Range Cover after Noxious Weed

desirable and undesirable grasses and forbs compete for range space cleared of Klamath weed by leaf-feeding beetles

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On two test ranches—in southeastern Humboldt County—range grasses and forbs quickly replaced Klamath weed following biological control by beetles—*Chrysolina*—which feed exclusively on the weed.

A year after the beetles were first noted in one test site, their numbers and evidence of feeding had been so great that Klamath weed comprised less than 5% of the vegetation, compared to the previous 40%.

The two primary effects of Klamath weed on a range are that good forage plants are crowded out and because of the inferior range feed, the livestock is more subject to malnutrition and disease.

To study the vegetational changes and the plants most likely to replace Klamath weed while biological control is in progress, an area in southeastern Humboldt County, which had been heavily infested since the 1920's, was selected. Pastures—varying in size from five to 50 acres—on two ranches were involved in the study. Elevation is approximately 2,000 feet. A co-operative arrangement was made so that control of forage use by livestock would be possible.

Southeastern Humboldt County has approximately 60″ of rainfall annually and is capable of supporting a stand predominated by perennial grasses. However, past stocking practices reduced the grass composition to annuals mostly. During the study, perennial grasses were encouraged by withholding grazing during the period of seedhead development until seed shattered and by rotating the grazing to develop thrifty grass plants.

Vegetation Composition on Sheep-Grazed Range During Biological Control of Klamath Weed from 1948 to 1953 in Southeastern Humboldt County.

	1948	1949	1950	1951	1953
	%	%	%	%	%
NORTH FIELD					
Klamath weed	50	40	T*	0	T
Annual grasses	25	40	55	45	50
Perennial grasses	0	T	T	T	T
Forbs	25	20	45	55	50
SOUTH FIELD					
Klamath weed	30	35	0	0	T
Annual grasses	30	40	45	40	50
Perennial grasses	T	T	T	T	T
Forbs	40	25	55	60	50

* T = trace

After four years of controlled animal use, a greater change in perennial grasses was not possible because of the initial low population density.

Invasion of other weedy range plants on those areas formerly occupied by Klamath weed was an important factor. Medusa-head was one of the more promiment weedy plants present on the experimental pastures. Other undesirable weedy grasses of less aggressiveness include nitgrass, dogtail, and foxtail fescues.

Forage pattern is generally a very dense cover of the annual vegetation typical of many California ranges. This pattern restricts the practical use of individual plant counts if a large number of samples are taken. For this study, forage was separated into groups—annual grasses, perennial grasses, forbs, and so forth—and the percentage of total vegetation for each group determined. Estimates of composition were made by using a square-foot frame placed on the ground at 20-foot intervals along an established line. Estimates were made to the nearest 5%.

Major Forage Species Observed in Study

ANNUAL GRASSES:
- Soft chess—*Bromus mollis*
- Ripgut brome—*Bromus rigidus*
- Red brome—*Bromus rubens*
- Foxtail fescue—*Festuca megalura*
- *Festuca dertonensis*
- Annual bluegrass—*Poa annua*
- Little quakinggrass—*Briza minor*
- Dogtail—*Cynosurus echinatus*
- Medusa-head—*Elymus caput-medusae*
- Mediterranean barley—*Hordeum hystrix*
- *Aira praecox*
- Silver hairgrass—*Aira caryophyllea*
- Wild oats—*Avena fatua*
- Slender wild oats—*Avena barbata*
- Nitgrass—*Gastridium ventricosum*
- Prairie three-awn—*Aristida oligantha*

PERENNIAL GRASSES:
- Pine bluegrass—*Poa scabrella*
- Blue wild-rye—*Elymus glaucus*
- Squirreltail—*Sitanion jubatum*
- California oatgrass—*Danthonia californica*
- Hall's bentgrass—*Agrostis hallii*
- Purple stipa—*Stipa pulchra*

