smilo were sown under the treated trees to enhance the quality of forage.

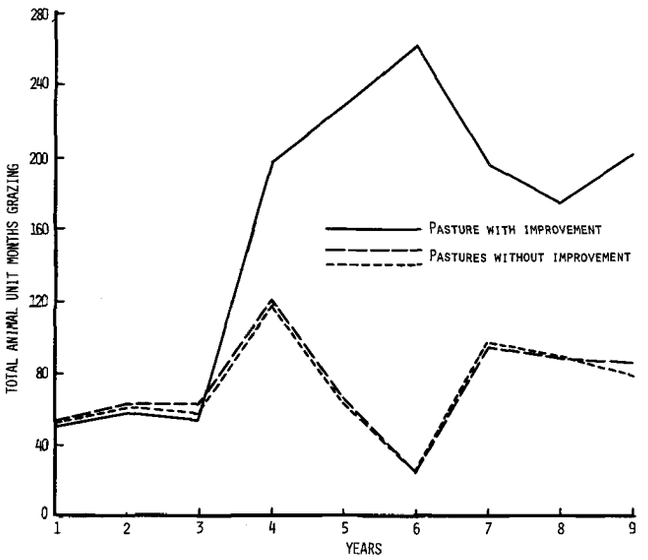
Grazing capacity

From 1956 to 1960, grazing was measured on the entire 865 acres before the pasture was subdivided with fences or any improvement was started. The income during this period was 74c per acre. After fencing into 3 pastures, the grazing yield income for 1961 through 1963 was $1.70 and $1.47 for J-I and J-II but only 94c for J-III (the pasture yet to be improved). Low grazing yield of these pastures indicated that productivity could be increased by applying various range improvement techniques.

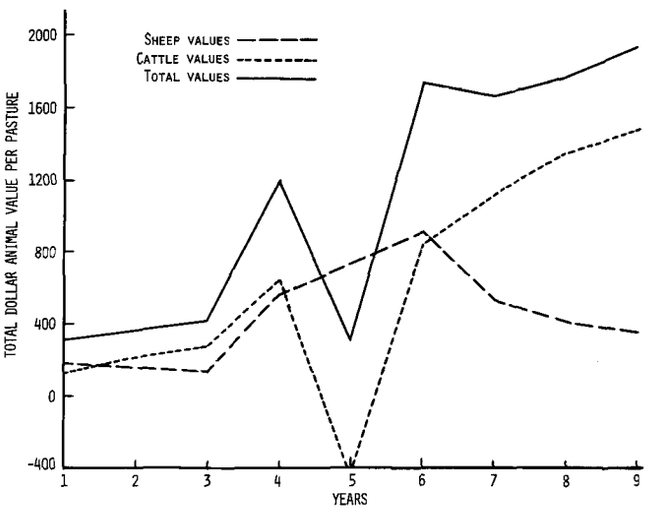
Improvement treatments on J-III started with tree treatment in the winter of 1961-62, crushing of brush in the fall of 1962, burning in the spring of 1963 followed by fall seeding of harding, smilo, Palestine orchard and blando brome grasses with rose and subclovers plus lana vetch. The impact of these initial improvement practices was not reflected in increased grazing capacity until 1964-65 as the seeded areas were not fully productive until their second growing season. Range improvement practices continued through 1965-66 involved mostly brush crushing, burning and seeding. Starting with the 1964-65 growing season through 1969-70, a six-year period, the improved grazing capacity was reflected by the increased grazing use of the J-III pasture (graph 1)

The greatest impact to increased grazing yield was the replacement of worthless brush areas by seeding useful grasses and legumes. Improved areas now provided livestock feed in excess of 2,000 pounds per acre, dry weight basis. The yield of feed would have been very low if the areas of brush removal had not been seeded. Tree-treated areas represented less of a forage impact because only 24% of the pasture was tree covered, as compared with 64% in brush and usually the quantity of the forage under trees was not as

GRAPH 1. INCREASE OF GRAZING USE RESULTING FROM PASTURE IMPROVEMENT AT HOPLAND.



