

THE SPRING DELL RANGE STUDY

Second Progress Report - 1953

A Cooperative Project:

California Division of Forestry

Agricultural Extension Service

Agricultural Experiment Station

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## THE SPRING DELL RANGE STUDY

### Second Progress Report—1953

The Spring Dell Range Study is a cooperative project of the California Division of Forestry, the California Agricultural Experiment Station, and the Agricultural Extension Service of the University of California, set up to study certain phases of clearing, utilization and management of chaparral-covered range lands of the foothill area in San Benito County, California.

The work accomplished on the Spring Dell Range Study from the time of its inception in 1949 through June 30, 1951, was summarized in "The Spring Dell Range Study, A Progress Report" issued early in 1952. At that time the objectives of the study, a description of the Study Area, and the plan of study were given in some detail. These points will be reviewed very briefly here; if further information is desired the earlier report should be consulted.

The Second Progress Report summarizes the work on this study from July 1, 1951, through June 30, 1953. During this period the project has been under the leadership of L. T. Burcham, Senior Forest Technician, J. P. Wade, State Forest Ranger, and T. W. Honeycutt, Associate State Forest Ranger, all of the California Division of Forestry, and E. C. Lydon, Farm Advisor, of the Agricultural Extension Service in San Benito County.

### THE SPRING DELL RANGE STUDY AREA

The Spring Dell Range Study Area, containing approximately 448 acres, is located in San Benito County, 32.7 miles south of Hollister, California. It is essentially a small watershed of moderately rolling to steep topography lying at elevations between 1925 feet and 2550 feet above sea level. (Note: The first progress report was in error in stating elevations were between 500 feet and 1100 feet above sea level.) The climate is of the Mediterranean type, marked by cool, moist winters and long, hot, rainless summers. Precipitation, air temperatures, and relative humidity have been measured by recording instruments since December, 1948. Records from July 1, 1949, through June 30, 1953, are summarized in Tables 1 and 2:

Table 1. Monthly Precipitation, Spring Dell Range Study Area: July, 1949 - June, 1953

Month	Precipitation							
	1949-50		1950-51		1951-52		1952-53	
	Inches	Per cent	Inches	Per cent	Inches	Per cent	Inches	Per cent
July	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	.15	1.1
October	.12	1.0	1.35	9.3	1.0	4.4	0	0
November	1.07	9.2	2.75	19.0	1.95	8.6	1.80	13.3
December	1.43	12.2	5.0	34.6	6.75	29.9	5.50	40.6
January	4.70	40.2	2.75	19.0	5.70	25.4	2.50	18.4
February	.84	7.2	1.25	8.7	1.20	5.3	0	0
March	2.38	20.2	.50	3.5	5.05	22.4	1.05	7.7
April	.91	7.8	.85	5.9	.90	4.0	1.35	10.0
May	.25	2.2	0	0	0	0	1.20	8.9
June	0	0	0	0	0	0	0	0
Totals	11.70	100.0	14.45	100.0	22.55	100.0	13.55	100.0

Table 2. Monthly mean temperature and relative humidity, Spring Dell Range Study Area, July, 1949-June, 1953

Month	Mean Temperature (degrees F.)				Mean Relative Humidity (per cent)			
	1949-50	1950-51	1951-52	1952-53	1949-50	1950-51	1951-52	1952-53
	July	69.6	71.2	67.6	73.5	44.0	44.3	42.7
August	65.1	70.2	68.8	71.4	57.6	49.5	42.8	54.4
September	67.1	64.4	68.5	70.6	52.1	51.3	43.6	52.3
October	58.5	64.0	57.7	60.8	52.3	55.8	48.7	63.4
November	58.9	54.2	51.6	49.6	52.4	65.3	58.5	61.5
December	42.1	47.4	42.3	46.3	63.6	67.4	67.3	77.8
January	35.9	43.3	39.5	50.7	69.2	68.1	69.0	77.6
February	46.9	43.3	47.0	48.0	63.8	66.7	69.5	59.8
March	47.2	45.8	44.5	49.6	64.3	60.2	75.0	67.9
April	52.6	50.6	52.1	50.2	62.8	64.1	72.3	71.0
May	56.4	56.1	59.5	50.9	58.0	58.9	61.5	69.3
June	58.6	61.5	58.4	58.2	55.8	53.9	66.5	51.4

The seasonal precipitation at Spring Dell is compared with that of the Weather Bureau station at Hollister, California, in Table 3. The mean rainfall of 15.56 inches at Spring Dell during the past four years loses much of its significance in view of the range from 11.70 inches to 22.55 inches.

