

Technical Report No. 43
COMPREHENSIVE NETWORK SITE DESCRIPTION
JORNADA

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GRASSLANDS BIOME
U. S. International Biological Program

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I. *Site name: Jornada.*

The Jornada Experimental Range was withdrawn from the Public Lands for research in 1912 by presidential proclamation. From 1915 until 1953 it was under jurisdiction of the U. S. Forest Service. Following realignment of range research activities within the Department of Agriculture in 1953, the Range was transferred to the Agricultural Research Service. Since 1953, the Jornada has been operated by the Arid Pasture and Range Sections Crops Research Division of ARS.

II. *Location and size.*

The entire Jornada Experimental Range contains 105,700 acres under direct control of the ARS and an additional 85,000 acres under lease to the White Sands Missile Range. The site selected for the IBP Grassland studies is located at 1,350 m elevation on the western side of the Range about six miles west of the Jornada Headquarters. The specific site is mostly in Section 4, Range 1 East, Township 20 South. The site is the area south and east of the West Well Range Gauge (Fig. 1). The site can be reached from Las Cruces, New Mexico, by traveling east on Highway 70-82 and turning north on a gravel road marked by a sign designating the Jornada Headquarters (Fig. 2). The site is about five miles northwest of the South Well.

The ungrazed area is a ten-acre enclosure, while the grazed area is the remainder of Pasture 9. Livestock utilization on the area has been light; but on the grazed area, the vegetation is at a stage below black grama climax because of grazing and drought. On the protected area, the vegetation is in the climax black grama stage.

III. Vegetation.

Several different vegetative types are represented on the Jornada Range. Major grassland types would be black grama and tobosa types while shrub types would be represented by various combinations of mesquite (*Prosopis juliflora*), tarbush (*Flourensia cernua*) and creosotebush (*Larrea divaricata*). The IBP Grassland Site is characterized by the black grama type. Some of the most abundant plant species are listed in Table 1.

Marked changes have occurred in the grassland portions of the Jornada Experimental Range in the last 100 years. These changes have been characterized by encroachment of brush species into grassland and have been documented by Buffington and Herbel (1965). Table 2 shows the nature of these changes for the mesa portions of the Jornada Range. In 1858, about 58% of the area was free of brush, while in 1963 none of the range was entirely free from brush (Table 2). Various reasons have been advanced for the increase in brush on the Jornada; it is likely that a combination of events is responsible (Buffington and Herbel, 1965).

The general aspect of the grassland areas is low-growing herbaceous vegetation with scattered shrubs such as mesquite, soap tree yucca (*Yucca elata*) and fourwing saltbush (*Atriplex canescens*). Black grama often reaches a height of 20-50 cm while some of the dropseeds (*Sporobolus* spp.) are taller. Basal area of black grama varies depending on precipitation and grazing intensity. Paulsen and Ares (1962) reported that basal area of black grama, one inch above the

ground varied from less than 1% to about 10% in the period 1916 to 1952. End-of-season standing crop averaged 518 kg per hectare for a 15-year period for five pastures.

IV. Consumers.

A list of consumers is presented in Table 3. These include herbivores as well as carnivores and birds, insects, and small mammals.

a. Small mammals.

The spotted ground squirrel (*Citellus spillosona*), bannertailed kangaroo rat (*Dipodomys spectabilis*), and Ord's kangaroo rat (*Dipodomys ordii*) were the most abundant rodents present on black grama grassland on the New Mexico State University Ranch, which is adjacent to the Jornada Experimental Range (Wood, 1969). In addition to their role as herbivores, these rodents have other influences in the grassland ecosystem through their burrowing activities. Wood (1969) estimated that denuding activities of the bannertailed kangaroo rat alone removed 10% of the area from vegetative production.

b. Birds.

Among the important birds found on grassland sites on the Jornada are the scaled quail (*Callipepla squamata*), Gambel quail (*Lophortyx gambeli*) and mourning dove (*Zenaidura macroura*). Other herbivorous and carnivorous birds also are present (Table 3).

c. Insects.

