Technical Report No. 42

COMPREHENSIVE NETWORK SITE DESCRIPTION

HOPLAND

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GRASSLANDS BIOME

U. S. International Biological Program

I. *Site name:* Hopland.

The study site is located on the Hopland Field Station, a unit of the California Agricultural Experiment Station. The station is owned by the University of California and is operated by the experiment station for range research. Since establishment in 1951, approximately 15 university departments have made use of the facilities, which are available for cooperative work with anyone.

II. *Location and elevation.*

The field station is in the Russian River drainage some three miles east of Hopland, California, which is on U. S. Highway 101 about 100 miles (160 km) north of San Francisco. Elevation extends from 500 to 3,000 ft (150-900 m).

III. *Size.*

The station is approximately 4,750 acres in size and roughly rectangular in shape. It has been grazed by sheep for many decades, although some 400 acres have been livestock-free for more than ten years. A wide variety of livestock grazing trials and rangeland manipulations (brush control, seeding, fertilization, etc.) have been applied in various pastures. The nature of immediate results has been recorded for most practices.

IV. *Type of grassland.*

The California Annual Grassland and the original perennial grassland have been named variously. They are the Pacific Prairie of Weaver and Clements (1938), who classified the vegetation as a dis-climax of annuals dominated by species of *Avena*, *Bromus*, *Hordeum*, and *Festuca*. According to Weaver and Clements (1938), *Stipa pulchra*

was by far the most important perennial grass in the pristine grassland. In 1957, Burcham described these grasslands as the California Prairie of which the Central Valley and southern portions were originally dominated by several species of *Stipa*, and discontinuous grasslands along the northern California coast were characterized principally by *Danthonia californica*, *Deschampsia caespitosa*, and two perennial fescues (*Festuca occidentalis* and *F. idahoensis*). Kuchler (1964) mapped the first of Burcham's categories as the California Steppe which was dominated by *Stipa pulchra* and *S. cernua* and the second as fescue-oatgrass. Munz and Keck (1963) named these types Valley Grassland and Coastal Prairie.

Burcham (1957) traces the introduction of mostly Mediterranean annual species into California and their replacement of the perennials on a historical basis. Intensive studies at two locations found the grassland to be over 90% annual species on a herbage cover basis of which 60% to 85% was introduced species (Talbot *et al.*, 1939; Heady, 1958). However, the degree of replacement is not uniform, as perennials dominate along the northern California coast, in scattered amounts further inland, and still occur in the driest parts of the type. Over most of the grassland, there is little doubt that the introduced annuals have become naturalized and are here to stay. For that reason the name, California Annual Grassland, will be used. The word "California" is appropriately a part of the title as the type is almost restricted to the state, although many of the species are more widely distributed, and no other North American annual grass type is like it.

Nearly 500 species of plants have been collected on the Hopland Field Station and are available in its museum. The richness of the flora is certainly related to the wide variety of habitat conditions, but 50 or more species often occur within an area of 100 ft on a side.

Seven major vegetational types were mapped, as shown below. The first four were divided into 23 subtypes.

Vegetational Type	Acres	Percent of Station
Grass	1,081	22.8
Woodland-grass	1,708	36.0
Dense woodland	1,034	21.8
Chaparral	710	14.9
Wet meadow	20	0.4
Rocks and gravel	11	0.2
Cultivated	186	3.9
	4,750	100.0

The grass type often has a few scattered trees and shrubs, and grades into the woodland-grass type. The latter is characterized by an overstory of blue oak (*Quercus douglasii*), valley oak (*Q. lobata*), and other trees, and a grass understory that is similar to the grass type. The dense woodland type, primarily evergreen, has little grass under the trees because of the thick tree canopy. The principal species are liveoak (*Q. wislizenii*), bay (*Umbellularia californica*), madrone (*Arbutus menziesii*), and black oak (*Q. kelloggii*). The chaparral is mostly chamise (*Adenostoma*

fasciculatum), but manzanita (*Arctostaphylos* spp.), shrub oak (*Q. dumosa*), and other species are abundant in some areas.