Table 3. Seasonal Precipitation at Spring Dell and at Hollister, California, 1949-1953.

Season	Seasonal Precipitation at	
	Spring Dell	Hollister
1949-50	11.70 ins.	11.69 ins.
1950-51	14.45 "	14.46 "
1951-52	22.55 "	16.88 "
1952-53	13.55 "	9.93 "
Mean	15.56 ins.	13.24 ins.

The soils of the Spring Dell Area are shallow to moderately deep sandy loams of the Vista series, developed from granitic rocks. For the most part the dominant plant cover is a variety of species typical of the chaparral and woodland associations of the California foothills. For the purposes of this study five vegetation types have been recognized. Chamise is the most extensive type, occupying approximately 194 acres, or 43.3 per cent, of the study area. Woodland chaparral covers some 101 acres, or 22.5 per cent, of the area. About 75 acres, or 16.8 per cent, of the Spring Dell Area is dominated by chamise-ceanothus. Woodland-grass occupies nearly 64 acres, or some 14 per cent, of the Study Area, while the 14 acres of annual grass accounts for only 3.2 per cent of the total acreage.

#### TREATMENT OF THE STUDY AREA PRIOR TO JUNE, 1951

The Spring Dell Area was divided into five plots, four of which have been subjected to various methods of treatment, while the fifth remained undisturbed as a control area.

The vegetation and soils were mapped prior to any treatment, weather instruments were installed, and arrangements made to have soil moisture sampling done by representatives of the Agricultural Experiment Station.

The brush on Plots A, B, and C was burned in August, 1949, without preparation other than construction of firebreaks. During October, 1948 the brush on Plot D was crushed, using a bulldozer with the blade raised slightly above the ground surface. This crushed brush was burned at the same time as the other three plots.

Plot A was allowed to revegetate to resident plants, without artificial seeding. Plot B was reseeded to a range forage mixture at the rate of 5.7 pounds per acre; Plots C and D were reseeded at the rate of 11 pounds and 10.2 pounds per acre, respectively.

The seeded forage plants showed very good germination, but extremely cold weather for this area during the first week of January, 1950, caused severe frost heaving, resulting in death of most of the seedlings. Growth conditions were more favorable during the winter and spring of 1951-52, and a number of the seeded species made reasonably good growth; resident annuals, especially filaree and red brome, made excellent growth.

Sprouting species of brush made a vigorous regrowth of Plots A, B, and C during the 1950 season and there was a considerable number of seedlings as well. On Plot D seedlings were virtually absent, and sprouting much less vigorous.

Livestock were grazed on the Spring Dell Area for the first time beginning in June, 1951, with plans to run them for about three months.

The preliminary results of the first two years of the Spring Dell Range Study indicated the combination of mechanical means and fire was more effective than fire alone in removing the brush cover; success of reseeded is dependent on climatic conditions, especially during the winter following seeding; and while a few species showed some promise for reseeded purposes they need further study before they can be recommended for areas having climate and soils similar to the Spring Dell Range Study Area.

## SUMMARY OF PROGRESS, 1951-1953

During the past two years the principal activities in the Spring Dell study have been the development of water supply and facilities for controlling the livestock, initiation of fertilizer trials, and follow-up treatment to control the brush cover. The activities are reviewed briefly in the following paragraphs.

### Development and Improvements

All fences were rebuilt and strengthened early in 1953, in order to obtain satisfactory control of grazing animals. A scale of 10,000 pounds capacity was installed, with a small corral on each side for holding cattle during the weighing process. At the same time a road was rebuilt by bulldozer to permit vehicles to gain access to the south end of the study area. A 2,500 gallon redwood tank was installed to supply water to Plots A, B, and D, with pipe and hose lines to carry the water to a trough in each of these plots; the spring in Plot C furnished water to a trough in that plot.

All of Plots A and B, Plot C except the six acres treated with chemicals, and that part of Plot D on the north side of Gloria Road were reburned in September, 1952, for the purpose of controlling seedlings and sprouts and removing portions of the brush cover which had been left during the first burning. Cattle had been excluded during all the grazing season prior to the reburn, to allow the grass to remain as fuel for the burn. Results of this operation varied from fair to poor on different parts of the area.

The labor for these improvements was furnished by CDC Honor Camp No. 4, at Slack Canyon; supervision was by personnel of the Division of Forestry in San Benito County, and the District Range Improvement Technician.