Some of the important insects on the Jornada are listed in Table 3. Although little work has been done on insects as far as

densities, biomass, etc., are concerned; some excellent background information is available in the work of Watts (1963, 1966).

V. *Climate.*

The climate of the area is hot during the summer and cool during the winter. The average annual precipitation at the Jornada headquarters is 22.76 cm for a 54-year period. About 55% of the total occurs between July 1 and September 30. Large scale fluctuations occur among years and seasons within years. For example, in 1922 total precipitation was 12.24 cm, while during 1923-24 it was 23.41 cm. In 1939, 14.73 cm were recorded for July and 0.15 cm for August (Table 4). A severe drought during the 1950's resulted in a drastic reduction of perennial grass cover.

June is the hottest month, with maximum temperatures averaging 36°C, while January is the coldest with temperatures averaging 13°C. Annual evaporation from a free water surface is about 236 cm (Paulsen and Ares, 1962). Wind velocities are highest in April and May.

These records were recorded at the U. S. Weather Bureau station maintained at the Jornada headquarters. This station is classed as a class A station.

VI. *Geology and soils.*

Topography of the Jornada Experimental Range is characterized by level to gently rolling plains and rough, steep terrain in the mountain ranges. Elevations vary from 1300 to 2830 m. The IBP site is located on an area of little relief at an elevation of about

1350 m. The Jornada plain consists of unconsolidated pleistocene detritus. This alluvial fill from the nearby mountains is about 100 m thick in places and in certain areas the aggradation process is still active.

Twenty-two soil types have been mapped by the Soil Conservation Service (Fig. 3). These types range from loamy sands to clays in texture. The main soil type on the IBP study site is a Simona-Palma Complex. It has been described as follows (Buffington and Herbel, 1965):

0-3% slopes. Soils with sandy surfaces over weak to moderate lime zones that may be discontinuously indurated. The principal soils are calcareous to very near the surface and are underlain with fractured, indurated caliche at depths of 10 to 24 inches. These soils comprise about 50 to 60% of the mapping unit. The other soils are moderately deep to deep, usually non-calcareous to about 15 inches, with weakly developed, rapidly permeable subsoils over weak to moderate accumulations of lime. Caliche gravels and fragments have been mixed throughout the soil profile by rodents in most areas.

VII. *Physical facilities.*

Temporary lab and office space are available at the Jornada Range Headquarters. Space for camping or parking a trailer is also available at the headquarters. Water, electricity, and shop facilities are available at headquarters. The telephone number at headquarters is 0901R2 (through the Las Cruces operator). Arrangements for any facilities at headquarters should be made with Clyde

Yarbrough at the above phone number. Dormitory space is available at New Mexico State University, and there are many motels in Las Cruces.

VIII. *Previous studies on area.*

Publications from the Jornada Experimental Range and the University Ranch date to the pre-1920's. The bulk of this work was aimed at improving conditions for livestock grazing, but many studies were made on basic ecology of the area and serve as an excellent base for ecosystem analysis.

Much information on vegetation and floristics of the area was collected by Little and Campbell. Some of their work was summarized in 1943 (Little and Campbell, 1943), when a description of the vegetation was given and a complete plant list was compiled for the Jornada. Little made other contributions to the ecology and taxonomy of southwestern plants, including *Drymaria pachyphylla* (Little, 1937a) and some bryophytes (Little, 1937b). Campbell also made many contributions on other species including yucca (Campbell, 1929; Campbell and Keller, 1932). Studies of other species on the mesas and mountains included alligator juniper (*Juniperus deppeana*) (Halloran and Ares, 1944), snakeweed (*Gutierrezia sarothrae*) (Campbell and Bomberger, 1934), *Euphorbia antisiphilitica* (Leyendecker and Kennedy, 1956), fourwing saltbush (*Atriplex canescens*) (Foster, Lantow, and Wilson, 1921; Brown, 1922; Cassady, 1937; Gerard, 1965), and creosotebush (*Larrea divaricata*) (Botkin and Duisberg, 1949; Singh, 1964; Valentine and Norris, 1964; Knipe and Herbel, 1966;

De Garmo, 1966; Valentine and Gerard, 1969). Several studies have been conducted on the ecology of black grama (Canfield, 1934, 1939; Nelson, 1934).