FORBS:
- Ribwort—*Plantago lanceolata*
- Sheep sorrel—*Rumex acetosella*
- *Linanthus bicolor*
- California buttercup—*Ranunculus californicus*
- Lupine—*Lupinus spp.*
- Broadleaf filaree—*Erodium botrys*
- Cutleaf filaree—*Erodium cicutarium*
- Popcorn flower—*Plagiobotrys sp.*
- *Navarretia intertexta*
- *Microgus californicus*
- Cat's ear—*Hypochoeris sp.*
- Turkey mullein—*Eremocarpus setigerus*
- Bur clover—*Medicago hispida*
- Dwarf sack clover—*Trifolium depauperatum*
- Shamrock clover—*Trifolium dubium*
- Rancheria clover—*Trifolium albopurpureum*
- Few flowered clover—*Trifolium oliganthum*
- Pinole clover—*Trifolium bifidum*
- Tomcat clover—*Trifolium tridentatum*
- Hill lotus—*Lotus humistratus*
- *Lotus subpinnatus*

Vegetation Composition on Sheep-Grazed Range During Biological Control of Klamath Weed in Experimental Pasture from 1948 to 1951.

	1948	1949	1950	1951
	%	%	%	%
Klamath weed	70	50	50	15
Annual grasses	20	30	25	55
Perennial grasses	T	T	10	10
Forbs	10	20	15	20

The percentage of perennial grasses on all the study areas was relatively low, yet they are important as forage producers. When these plants occurred, they were listed by species in percentage density for closer observation.

Sheep were the grazing animals used in all the study pastures. Grazing use in all cases was at two separate periods: first, in the spring during April and May; second, in late June and July. The aim of this type of grazing was twofold: first, to utilize the annual growth by early grazing, thus reducing its competition with perennial grasses, and to utilize the new tender spring shoots of the Klamath weed; second, to allow the desirable perennial grasses—notably California oatgrass—to set a seed crop. Oatgrass was able to set seed between the first and second grazing period. Animals grazed some of the flowering Klamath weed and reduced its seed crop, tramped mature oatgrass seed into the ground, and utilized some of the summer forage growth.

Pasture elevation on one study location is 1,000′ with a 10° slope to the southwest, draining toward the main fork of the Eel River. Past grazing was characterized by fairly constant use from early winter until late spring or during the major growing period of the range plants. The resulting cover was a dominant stand of annual plants and few perennial grasses.

Annual grasses and forbs each made up about 30% of the vegetation. After Klamath weed was controlled by beetle feeding, the weed-free area was covered about equally with annual grasses and forbs. A trace of Klamath weed—noted in 1953—was from a seedling crop that

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LUMBER

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uted among the several stages of manufacture about as follows:

Item	%
Stumpage	16
Logging	20
Log transport	15
Sawmill	10
Yard and kiln	10
Planing and shipping	12
Selling	1
Overhead	12

Logging and log transportation thus account for more than a third of the total cost of putting lumber in the cars.

The cost history of a representative pine operation—over the past 20 years—shows real cost increases by departments to be:

Item	% Increase
Mill overhead	22
Planing, shipping, and selling costs	24
Sawing, yard, and drying costs	59
Log transportation	62
Logging cost	81

In the face of these figures it seems apparent that loggers have the biggest opportunities to reduce costs of any group in the lumber industry.

Logging and log transport costs in the California Pine Region have increased about $18.50 per M—from about $6.50 per M to around $25 per M—in 20 years. Of this increase, about $8.30 has resulted from general decline in the purchasing power of the dollar. Although this inflationary factor is the most important single cause of cost increases, it actually accounts for less than half of the rise in logging costs. Another $10.20 per M has been added to costs for reasons other than inflation.

One of these reasons is increased hourly earnings of woods labor. Average hourly earnings have risen about 3⅓ times in actual dollars during the last twenty years—somewhat less than the percentage increase in logging costs. After allowing for changes in the value of the dollar, of the total $10.20 increase in real logging and transport costs about $3.60 is attributable to increased hourly earnings. In terms of real economic cost, about 35% of the cost increase has been due to higher real wage rates.