### Fertilization Trials

Six one-third acre plots were laid out on October 24, 1952, on the north side of the county road, and treated with fertilizers as follows:

#### Plot D

Area 1a - Sulfate of ammonia at the rate of 56 pounds of available nitrogen per acre.

Area 2a - Ammonium phosphate (16-20) at the rate of 56 pounds of available nitrogen and 70 pounds of phosphorous per acre.

Area 3a - Treble superphosphate at the rate of 70 pounds of phosphate per acre.

Soil tests by the Extension Service indicated a possible phosphate deficiency prior to treatment on all three of these areas.

Plot C

Area 1b - Sulfate of ammonia at the rate of 28 pounds of available nitrogen per acre (one-half the rate of 1a).

Area 2b - Ammonium Phosphate (16-20) at the rate of 28 pounds of available nitrogen and 35 pounds of phosphorous per acre (one-half the rate of 2a).

Area 3b - Treble superphosphate at the rate of 35 pounds of phosphorous per acre (one-half the rate of 3a).

Soil tests by the Extension Service indicated no phosphorous deficiency prior to treatment on these areas.

Chemical Treatment of Brush

A portion of Plot D was treated with chemicals for control of seedlings and sprouts of chamise and seedlings of wooly yerba santa on April 28, 1952, in accordance with the original plan of the study which called for attempting to control the brush cover of this plot without use of fire subsequent to the first burning in 1949. A total of 41.26 acres was treated with an ester form of 2,4-D at the rate of two pounds per acre, applied in  $4\frac{1}{2}$  gallons of Diesel fuel.\* Application was by helicopter.

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\*This formulation was recommended by Dr. O. C. Leonard, Department of Botany, University of California at Davis.

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An attempt was made to apply the 2,4-D in Shell Helix 22 and in Helix 15, but the temperature of 36° F. was too low for successful spraying of oils of this viscosity.

At the same time the mature chamise on an area of approximately six acres in Plot C, on the alluvial flat south of Gloria Road, was treated in the same manner as Plot D.



### Reseeding

Following the reburning in 1952, Plots B and C, and 25 acres of Plot D north of Gloria Road, were reseeded to the species and at the rates shown in Table 4. Plot A was not reseeded, as it was planned that it should revegetate naturally to resident plants.

Table 4. Kinds of Seed and Rates of Seeding Spring Dell Range Study Area, 1952

Kind of Seed	Pounds of Seed per Acre			Total Seed (lbs)
	Plot B	Plot C	Plot D	
<u>Grasses:</u>				
Harding Grass	1.0	3.0	3.0	433
Orchard grass		.5	.5	58
Ryegrass, annual	.5			44
Ryegrass, perennial	.5	1.0	1.0	159
Smilo		1.0	1.0	115
Tall fescue		.5	.5	58
<u>Legumes:</u>				
Alfalfa	1.0	2.0	2.0	318
Clover, bur	1.0	1.0	1.0	203
Clover, rose	1.0	1.0	1.0	203
<b>Totals</b>	<b>5.0</b>	<b>10.0</b>	<b>10.0</b>	<b>1,591</b>

This seeding was essentially the same as that following the original burn in 1949, except that burnet was eliminated from Plot B and rose clover was added to all three plots. Part of the seeding was done on September 25, 1952, and it was completed on October 15, 1952.

### Rodent Control

During the period following the initial treatment and seeding, especially in 1951 and 1952, a considerable population of rodents developed on some portions of the Study Area. These were chiefly meadow mice (Microtus californicus) and kangaroo rats (Dipodomys heermanni) and for the most part were localized in the area immediately south of the Gloria Road.

The reburning, on September 21, 1952, reduced the small rodent population by about one-half, either through direct effect or by reduction of available food. Following the reseeding it became evident that additional measures must be taken to control the rodents.

In accordance with recommendations of the California Department of Agriculture, 155 pounds of crushed oats treated with Compound 1080 (sodium fluoro-acetate) were distributed on the Study Area on November 7, 1952. This work was done under supervision of representatives of the California Department of Agriculture.

### Grazing

Approximately 100 head of cattle were allowed access to the entire Spring Dell Area from June 12, 1951, to September 1, 1951. Details of weight and use were not obtained because the principal purpose of the grazing was to trample seeds present into the soil to produce fuel for the reburning.