Many of the early studies on the Jornada were concerned with grazing effects and management (Ares, 1936, 1939, 1953; Paulsen and Ares, 1962; Canfield, 1939; Jardine and Forsling, 1922). Other studies were made on methods of determining utilization of forage species (Ares, 1939; Crafts, 1939; Canfield, 1944; Valentine, 1947). Recent studies have been made on grazing patterns of livestock and species preferences (Valentine, 1947; Herbel and Nelson, 1966_a, 1966_b; Herbel, Ares, and Nelson, 1967). Considerable work also has been devoted to reseeding practices (Wilson, 1931; Bridges, 1942; Cassady, 1937; Sosebee and Herbel, 1969; Herbel and Sosebee, 1969) and mesquite control (Herbel, Ares, and Bridges, 1958; Herbel and Ares, 1961; Valentine and Norris, 1960; Norris, Valentine, and Gerard, 1963).

Much information also is available on changes in vegetation on the Jornada. This includes two papers by Campbell (1929 and 1931) on successional trend on light and heavy soils. Changes in the vegetation in the past 100 years have been carefully documented by Buffington and Herbel (1965). Drought effects have been studied by Wright (1960), Lohmiller (1963), and Herbel, Ares, and Wright (1968). Information also is available on chemical composition of the major grass species (Watkins, 1937, 1939, 1943; Watkins and Knox, 1945).

Considerable information also is available on animal populations of the Jornada and adjacent areas. For small mammals, the influence of rodents and rabbits on grassland vegetation was studied by Norris (1950). Wood (1965, 1969) studied control methods for several rodent species and determined densities and biomass of rodents on different habitats.

Analysis of population composition, densities, and habitat preferences of the avifauna in a desert scrub area has been completed (Maze, 1965). Other studies have been conducted by Henderson (1967), Raitt (1964, 1966, 1967a, 1967b), and Valentine (1944, 1945).

Insect studies have been made on harvester ants (Melendez, 1963) and on seed destroying insects on black grama (Watts, 1963, 1966).

A few microbiological studies have been conducted by Staffeldt (1967, 1968; Calderon and Staffeldt, 1965).

The following long-term studies are currently being conducted on the Jornada:

1. Vegetative changes following the drought of the 1950's.
 2. Effect of micro-environmental variables on herbage production.
 3. Methods of control of mesquite, creosotebush, and tarbush.
 4. Weather-plant-livestock relations.
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Table 1. List of important plants occurring on grassland portions of the Jornada Experimental Range.

| Species | Species |
|--------------------------------|-------------------------------|
| GRASSES | FORBS |
| <i>Bouteloua eriopoda</i> | <i>Baileya multiradiata</i> |
| <i>Sporobolus flexuosus</i> | <i>Croton corymbulosus</i> |
| <i>Sporobolus airoides</i> | <i>Perezia nana</i> |
| <i>Sporobolus cryptandrus</i> | <i>Psilostrophe tagetinae</i> |
| <i>Hilaria mutica</i> | SHRUBS |
| <i>Aristida purpurea</i> | <i>Atriplex canescens</i> |
| <i>Aristida longiseta</i> | <i>Larrea divaricata</i> |
| <i>Scleropogon brevifolius</i> | <i>Gutierrezia sarothrae</i> |
| <i>Muhlenbergia porteri</i> | <i>Prosopis juliflora</i> |
| | <i>Flourensia cernua</i> |

Table 2. Size of areas occupied by various brush species on the Jornada Range in 1858, 1915, 1928, and 1963. (from Buffington and Herbel, 1965).

