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RESIDUE MAPPING AND PASTURE USE RECORDS FOR MONITORING CALIFORNIA ANNUAL RANGELANDS

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low end range of rainfall for the foothill Riparian Habitat

Site Description

The San Joaquin Experimental Range is located near the center of the state in the heart of the granite soil section of the Sierra Nevada foothills in Madera County adjacent to the Sierra National Forest 28 miles north of Fresno. It supports annual plant/oak woodland type of vegetation and is characterized by grassy, rolling hills with a scattering of trees and occasional dense stands of brush. It is in the lower part of the woodland zone between the treeless valley floor and the higher brush and timber belts. Seeds of most herbaceous plant species germinate with the first 0.5 to 1.0 inches of fall rain. The plants grow slowly during the winter and then rapidly when warm temperatures return in March. A majority of the herbaceous species reach maturity in April and are mostly dry by mid-May. The climate is Mediterranean, characterized by mild, rainy winters and hot, dry summers. Snow is rare and usually short-lived at the Range. Seasonal precipitation generally begins in October. Annual precipitation averages 19 inches, with extremes of 9 and 37 inches. The annual mean maximum temperature is 73°F, and the annual mean minimum temperature, 44°F. Table 1 shows germination date, total rainfall, and forage production.

Elevations range between 700 and 1,700 feet; most of the area lies between 1,000 and 1,500 feet. Exposures in general are southwesterly. The drainage basin empties into a small tributary of the San Joaquin River. Numerous springs occur, but no permanent streams flow through the experimental area although many small drainage lines carry surface flows during the rainy winter months.

The soils on the Range's slopes are shallow, residual, and granitic, generally classed in the Ahwahnee series (Mollic Haploxeralf). The soils in the swales are deeper and of alluvial origin--the Visalia series (Pachic Haploxeroll). Both slope and swale soils have a low water-holding capacity.

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Methods

During the dry forage period, usually July through early October, livestock use of the pastures was expressed by mapping residual dry matter (RDM) classes of high, moderate, and low (Table III, Figures 1 and 2). The method for determining RDM consisted of both visual and weight determination. The field visual estimation of weight in pounds per acre was calibrated by estimating, clipping, and weighing a few plots. The three photos and written descriptions of high, moderate, and low RDM, shown in U.C. Cooperative Extension Leaflet 21327 (McDougald, Clawson and Duncan, 1982), were used to provide a consistent reference while delineating color coding the classes on a topographic map (Table IV). The acreages by classes were measured, then expressed as percentages to assist in describing the maps' visual representation of livestock use.

A system of site classification has been developed for rangelands typified by the San Joaquin Experimental Range (Bently and Talbot, 1951; Wagnon, 1968). For the purpose of monitoring RDM and other management activities, these sites can be described by the following slope categories (Table II).

Swale	-	<10% slope, usually a depressed area
Open Rolling	-	10-25% slope <50% canopy cover
Upper/Steep Rocky, Brushy	-	>25% slope

Four pastures were grazed similarly in each of the three years at a stocking rate of 15 acres per animal unit on a yearlong basis. A record of the livestock grazing was kept using the UC Pasture Inventory (George, Bell and Lasarow, 1987). This computer program can be used to monitor seasonal and animal performance of pastures and animal groups. Reports from the program compare pastures within years, monitor long-term trends in pasture productivity and use, and monitor performance by animal groups. The animal use data (AUMs per pasture per year) was derived from these reports.

Results

The three-year averages of percentages of area with low, moderate, and high levels of residue were similar to the percentage of area which was swale, open rolling slopes, and upper steep slopes (Tables II and III). At the end of the dry forage period, generally October, swales and low slopes were left with low to moderate amounts of RDM, upper or steep slopes with high RDM, and the gentle open rolling slopes ranged from low to high RDM. Areas surrounding supplemental feeding locations were left with low to moderate residue amounts, as were watering and salting locations. Variations occurred in the percentages within RDM classes between years, but this in the general pattern that occurred over the duration of the trial.