In most industries, the impact of increasing wage rates has been offset in large measure by increases in over-all production from material, men, and machines. For example, between 1939 and 1950, over-all productivity of operations went up 10% in the paper and pulp industry, 24% in the clay construction products industry, and 17% in the mining industry, all of which are concerned with products competitive in some degree with lumber. In contrast to this general pattern of expanding productivity in the use of material, machines, and men, the hourly product in logging in the California pine region appears to have declined. For a representative group of operations, hourly product is apparently down about 20% in 20 years. This is equivalent to $5.10 per M, or half of the noninflationary increase in cost.

The decline in productivity reflects the decreasing size of timber and density of stand, more difficult logging terrain, and longer hauls. In part, these reductions were offset by better equipment. Other factors, such as changing productivities of workers and equipment and how well management recognized and dealt with the problem of efficiency in the woods, affected the end result. To reverse the productivity trend is therefore not a simple job or one the industry can expect to accomplish overnight, but productivity increase seems to be the one way which the industry has for minimizing the squeeze between costs and prices.

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BRUSH

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The kind of spray used made little difference.

3. Seedlings were more susceptible to sprays in the spring when the soil was moist than later in summer. Also, sprays were more effective on northerly exposures than on southerly ones, and more effective in sparse stands of grass where the soil moisture remained high than in dense stands where it was depleted.

4. Species were susceptible to sprays in the following descending order: yerba santa, chamise, manzanita, wavyleaf ceanothus, wedgeleaf ceanothus.

5. Although some very high kills of brush seedlings were obtained when hormone sprays were properly applied, some seedlings remained in every case. Also, when current seedlings were treated, new seedlings appeared the second year, thus tending to mask the effect of the sprays.

Results of the tests indicate that when sprays are used, the best kills can be obtained when applied to current year seedlings in the early spring after germination is complete and at the approximate rate of four pounds of acid per acre.

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RANGE

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developed that year. Beetle numbers in 1953 had declined temporarily from the 1950–51 high.

This area had a few spots infested with Medusa-head, an undesirable range grass. One line transect went through such a spot so that a progressive study could be made. In 1948 only a trace was recorded, but the next year this weedy grass made up 16% of the annual grasses. By 1953, this had increased to 24%.

The perennial grass found most frequently in plots was California oatgrass—probably the best native forage grass available for this section of the state—which had managed to withstand the Klamath weed competition. When the weed was controlled, oatgrass had an excellent opportunity to spread.

Purple stipa was the second most frequent perennial grass, followed in order by squirreltail and blue wild-rye.

At the second location, the study pastures are at an elevation of 2,000′ on a 5% slope to the north, and drain into Laribee Creek, a tributary of the Eel River. Past grazing use has principally been in spring and summer, tending to give a slightly better perennial grass stand initially than in the other study area.

These pastures were approximately 10 miles from an initial beetle-release area. The first indication of beetle feeding was in 1950. Since many colonies had been distributed by ranchers on various sections of the range, it is quite possible that the beetles may have come from areas other than the initial release point. Observations during 1953 were not possible.

Klamath weed made up 70% of the vegetation in the pre-beetle observation. This dropped to 15% the year after beetles were first observed. The annual grass and forb population was about equal the first year of observation. After Klamath weed was greatly reduced by beetle feeding, the anual grasses occupied a greater part of the vacated area.

Medusa-head did not appear in the count area until the 1950 readings, and then only in one line transect. On this line, it made up 60% of the annual grass cover, or 20% of the total forage cover. During 1951, the annual grass cover increased, but at this time the weedy grasses made up only 30% of the annual grass cover and only 20% of the total forage cover.

California oatgrass was the most abundant perennial both before and after Klamath weed control. After weed control, some Hall's bentgrass and blue

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