| Vegetative Type | Cover of brush | YEAR | | | |
|-------------------------------|----------------|---------|---------|---------|---------|
| | | 1858 | 1915 | 1928 | 1963 |
| | Percent | | | Acres | |
| No brush | 0 | 83,625 | 35,459 | 32,833 | 0 |
| Mesquite | 1- 15 | 749 | 15,134 | 20,789 | 14,756 |
| | 15- 55 | 22,074 | 10,890 | 14,860 | 10,794 |
| | 55-100 | 6,266 | 32,255 | 29,676 | 66,151 |
| Mesquite-creosotebush | 1- 15 | 0 | 126 | 309 | 0 |
| | 15- 55 | 9,235 | 0 | 379 | 0 |
| | 55-100 | 0 | 629 | 0 | 1,787 |
| Creosotebush | 1- 15 | 0 | 0 | 0 | 0 |
| | 15- 55 | 644 | 0 | 1,167 | 0 |
| | 55-100 | 0 | 926 | 1,869 | 12,388 |
| Creosotebush-tarbush | 1- 15 | 0 | 367 | 1,583 | 0 |
| | 15- 55 | 251 | 27,069 | 3,307 | 1,168 |
| | 55-100 | 0 | 2,425 | 7,425 | 4,876 |
| Tarbush | 1- 15 | 0 | 41 | 410 | 2,364 |
| | 15- 55 | 501 | 742 | 406 | 2,004 |
| | 55-100 | 0 | 0 | 1,012 | 1,727 |
| Tarbush-mesquite-creosotebush | 1- 15 | 571 | 428 | 724 | 175 |
| | 15- 55 | 9,578 | 2,847 | 6,586 | 0 |
| | 55-100 | 1,916 | 3,953 | 6,199 | 14,372 |
| Total | | 144,475 | 144,475 | 144,475 | 144,475 |

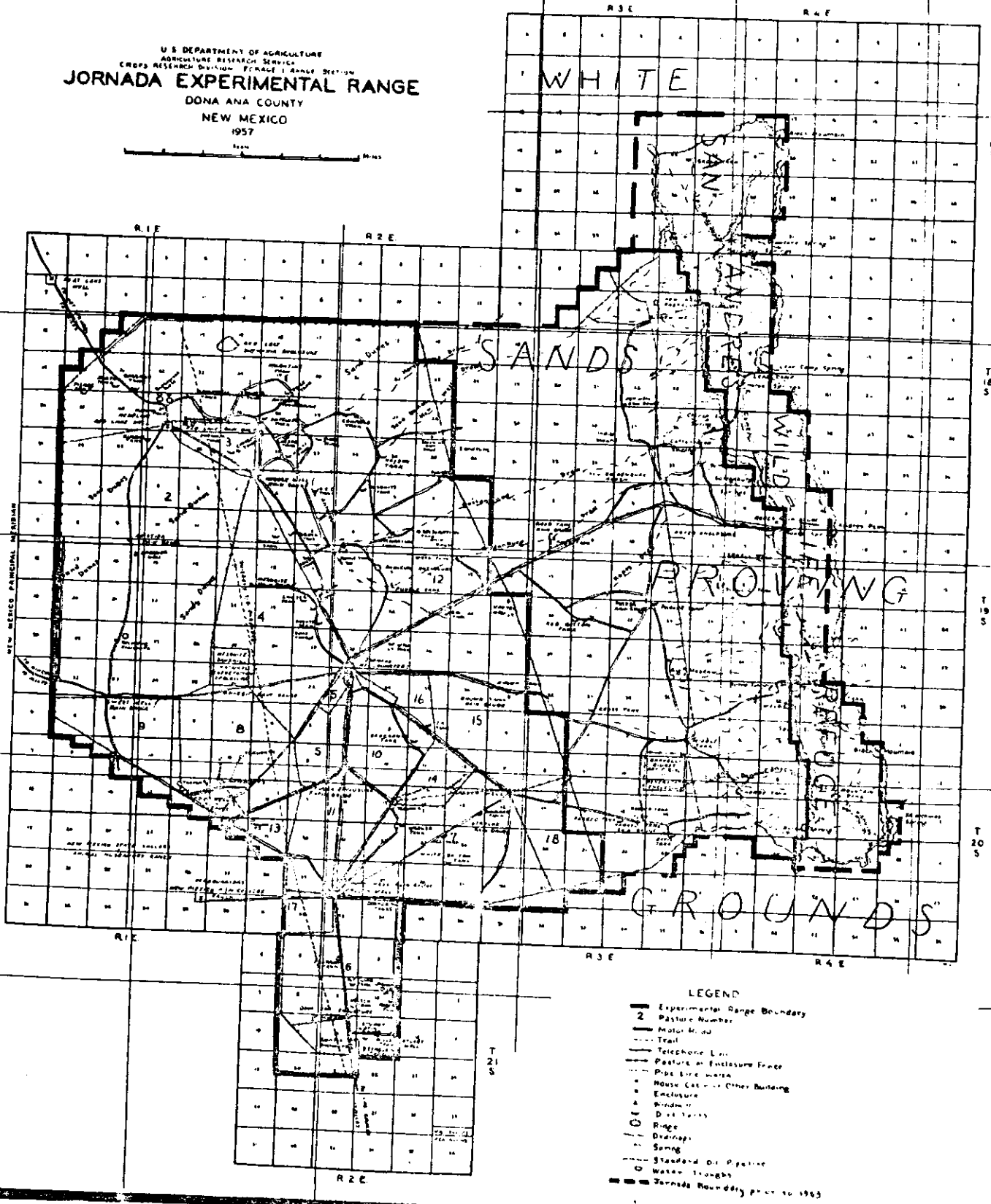
Table 3. List of herbivores and carnivores on Jornada Experimental Range.