The amount of area within the RDM classes was not related to the total forage production in a specific year. For example, in 1983-84 the average forage production on the San Joaquin Experimental Range was 1824 lbs./acre. At this production level 16% of Pasture I had low levels of RDM and 41% had a moderate amount, while in Pasture II 20% of the area had low and 6% had moderate amounts of RDM. In 1984-85 the average production was 1690

lbs./acre and the percentages of areas with low, moderate, and high RDM were 1%, 12%, and 87% in Pasture I and 2%, 5%, and 93% in Pasture II. This was similar to the results from 1982-83 when the average production was highest, 3630 lbs./acre. This change in residue distribution was not due to differences in the actual use of the pastures or supplemental feeding practices which were similar across the three years. Contributing to the lower residue levels in 1983-84 was the occurrence of very high grasshopper populations.

Mapping of residue throughout the dry forage period revealed the same pattern of use in all years (Figures 1 and 2). Cattle preferred the swales and low flat slopes, reducing residue to moderate or low levels before residue levels were lowered below the high RDM class on the gentle open rolling slopes. In turn, the residue levels on the rolling slopes were reduced to at least the moderate level before use was detected on the upper steep slopes.

Importance of Residual Dry Matter

Residual dry matter is the dry plant material left on the ground from the previous year's growth. Residual dry matter provides favorable microenvironments for early seedling growth, soil protection, adequate soil organic matter maintenance, and a source of low-moisture fall forage for livestock feed.

Mapping RDM periodically throughout the dry forage period provides a valuable tool for both livestock and rangeland management. The RDM maps provide a means for assessing the total herbage pool remaining on a pasture, ranch, or allotment, as well as its distribution. This information can be utilized to make management decisions, such as movement of livestock between pastures and the location of supplemental feeding sites and water developments to best utilize the remaining forage. Long-term RDM mapping in conjunction with actual use records, such as those produced by the Pasture Inventory Program (see Figure 3), provide accurate estimates of the livestock carrying capacity of a given land unit.

Table I. Total forage production and precipitation at the San Joaquin Experimental Range 1982-85.

Year	Production (lbs/acre)	Date of Germinating Rain[1]	Total Precip. (in.)
1982-83	3,630	Sept. 26	37.4
1983-84	1,824	Oct. 1	16.3
1984-85	1,690	Oct. 17	13.6
50 year average	2,405	Oct. 27	19.3

[1]The date when 1/2" precipitation falls within a seven day period.

TABLE II. Percentage of area within site classes.

Pasture	Acres	Percent		
		Swale	Open Rolling	Upper Steep Slopes
I	467	6	21	73
II	457	4	10	86
IV	446	3	5	92
VIII	457	7	6	87

TABLE III. Prior AUM use and percentage of area within residue classes.

Year	Pasture	Actual Use (AUM's)	Percent Low	Moderate	High
1982-83	I	467	1	5	94
	II	407	1	6	93
	IV	496	0	8	92
	VIII	469	2	6	92
1983-84	I	415	16	41	43
	II	418	20	6	74
	IV	411	15	30	65
	VIII	627	14	25	61
1984-85	I	465	1	12	87
	II	443	2	5	93
	IV	496	2	6	92
	VIII	469	4	9	87
3 Yr. Avg.	I	449	6	19	75
	II	423	7	6	87
	IV	468	6	15	79
	VIII	522	7	13	80

Table IV. San Joaquin Experimental Range residual dry matter (RDM) standards.