GRAPH 2. VALUE PER PASTURE OF ANIMAL PRODUCTS RESULTING FROM PASTURE IMPROVEMENTS IN J-III PLOT — TREE TREATMENT, BRUSH REMOVAL, SEEDING

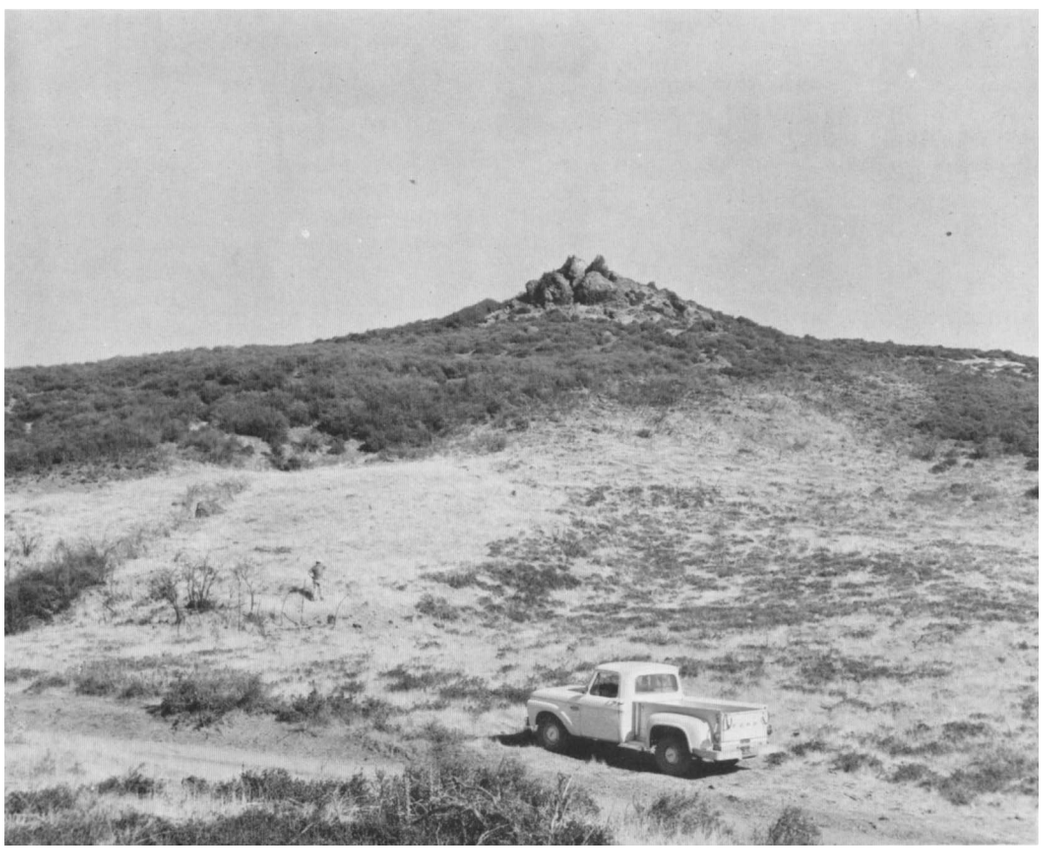


great as that produced in the areas formerly in brush.

Improvement economics

During the period of improvement, 1961-62 to 1965-66, the cost distribution was: 44% for labor, 27% for machinery and the balance of 29% for materials such as herbicide, seed, and fertilizer (table 1). In terms of type of improvement, tree treatment accounted for 21.1% of total costs; seeding and fertilizer, 49.1% ; and brush crushing, burning, and spraying, 29.8% (table 2).

Seed was applied either by a rangeland drill or broadcast where the drill could not be used. Grasses most successfully established and contributing most to feed production were hardinggrass and Palestine strain of orchardgrass. Blando brome also established well initially but was not as persistent a feed producer for long range purposes as the 2 perennials mentioned. The legumes—rose clover, sub clover and lana vetch—were seeded but generally were successful only in the areas below 2,000 feet and seedling damage was severe from birds and rodents, thus reducing the initial population. Ammonium sulphate at 100 lbs per acre was applied at



Hillside showing treated area, foreground, and untreated brush in background.

TABLE 1. BRUSHLAND IMPROVEMENT COSTS BY YEAR AND CATEGORY.

Year	Labor	Machinery and equipment	Materials	Total
1961-62	$ 489.15	—	$ 163.20	$ 652.35
1962-63	396.15	$ 130.50	178.60	705.25
1963-64	411.75	421.07	439.28	1,272.10
1964-65	697.20	609.14	465.30	1771.64
1965-66	857.55	599.59	612.35	2,069.49
TOTAL COST	$ 2,851.80	$ 1,760.30	$ 1,858.73	$ 6,470.83
PER ACRE COST	7.37	4.55	4.80	16.72
PERCENTAGE	44.	27.2	28.7	

TABLE 2. BRUSHLAND IMPROVEMENT COSTS BY CATEGORY AND PRACTICE.