| Species | Species |
|---------------------------|------------------------|
| HERBIVORES | CARNIVORES |
| Small mammals | Mammals |
| Dipodomys merriami | Canis latrans |
| Dipodomys ordii | Taxidea taxus |
| Dipodomys spectabilis | Lynx rufus |
| Neotoma albigula | Birds |
| Citellus spilosoma | Geococcyx californicus |
| Onychomys leucogaster | Auriparis flaviceps |
| Perognathus flavus | Circus cyaneus |
| Lepus californica | Speotypto curcularia |
| Birds | Buteo jamicensis |
| Zenaidura macroura | Asio flammeus |
| Callipepla squamata | |
| Lophortyx gambeli | |
| Amphispiza bilineata | |
| Insects | |
| Pogonomyrmex occidentalis | |
| Acrididae spp. | |
| Chirothrips falsus | |
| Nesosteles neglects | |
| Nysius raphanus | |
| Sapotes spp. | |

Table 4. Yearly and growing season precipitation totals at the Jornada Experimental Range (cm).

| Year | July | Aug. | Sept. | Yearly Total | Year | July | Aug. | Sept. | Yearly Total |
|------|-------|-------|-------|--------------|------|-------|-------|-------|--------------|
| 1916 | 3.57 | 4.87 | 3.95 | 20.71 | 1944 | 5.96 | 1.42 | 2.97 | 21.18 |
| 1917 | 2.29 | 2.45 | 1.84 | 17.30 | 1945 | 5.87 | 2.86 | 3.30 | 21.79 |
| 1918 | 1.45 | 3.88 | 0.64 | 9.19 | 1946 | 2.88 | 2.40 | 5.51 | 14.43 |
| 1919 | 3.90 | 7.34 | 0.00 | 26.70 | 1947 | 5.28 | 6.45 | 6.32 | 27.33 |
| 1920 | 7.98 | 6.43 | 6.50 | 35.69 | 1948 | 2.21 | 7.19 | 0.13 | 19.81 |
| 1921 | 3.83 | 8.36 | 2.27 | 24.69 | 1949 | 1.30 | 0.40 | 1.12 | 17.60 |
| 1922 | 3.83 | 3.20 | 1.86 | 12.24 | 1950 | 7.06 | 0.77 | 8.73 | 23.10 |
| 1923 | 0.64 | 4.59 | 2.88 | 23.41 | 1951 | 6.86 | 2.54 | 4.18 | 21.87 |
| 1924 | 1.73 | 3.90 | 4.44 | 18.93 | 1952 | 0.86 | 2.17 | 0.46 | 17.15 |
| 1925 | 8.52 | 0.81 | 0.54 | 15.56 | 1953 | 4.72 | 0.66 | 7.95 | 14.51 |
| 1926 | 4.27 | 3.03 | 2.27 | 26.62 | 1954 | 2.08 | 3.37 | 5.71 | 18.74 |