Site	Residual Dry Matter (lbs/acre) Low	Moderate	High
Low flat slopes and swales	<400	400 - 800	> 800
Gentle rolling slopes	<600	600 - 1000	>1000
Upper or steep slopes	<800	800 - 1200	>1200

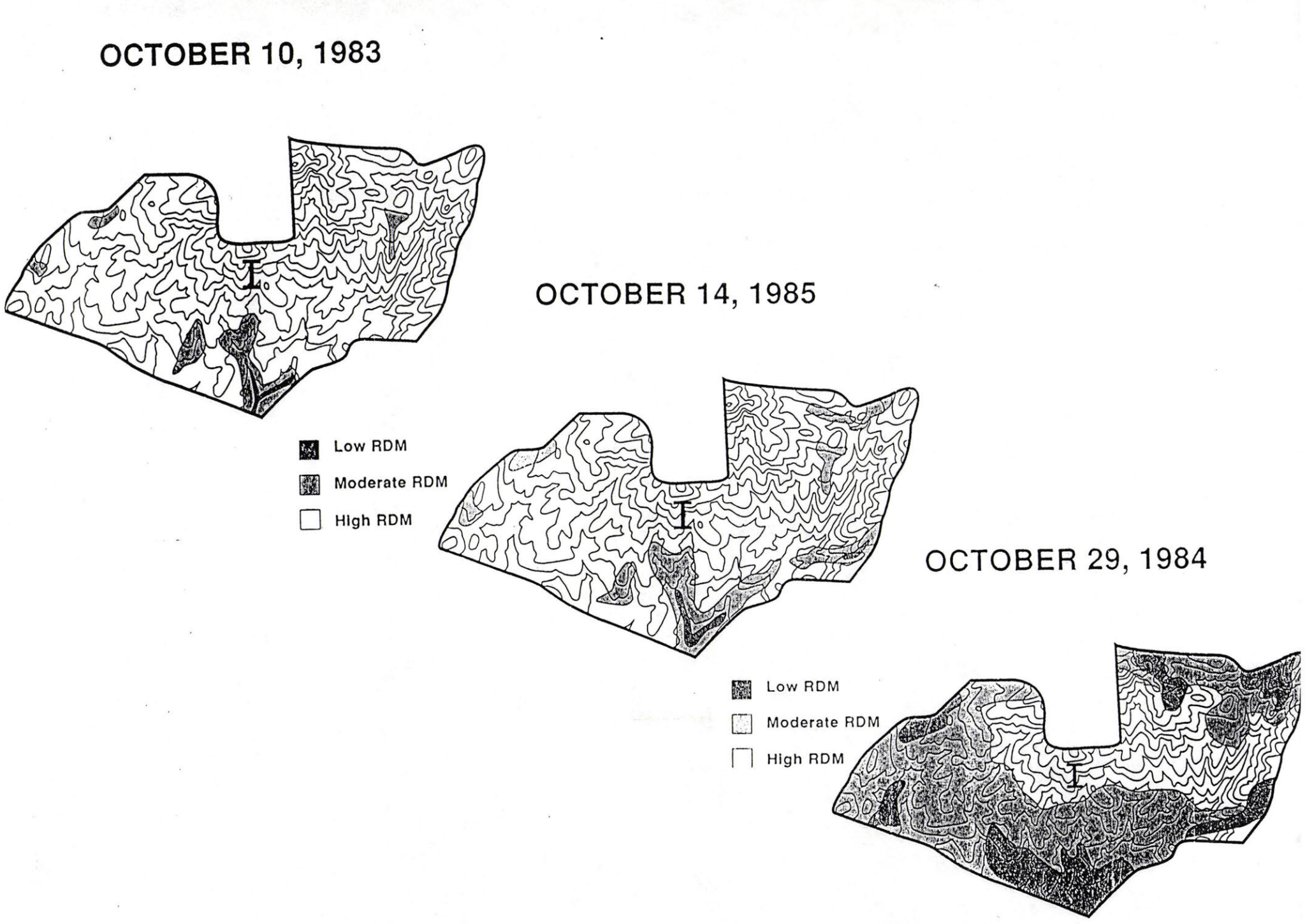
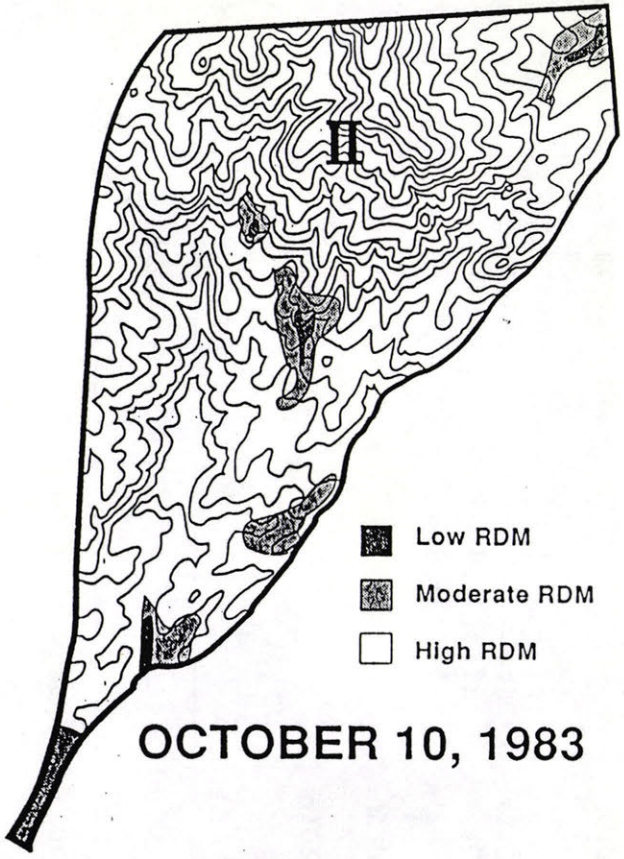
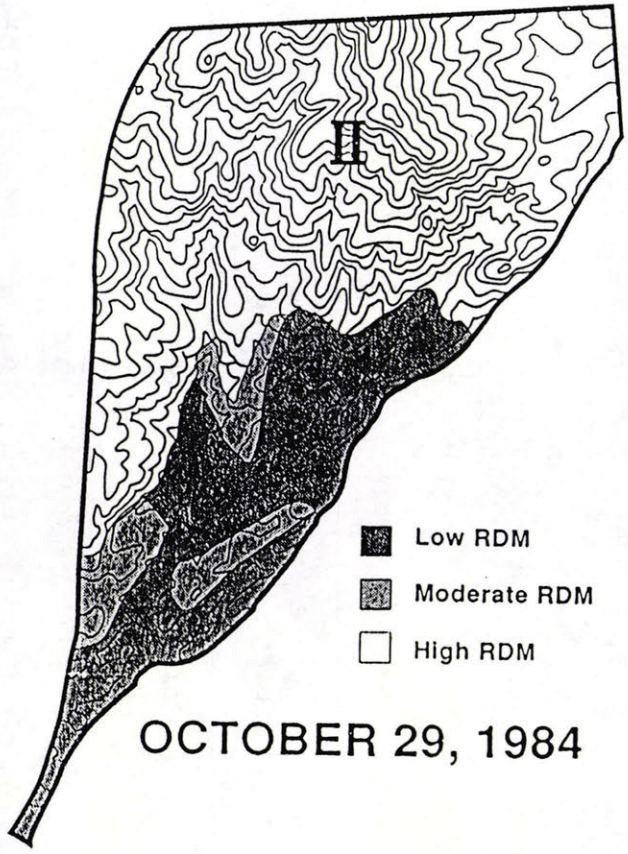