The proportion of the different annual species varies to such an extent that some years are known as good clover (mainly *Trifolium* spp.) years, some as filaree (*Erodium botrys*) years, and some as grass years. The magnitude of these differences is shown by data from a series of plots sampled from 1953 to 1959. Grasses constituted 87% of the cover in 1958, but only 29% in 1955. Filaree varied between 6% and 35%, and legumes from 1% to 17%. Drought periods favor the filaree, and frequent rains favor the grasses.

The period of rapid plant growth in the spring (March 1 to late May at Hopland) is one of a progression of different species. Observations at Hopland indicate that desirable and undesirable species for livestock mature throughout the season. Legumes and undesirable weeds set seed early and at the same time. Soft chess (*Bromus mollis*) and ripgut (*Bromus rigidus*) mature near the end of the season, and slightly later than bur clover (*Medicago hispida*). Filaree and wildoat (*Avena barbata*) set seed all spring. The last plants to mature are mostly undesirable--medusahead (*Elymus caput medusae*), nit grass (*Gastridium ventricosum*), tarweed (*Madia* spp.), turkey mullein (*Eremocarpus setigerus*), prairie three-awn (*Aristida oligantha*). These relative times of flush growth and maturity for the many species are within a two-month period, except for the summer species. A certain amount of telescoping in response to

weather is evident in years with low spring precipitation. In 1956, all the species set seed and turned dry in a three-week period.

Weight of herbage production at the end of the growing season may differ between years by more than 100%. From 1954 through 1958, production varied from less than 1,000 lb. per acre to more than 2,000 lb. per acre in one set of plots near the site to be used in the IBP study.

Response of the annual vegetation to changing conditions of any kind is rapid. The major responses to litter manipulation were attained in a year or two, and maintained by continued treatment (Heady, 1956). Additional evidence of rapid change is available from a study of burning in the annual grass type. These changes in vegetation are temporary and soon disappear, once the burning or other treatment or grazing pressure is changed. For example, by a combination of mulch manipulation and seeding, four plots were obtained with percentages of soft chess between 25 and 44, filaree between 36 and 52, and bur clover between 2.5 and 16. These plots were left ungrazed and untreated. The next year, soft chess percentages were between 76 and 85, filaree between 2 and 7, and bur clover from 0 to 2.5.

Of particular interest in the biome study are two points, as they make California Annual Grassland vastly different from vegetation on the other network sites. The annual characteristic means a

new generation of plants each year; hence rapid species compositional response to weather and treatments. Second, the annual characteristic and rapid decomposition occurring for about six months each year leads to all plant materials becoming litter and all litter decomposing within a year. The problems of separating live from dead material and new crop from old do not exist during most dry seasons at the Hopland site.

Specimens of nearly all the vertebrates occurring on the station are in the headquarters museum. Entomologists have studied grasshoppers and biting insects (of mammals) in the area.

V. *Climate.*

The following analysis of weather on the Hopland Field Station for the years 1951-1960 (Heady, 1961*a*) adequately characterizes the general climate. Average seasonal precipitation on the station for 1951-1960 was 36.82 inches. The range was 24.84 to 60.43 inches, including two very high records, four very low ones, and three close to the average. The first fall rains fell between July 19 and October 18, and the last spring rains came between April 30 and June 29, with average dates of September 3 and June 4. The average length of the rainy period was 273 days with extremes of 236 and 307 days. If rains of over one inch are arbitrarily considered as effective for initiating plant growth in the fall and extending the growing period in the spring, the average effective season would be between October 23 and April 21. These two dates had ranges of eight weeks in the fall and ten weeks in the spring

during the nine years of record. The first effective rains came between September 18 and November 13, and the last between March 19 and May 26. Four first-effective rains and four last-effective spring rains differed from the average dates by more than 20 days. In six of the nine years, late- or early-effective spring rains followed late or early fall rains. Thus the effective rainy seasons tended to be about the same length, and near the mean of 180 days. In two of the three remaining years, an early ending followed a late beginning for effective seasons of 141 and 146 days, respectively. The other year had just the reverse situation, with 251 days. At least one and as many as three dry periods of longer than 20 days occurred during the effective rainy season in every year. There were 18 such periods in the nine years, averaging 44 days in length. The longest was 94 days in the fall of 1959. Ten of the 18 dry periods occurred during the flush growth period between late March and June 1.