| 1927 | 12.62 | 0.97 | 8.16 | 34.65 | 1955 | 8.99 | 1.33 | 0.23 | 18.49 |
| 1928 | 3.80 | 5.92 | 6.43 | 23.09 | 1956 | 5.71 | 1.68 | 0.00 | 9.14 |
| 1929 | 3.24 | 6.68 | 0.07 | 26.59 | 1957 | 4.78 | 11.07 | 0.00 | 26.01 |
| 1930 | 4.97 | 6.96 | 15.70 | 23.14 | 1958 | 2.18 | 4.72 | 9.55 | 34.27 |
| 1931 | 3.70 | 0.07 | 7.72 | 25.32 | 1959 | 3.80 | 16.29 | 0.00 | 22.87 |
| 1932 | 2.68 | 4.10 | 5.10 | 23.83 | 1960 | 3.50 | 3.73 | 0.30 | 17.80 |
| 1933 | 2.52 | 11.50 | 6.38 | 35.60 | 1961 | 6.02 | 8.73 | 8.34 | 32.44 |
| 1934 | 3.76 | 5.25 | 11.63 | 18.59 | 1962 | 12.12 | 6.60 | 8.31 | 39.47 |
| 1935 | 2.22 | 2.03 | 0.18 | 14.25 | 1963 | 1.47 | 4.21 | 3.54 | 13.77 |
| 1936 | 2.35 | 10.05 | 4.92 | 27.08 | 1964 | 6.99 | 5.51 | 4.37 | 20.20 |
| 1937 | 4.13 | 2.96 | 7.34 | 26.31 | 1965 | 3.00 | 0.64 | 3.51 | 17.75 |
| 1938 | 1.12 | 2.26 | 8.00 | 20.43 | 1966 | 1.73 | 5.20 | 3.18 | 16.56 |
| 1939 | 14.73 | 0.15 | 8.06 | 32.10 | 1967 | 1.22 | 4.06 | 4.64 | 21.79 |
| 1940 | 2.74 | 2.45 | 5.41 | 27.20 | 1968 | 5.33 | 5.61 | 2.47 | 24.74 |
| 1941 | 3.78 | 1.86 | 5.96 | 27.23 | 1969 | 6.76 | 3.76 | 2.95 | |
| 1942 | 4.87 | 5.38 | 11.45 | 36.34 | | | | | |
| 1943 | 1.96 | 6.07 | 3.22 | 20.68 | | | | | |
| | | | | | Avg. | 4.37 | 4.39 | 4.46 | 22.76 |

U.S. DEPARTMENT OF AGRICULTURE
 AGRICULTURE RESEARCH SERVICE
 CROPS RESEARCH DIVISION RANGE STATION
JORNADA EXPERIMENTAL RANGE
 DONA ANA COUNTY
 NEW MEXICO
 1957



- LEGEND**
- Experimental Range Boundary
 - 2 Pasture Number
 - Motor Road
 - - - Trail
 - · · Telephone Line
 - Pasture or Enclosure Fence
 - Pipe Line
 - House Lot or Other Building
 - Enclosure
 - × Dead Tree
 - Ring
 - - - Drainage
 - Spring
 - Standard or Pipe
 - Water Trough
 - Jornada Boundary prior to 1905

Fig. 1. Map of the Jornada Experimental Range.