Figure 1. RDM levels for Pasture I





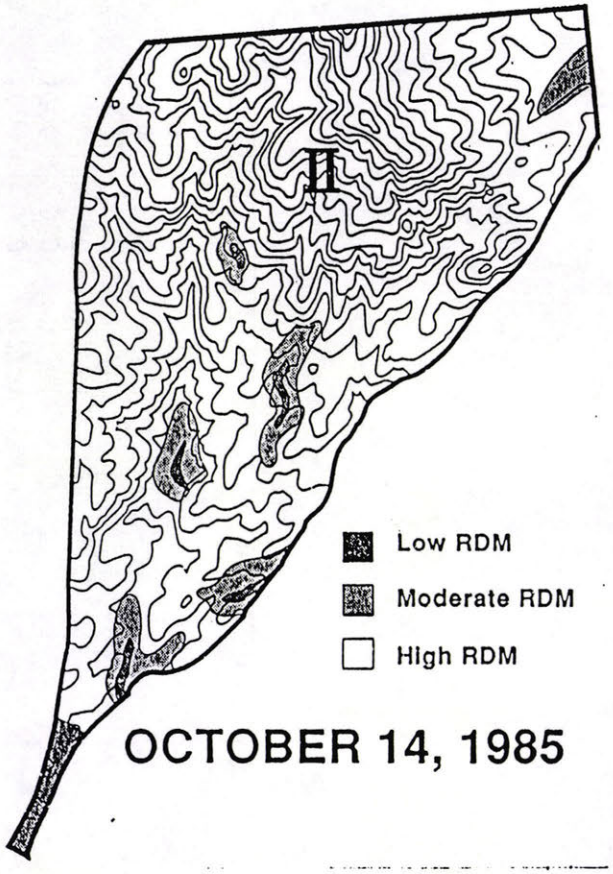


Figure 2. RDM levels for Pasture II

Figure 3
Report 2--Carrying Capacity of Pasture 2

Head/Kind	Comment	Days	Head Days	AUM	AUM/ Acre	Residue	Sup. AUM
PASTURE: SJER2 is 457 acres							
78 Cows		9	702	23	0.05	1000	0.00
13 Cows		40	520	17	0.03	400	0.00
13 Calves		40	520	2	0.00	400	0.00
40 Calves		41	1640	9	0.02	200	0.00
2 Bulls		190	380	14	0.03	1800	0.00
30 Calves	Weaned	138	4140	47	0.10	0	0.00
30 Cows		149	4470	146	0.32	1800	0.00
2 Cows		14	28	1	0.00	1800	0.00
1 Bull		14	14	0	0.00	1800	0.00
32 Cows		14	448	14	0.03	1800	0.00
30 Cows-L		48	1440	45	0.10	1400	0.00
30 Cows-H	Adjusted	29	870	29	0.06	500	0.00
9 Calves-H		13	116	0	0.00	1000	0.00
TOTALS			16929	408	0.89		0.00

Report 4--Animal Gains on Pasture 2

Head/Kind	Comment	Avg. Wt. In	Avg. Wt. Out	Avg. Dly. Gn.	Date In	Date Out	Days	Head Days
PASTURE: SJER2 is 457 acres								
78 Cows		1000	1000	0.0	10/01	10/10	9	702
13 Cows		1000	1000	0.0	11/10	12/20	40	520
13 Calves		130	160	0.7	11/10	12/20	40	520
40 Calves		160	210	1.2	12/23	02/02	41	1640
40 Cow s		1000	1000	0.0	12/23	02/02	41	1640
2 Bulls		1200	1200	0.0	12/23	07/01	190	380
30 Calves	Weaned	210	495	2.0	02/02	06/20	138	4140
30 Cows		1000	1000	0.0	02/02	07/01	149	4470
2 Cows		1000	1000	0.0	07/01	07/15	14	28
1 Bull		1200	1200	0.0	07/01	07/15	14	14
32 Cows		1000	1000	0.0	07/01	07/15	14	448
30 Cows-L		967	967	0.0	07/15	09/01	48	1440
30 Cows-H	Adjusted	1031	1031	0.0	09/01	11/15	29	870
9 Calves-H		87	87	0.0	09/17	10/23	13	117
			Avg.	0.6				Tot. 16901

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