On April 20, 1953, fifty-two yearling steers averaging 497 pounds each were weighed into the Spring Dell Study Area. These steers were corralled at 7:00 a.m., prior to feeding and watering, and trucked ten miles to the study area. Before being divided equally among Plots A, B, C and D, the steers were sprayed with a mixture of DDT and Methoxychlor for fly control. Three marked steers were weighed individually and placed in each plot; the remaining ten placed in each plot were weighed as a group. On May 22, 1953, the 13 steers in Plot D were weighed out at 11:00 a.m. and placed in Plot C. On June 3, 1953, all steers were weighed out of the plots, following the same procedure with respect to marked steers and groups as when they were placed in the plots. A shrinkage of 3 per cent was applied to the "out" weights in order to make the "in" and "out" weighing conditions comparable.

### SOIL MOISTURE STUDIES

As was indicated on page 3, a program of soil moisture sampling by representatives of the Agricultural Experiment Station was initiated at the outset of this study. This work was done under direction of Professor F. J. Veihmeyer, of that Station, and the following summary of that work was prepared by Professor Veihmeyer for inclusion in this progress report.

### Soil Moisture

Sampling was done on Plots C, D and E. Plots C and D (chamise cover) were burned in August, 1949. Plot D had been pushed down by a bulldozer in 1948 and burned in 1949. Plot E, the control plot, was left in cover of oak, wild cherry and some chamise of very dense growth.

The soil is granitic and varies from fine sandy loam at surface to coarse decomposed granitic at the 3 and 4 foot levels. The Division of Soils of the University of California has listed it as belonging to the Vista Series.

Soil moisture sampling was started in October, 1949. The samples were taken about once a month for three years terminating in October, 1952. They were taken every foot to a depth of 4 feet. The average of four holes was taken for each plot.

Table 5. Per cent moisture in soil of three plots, Spring Dell Range Study Area, 1949-1952

	Plot C	Plot D	Plot E	Rainfall, in.
October, 1949	3.3	4.5	2.7	
October, 1950	3.7	3.4	2.4	10.62
October, 1951	2.7	2.5	2.5	14.62
October, 1952	4.6	7.7	2.6	23.95

The chamise on Plots C and D produced sprouts and seedlings in the spring of 1950 and continued to grow until April, 1952. At this time Plot D and a portion of Plot C were sprayed with 2, 4-D. The transpiration demands were sufficient to take most of the available water. Therefore, there was very little difference between residual moisture at the end of the growing season in any of the plots. However, there was more water in D plot (partially denuded) than in E plot (covered). When Plots C and D were sprayed in April, 1952, with the result given on page 11, there was an appreciable difference in the moisture content between C, E and D. For example, in October, 1952, there were 3.9 inches more water in Plot D than in Plot E.

### Rainfall

A standard rain gauge and two trough gauges were placed in an open area on Plot E. The trough gauges were placed in dense growth of old chamise.

Table 6. Rainfall and interception on Plot E, Spring Dell Range Study Area

	Standard Gauge	Trough Gauge Av.	Interception*
1949-50	10.62	5.79	50%
1950-51	14.62	7.18	49%
1951-52	23.95	10.80	45%

\*Per cent difference between the catch in standard gauges in the open and in trough gauges under the brush.

#### Spring Dell Spring

The spring was developed in 1948 with a redwood box with outlet to a one inch pipe and a meter at the end of the pipe. The box had some water in it at all times but did not come up to the pipe outlet.

In December, 1950, the brush was cut from around the spring for a radius of about 50 feet and the outlet lowered about 6 inches. The water level rose in the spring to the outlet but not enough to operate the meter. In April of 1951 the brush and trees were cut around the spring in a radius of about 100 feet. Some of the larger oak trees were sprayed with 245-T and water, which seemed to have no effect on the trees at this date. This increased the flow in the spring, but it still could not be measured by the meter.

In February of 1952 there was a flow of water from the spring. There was sufficient debris washed down into the gully below the spring to fill the box and pipe. The flow increased in the spring of 1952 and was measured on July 12, 1952, at 12 cubic feet per minute. The meter was removed in the summer of 1952 and not replaced.

This trough supplied water for 13 steers, averaging less than 600 pounds each, between April 20 and May 21, 1953, and for 26 steers, of the same average weight, from May 22, through June 3, 1953, a total of 728 days of use by these steers.

## PRELIMINARY RESULTS, 1951 - 1953

### Fertilization Trials

Visual observations indicated a slight response on area 2a (treated with ammonium phosphate) which was evident in terms of increased height growth, greater density, and better color which indicated more vigorous growth. On this basis the response on 1a (treated with sulphate of ammonia) and on 3a (treated with treble superphosphate) was approximately 1/2 and 1/10th respectively of that on area 2a.