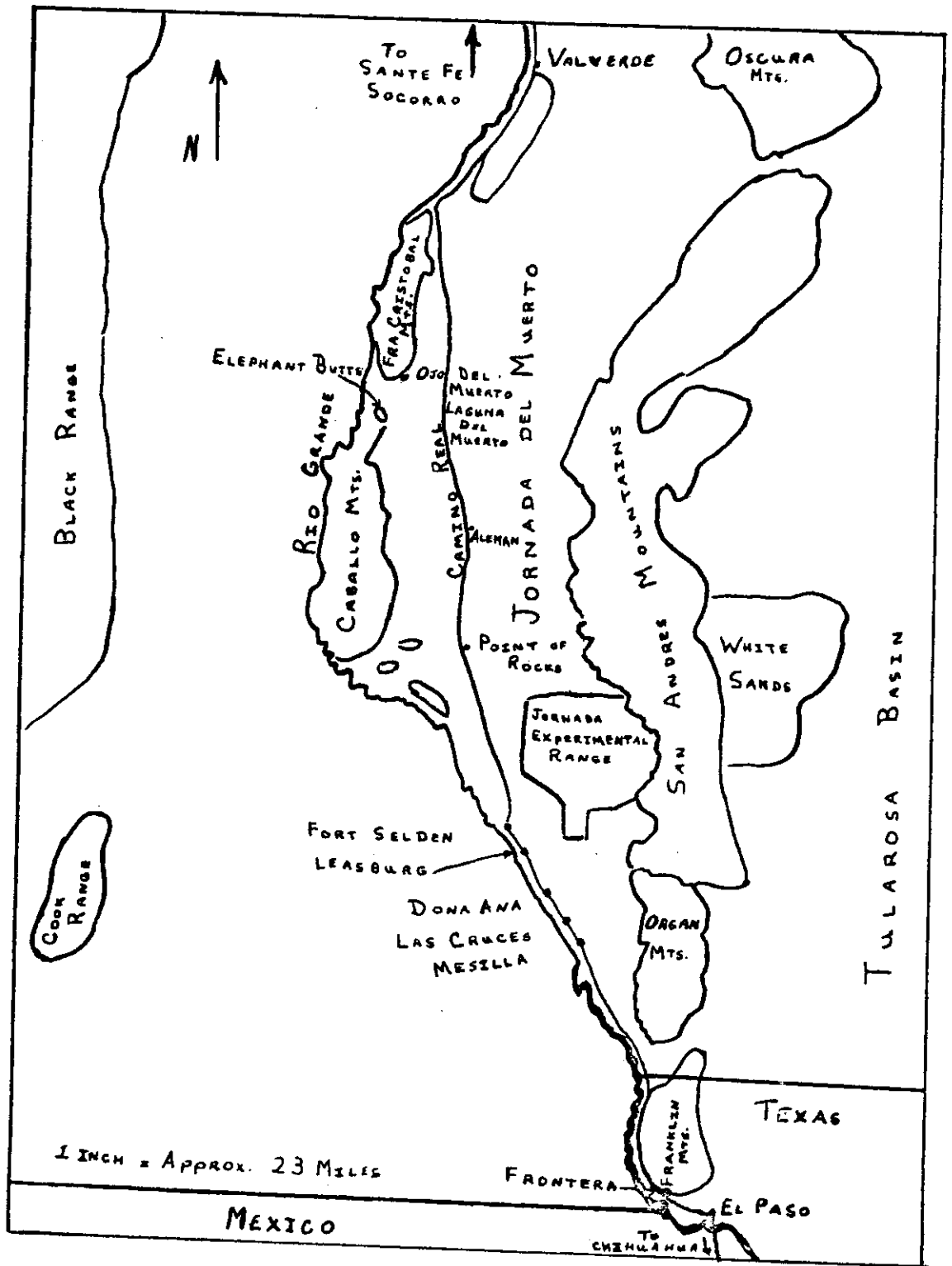


Fig. 2. Map of the area near the Jornada Experimental Range in southern New Mexico.