	Labor		Machinery		
	Hrs.	Cost	and equipment	Materials	Total
Tree treatment	607	$1,075.80	—	$ 289.00	$ 1,364.80
Crush brush	112	243.00	$ 507.50	—	750.50
Brush spraying	229	450.00	253.31	260.15	963.46
Brush burning	119	211.20	—	—	211.20
Reseeding and fertilizing	456	871.80	999.49	1,309.58	3,180.87

TABLE 3. BRUSHLAND IMPROVEMENT COSTS AND INCOME PER ACRE FOR NINE YEARS DISCOUNTED AT 6% RATE*

Period	Year	Return no improvement	Improvement costs	Return	Net	Cumulative net income
1961-62	1	$ .88	$ 1.58	$ .76	$ - .82	$ - .82
	2	.83	1.72	.89	- .83	- 1.65
	3	.78	3.10	.97	- 2.13	- 3.78
	4	.74	4.32	2.92	- 1.40	- 5.18
1965-66	5	.70	5.05	.47	- 4.58	- 9.76
	6	.66	—	4.25	4.25	- 5.51
	7	.62	—	4.04	4.04	- 1.47
	8	.59	—	4.31	4.31	+ 2.84
1970-71	9	.56	—	4.50	4.50	+ 7.34
TOTAL		$ 6.36	$ 15.77	$ 23.11	$ 7.34	

Difference in costs from Table 1 is the result of figuring 6% discount.

*6% rate equal to what money would have earned in alternate investments.

seeding time on the area planted with the rangeland drill.

Different grazing values were used for sheep and cattle. The return for sheep grazing was determined by assigning a value of 3 cents per sheep day; for cattle the measure was pounds of gain at 25 cents per pound. The sheep were grazing during the summer, fall and early winter with maintenance feeding the aim rather than an increase in poundage. The cattle were young heifers which were in the area during late winter, spring and early summer, however, and increased weight was the important factor.

In the first 3 years, before the improvement practices were effective, the average annual value of animal products was about $360 (graph 2). By the fourth year an upward trend in values was apparent although in the fifth year a very poor, early spring feed condition produced a sharp dip. Cattle values contributed most of the increase because their numbers were augmented when more feed became available during the spring portion of the grazing season. Sheep, on the other hand, grazed on the residual feed in the fall when it was dry thus their numbers were more constant. Some of the decrease in sheep values, in the last 3 years, was due to sheep killing by coyotes, which reduced the yield of sheep products.

A comparison of improvement costs with net income discounted at 6% (a cost equal to what money would earn in various alternative investments) over the 9 years of the study is shown in table 3. At the end of the fifth year when all improvements had been made, the total net returns amounted to $9.76 less than the improvement costs. During the eighth year, however, net returns were greater than the improvement costs by $2.87; by the end of the ninth year they had exceeded them by $7.34. From the eighth year onward with minimal maintenance or improvement costs, the net returns may be expected to increase at a substantial rate.

Other values

Removal or reduction of brush and substitution of grasses and clover achieves other advantages not measured by livestock. For example, the possibility of large wildfires is much reduced when big areas of brush are broken into small units separated by grassy openings less subject to fires. Feed values lost by fires are estimated at about $2 per acre per year, thus the reduced probability of feed loss from fire could be added to the benefits achieved.

If hunting is a product of the land then a value could be assigned to the increase in deer resulting from more young browse available with better nutrition and palatability than old growth. Removal of dense brush would increase hunter success by making more area accessible. Finally, the mixture of brush with grass provides a greater range of food selection for deer than dense brush.

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The problem of diarrhea in dairy calves was studied using samples of dairy farms from two counties in California. Farmers were interviewed concerning (1) the nature and extent of the problem in calves on their farms, and (2) management practices. Survey findings showed differences between the two counties regarding causes of diarrhea; age at onset; and management practices—particularly with respect to vaccination, calving sites, and treatment.

DIARRHEA IN DAIRY CALVES in California is a major animal health problem. The major diarrhetic diseases of calves have been outlined as (1) hemorrhagic enterotoxemia, due to *Clostridium perfringens* type C, which occurs primarily in animals less than 2 weeks of age; (2) bovine virus diarrhea (mucosal disease†; and (3) calf scours, a disease of newborn calves, characterized by septicemia, toxemia, or diarrhea. Calf scours is caused most commonly by *Escherichia coli,* but can result from infections by other agents, including streptococcus, diplococcus, pasteurella, salmonella, and certain viruses.

Providentia stuarti, Proteus (several species), mycoplasmas, the chlamydia, and some fungi have also been incriminated as causes of calf scours. Calf scours is a major cause of losses in newborn calves, but adequate data relating animal morbidity and mortality to this symptom are unavailable. Therefore, a pilot survey was initiated in June, 1969, to obtain this information about diarrhea in calves for a limited area in the state of California.