On a similar basis there was no response on areas 1b, 2b, and 3b.

### Chemical Treatment of Brush

Observations made thirteen months after treatment indicated that on Plot D approximately 25% of the chamise seedlings and sprouts had been killed, and approximately 50% of the wooly yerba santa seedlings had been killed. On Plot C the leaves of the mature chamise were burned by the chemical but there was no appreciable kill. Dr. O. C. Leonard participated in checking these results.

### Rodent Control

There was a marked reduction in the population of meadow mice and kangaroo rats following treatment of the area with Compound 1080. Although accurate estimates of the results were not made, meadow mice were found dead almost immediately after treatment was completed. However, such control as was effected was not sustained because losses of forage due to rodents were obvious during the 1953 grazing season.

### Reseeding and Forage Production

Favorable early fall rains were followed by about one-half of normal rainfall during January, 1953, while the month of February was rainless. Early germination of the seeded plants appeared to be good, but most of the plants died during the winter drought, so the final result of the seeding was poor.

During the 1953 grazing season, livestock were grazed on the Spring Dell Range Study Area during the period April 20th to June 3rd, as discussed in the preceding section. The meat production and grazing use on the various plots are summarized in Table 7. The wide variation between columns 2 and 3 of this Table,

Table 7. Weight gains, meat production and Grazing Use. Spring Dell Range Study Area, 1953

Plot	Area (Acres)	Average Total Weight Gains: Individual Steers (Pounds)	Average Total Weight Gains: All Steers (pounds)	Meat Production (Pounds per Acre)	Actual Grazing Use. (Acres per AUM).
A	60.96	63.66	96.69	20.62	4.99
B	55.18	86.00	97.38	22.94	4.91
C	59.60	78.33	107.30	23.57	4.17
D	41.26	73.00	124.61	39.26	4.95

especially for Plots C and D, suggests the possibility of some error. Repetition of the grazing trials over a period of years will be necessary to indicate the source of error and show how it can be eliminated.

In addition to the livestock use, forage production of Spring Dell during 1952 and 1953 was determined by clipping sample plots and weighing the forage produced on them. This forage production is summarized in Table 8.

Table 8. Forage Production, Spring Dell Range Study Area, 1952-53

Plot	Air dry weight of forage (pounds per acre)	
	1952	1953
A	793	378
B	923	340
C	1,106	1,210
D	1,586	605

The low value for Plot D in 1953 is due partly to destruction of forage on the sample plot by rabbits and other rodents, and partly to the clipping being postponed until very late in the season.

#### PROBLEM IN BRUSH CONTROL DUE TO PLANT SUCCESSION

A result of the operations on Spring Dell which was not anticipated in planning the study originally has been the problem of brush control arising from natural succession on the treated area, primarily on Plot D.

Woolly yerba santa (Eriodictyon tomentosum) was represented in the plant cover of this area by only a few scattered specimens when the study was initiated. After Plot D had been cleared and seeded to range forage species in 1949, a few seedlings of this shrub began to appear, mostly on south-facing slopes. By the spring of 1952 this species had increased in both numbers and size to a point where it presented as important a brush control problem as did the sprouts and seedlings of chamise on the same area.

Apparently these plants were derived from two sources: (1) seed stored in the duff on the area; and (2) seed from the scattered plants resident on the area. Woolly yerba santa is one of a number of species of chaparral which often are sparingly represented in brush stands that have not been disturbed for a considerable period. Clearing of the dominant brush species favors the increase of such minor resident species to near-dominance, so that the secondary species then must be dealt with as a distinct problem in brush control. In various parts of the State, bush monkey-flower (Diplacus aurantiacus), poison oak (Rhus diversiloba) and thimble-berry (Rubus parviflorus) also have been observed to react in this same manner. This is the first time that such a problem has been encountered in a field study.

Steps were taken to include treatment of the woolly yerba santa in the chemical control measures, with the results indicated on page 11.

#### IN CONCLUSION

Such results as have been obtained in the Spring Dell Range Study to date have not been clear cut and definite. This is due in part to the nature of the problem under study, in part to variations in natural conditions obtaining here, and in part to the relatively short period of time covered by the study. Much of the work done has been preliminary in character. It appears that a sound foundation has been laid and there is ample justification for continuing the study for another five year period.