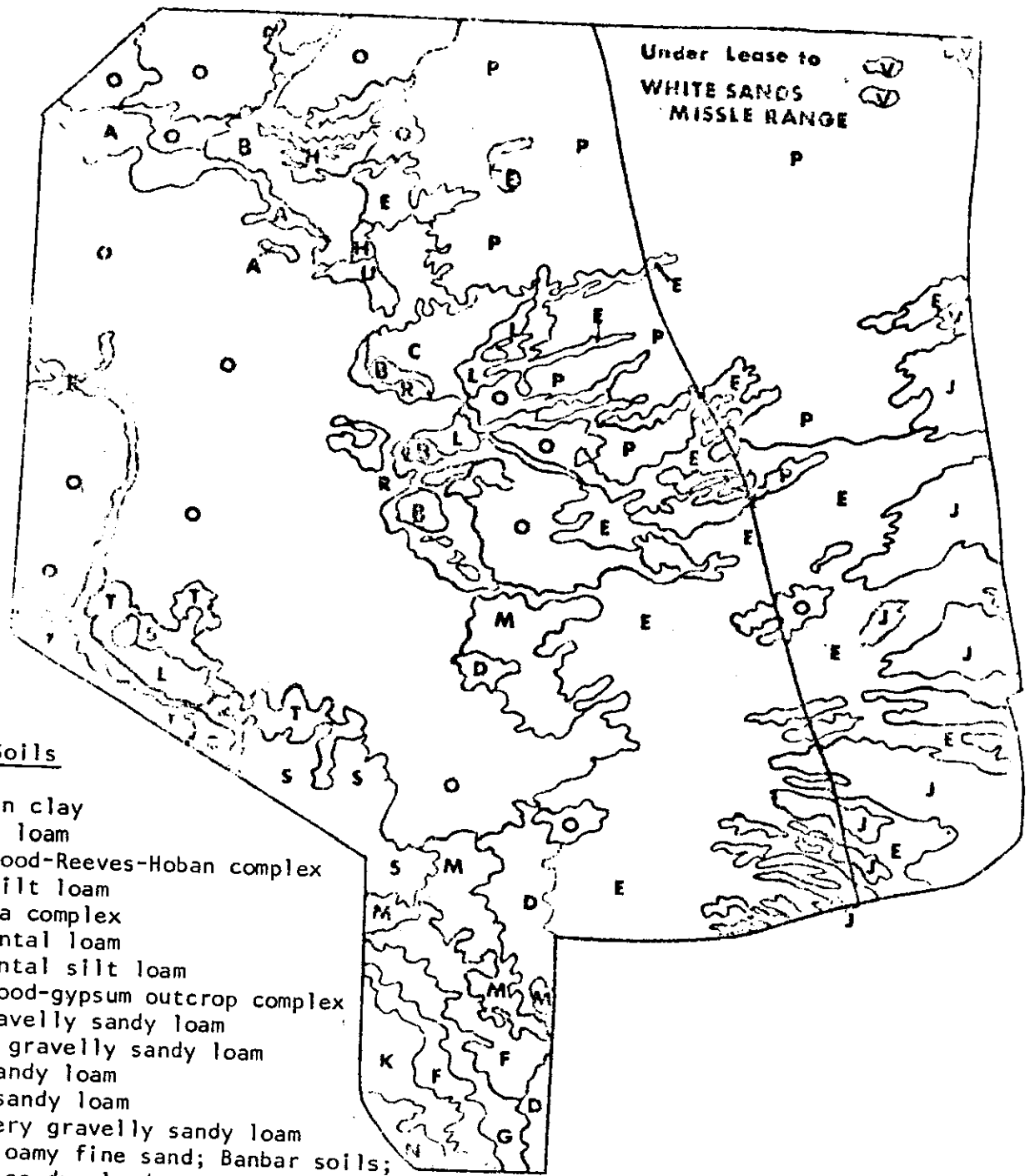


Fig. 3. Map showing major soil types on the Jornada Experimental Range.