Temperatures also are important in the regulation of forage growth. Late fall rains, even though they are sufficient for plant growth, do not ensure adequate growth of forage because low temperatues may prevent it. The first temperatures below 32°F occurred between October 6 and November 18, and the last frosts were between March 23 and May 22. The average number of days with frost each winter was 70--the lowest, 22; the highest, 117. The lowest temperature recorded in the nine years was 17°F.

The following table, taken from the 1967 Annual Report of the Hopland Field Station, is presented to characterize climate for a year and to illustrate the type of available climatic data.

Month	Total Rain-fall	T. Max.	T. Min.	RH+	RH-	S.T. Max.	S.T. Min.	K. Max.	K. Min.	WV Day	WV Night
July '66	--	88	50	30	93	91	81	113	50	2.3	1.3
August	0.23	92	54	26	84	92	83	117	55	2.6	1.6
Sept.	0.13	86	51	32	92	84	76	111	51	2.6	1.7
Oct.	--	80	45	31	93	76	69	105	45	1.8	0.8
Nov.	8.59	61	41	66	98	61	58	81	42	2.3	1.4
Dec.	7.06	54	36	75	100	53	51	76	35	2.0	1.2
Jan. '67	9.37	58	38	55	98	51	48	75	34	2.2	1.5
Feb.	0.39	66	38	39	97	56	51	91	34	2.0	0.7
March	7.72	56	36	53	97	56	52	80	32	3.4	1.6
April	4.66	54	34	53	99	57	53	82	30	3.1	1.4
May	0.47	78	46	36	89	74	66	100	43	2.7	1.2
June	1.55	85	51	33	92	81	72	104	49	2.4	1.0
TOTAL	40.17										

All above temperatures and wind velocities are mean monthly readings.

T. Max., T. Min. = Maximum and minimum temperature °F.
RH+, RH- = Relative humidity at maximum and minimum dry bulb.
S.T. Max., S.T. Min. = Maximum and minimum soil temperature °F at 6 inches.
K. Max., K. Min. = Maximum and minimum black globe temperature °F.
WV = Average wind velocity mph.

VI. *Soils, exposure, topography.*

A Soil-Vegetation Survey of the station was released in 1958. Eighteen different soil series were mapped to a two-acre minimum. The complex of soils and vegetation is wide, as much land is

steep and the drainage pattern gives many west-, north-, and south-facing slopes. Maps prepared in this survey are available for use, but insufficient copies are available for general distribution. The 18 soil series have been described in detail.

VII. *Physical facilities.*

Four senior personnel and several assistants are permanently located at Hopland. They have a shop and laboratory equipped to handle routine drying, freezing, grinding, and chemical analysis. Recently, much work in gas chromotography and *in vitro* digestion has been done. The only restrictions on the use of any laboratory or other station-owned facilities are those imposed by prior scheduled use by others. Inquiries should be addressed through a research cooperator or to Mr. A. H. Murphy, Superintendent, Hopland Field Station, Route 1, Box 53, Hopland, California 95449; or phone 707-744-2701. The station does not maintain dormitory and camping space so most visitors seek food and lodging at Ukiah, about 15 miles distance. A dormitory is in the long-range plans and trailers have been used for temporary summer employees.

VIII. *Previous studies.*

Publications which derive some or all of their information from research on the station number into the hundreds and are mainly in the fields of agronomy, animal science, wildlife, hydrology, and range management.

Complete aerial photo coverage of the whole station and parts of it has been done several times, at different scales, and a few

times in color. Prints of any negative may be purchased from the contractor. Address inquiries to the Station Superintendent.

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