PART ONE

BASIC DATA

I. LAND MANAGEMENT UNIT NO. 7

A. INTRODUCTION:

The land planning survey field work on Land Management Unit No. 7 was started in August 1937 and completed in October 1937 by the Land Planning Survey Party - "C", Soil Conservation Service, Department of Agriculture.

B. GEOGRAPHIC FEATURES:

1. DESCRIPTION:

a. Location and Political History:

Land Management Unit No. 7 comprises 924,082 surface acres in the south central part of the Navajo Reservation - 874,675 acres are in Navajo County and 49,407 acres in Apache County, Arizona. (See Map No. 1).

That portion of the Unit north of 35°30" parallel of latitude and west of 110°00" meridian of longitude was made Reservation by Executive Order on December 16, 1892.

That portion south of 35°30" parallel of latitude, except for the railroad and other patented lands which have not yet been reconveyed to the Government, was made Reservation by Congressional Act of June 14, 1934.

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Those portions east of 110°00" meridian of longitude were made Reservation in 1890 and 1908 (See Map No. 1).

b. Land Surveys:

Practically all of the Unit has been surveyed. The oldest survey is on that land which was taken in Reservation as of the Congressional Act of June 1934, this survey being made in 1882 and approved in 1883. Rock and wooden markers were used and only a very few of these can be found and identified. Subsequent surveys were marked with iron stakes. Accurate locations of land lines were very difficult to make.

c. Area and Boundary:

The computed area of this Unit, as stated above, is 924,082 acres. The boundaries are usually well defined and easily followed in the field. The south boundary is the south boundary of the Navajo Reservation and is fenced. Unit No. 7 is bounded on the west by Units No. 5 and 6, on the north by Unit No. 4, and on the east by Units Nos. 10 and 17. (See Map No. 1).

d. Land Status:

At the present time, there are approximately 234,870 acres of land included in this Unit which does not belong to the Federal Government. Of this amount, approximately 40,680 acres are patented Indian allotments. Practically all of these lands, except the Indian allotments, are in the process of being purchased or reconveyed to the Government. It is not known how soon this change of land status will take place. Table No. I

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shows the acreage and carrying capacity of each class of land in this Unit which has not been reconveyed to the Government. (See Map No. 13).

Table No. I LAND STATUS

Owner	Surface Acres	Forage Acres	C.C. S.Y.L.	Sheep Months
Indian Allotments	40,680	6,056	2,422	29,064
A.T. & S.F. Railway	107,005	14,042	5,617	67,404
New Mexico and Arizona Land Co.	75,745	12,116	4,846	58,152
State Land Holding Co.	10,000	1,215	486	5,832
Other Patented (White)	1,440	249	100	1,200
Total	234,870	33,678	13,471	161,652

2. PHYSIOGRAPHY:

a. Elevation and Topography:

The elevation varies from approximately 5,300 feet to 7,500 feet. (See Table No. III). The northern portion of the Unit is an extension of Black Mesa. Cliff recessions are caused by the resistant Mesa Verde caprock and the softer underlying clays and shales. South of the mesas the terraine is characterized by rolling planes broken by innumerable mesas, buttes and peaks which form the Hopi Buttes volcanic field. In the extreme southern portion of the Unit there are the high escarpments and broken badlands of the Painted Desert. The principal drainages on the Unit are the Jeddito, Coyote, Bida-ho-chee and Cottonwood (Pueblo Colorado) Washes. All of these drain in a southwesterly direction

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except Coyote Wash which flows to the northwest. All of the washes have cut channels of varying depths. The Jeddito, however, "fans out" on the lower end.

b. Geology:

A summary of the geology of this Unit has been written by Mr. Tom Meeks and is quoted below in part:

"1. General Geology:

"The geology of the Unit is represented by formations from the Triassic to late Tertiary in age. The variegated Chin Lee formation is the most wide spread of the Unit, extending from the vicinity of Indian Wells south to the southern border of the district. The Mesa Verde formation forms the mesas in the northern part of the Unit with the Mancos, Dakota, the Morrison forming a thin border along its outskirts. The Tertiary sediments are distributed throughout the Unit and occupy zones immediately overlying all of the other formations.

"2. Stratigraphy:

a. Triassic Formations:

"The only representative of the Triassic in this Unit is the Chin Lee formation which forms the Painted Desert physiographic sub-province.

(1) Chin Lee Formation:

"The Chin Lee formation exceeds 1,000 feet in thickness and is exposed throughout the southern portion of the Unit. The hitherto unmapped portion of the Hopi Buttes area is assigned to

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which causes the steep cliffs in the northern part of the Unit. It is about 400 feet thick and is composed of fresh water sandstones, shales and coal. Below the upper massive sandstone bed is a succession of shales, sandstone and coal of varying thickness.

(4) Tertiary Sediments:

"The Tertiary sediments of this area are of interest mainly because of their close relationship with the volcanics of the region. Volcanic ash occurs throughout the formation interbedded with the sandstone and clays. Volcanic tuff is also common. The relationship of volcanic ash and tuff to the associated non-volcanic sediments is shown about four miles north of White Cone where the ash lies on an unevenly eroded surface of red clay.

(5) Volcanics:

"The Hopi Buttes volcanic field is an isolated field measuring from 35 to 40 miles on a side.

"The typical Hopi vent was opened by the explosive drilling of a cylindrical pipe, and doubtless a pyroclastic cone was formed about the orifice. Subsequently, upwelling lava filled the crater and spilled over the rim. The fact that hardly a neck is without inward dipping pyroclastic debris, made up of lava and sedimentary fragments is abundant evidence for this history.

"The succession and thickness of the flows varies over short distances. On one mesa several flows may be noted while on an adjoining one there may be only a single flow.

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"The dikes in the Unit are aligned approximately in a northwest-southeast direction, and all of them show many small offsets along their length. Most of the dikes are made up of dense black, porphyritic lava identical with that forming flows on the adjacent mesas but others are composed principally of tuff boccia.

"3. Economic Geology:

"Coal is the only important geological resource in the Unit. Commercial coal beds may be found throughout the northern part of the Unit in the Mesa Verde formation. (See map). Deposits are also found in the Dakota formation in some of the buttes along the Keams Canyon-Winslow road. Coal in the Dakota is mined at Montezuma's Chair and Round Top Butte where it occurs in seams about six feet thick. The seams are not a continuous vein of coal but are made up of veins six to eighteen inches thick, interbedded with thin layers of sandstone and clay.

"About a mile east of the Jeddito Wash and just south of the Steamboat-Keams Canyon road is a thin lense of bentonite with a thickness of about a foot and a lateral extent of two or three hundred feet. The limited amount and difficulty of removal make this deposit without commercial value.

"4. Historical:

"The main features of the history of this region have been taken from Williams' report on the Hopi Volcanoes.*

*Williams, Howell. Pliocene Volcanoes of the Navajo-Hopi country. Geological Soc. Am. Bull. Vol. 47 pp. 111,172,1936.

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The surface upon which the Hopi volcanoes erupted was carved from the almost flat-lying Mesozoic sediments during the long interval between Cretaceous and Pliocene time.

"Such valleys as existed were choked by showers of ash at the beginning of volcanic activity. The streams were dammed to form playas and ponds, which apparently were finally united to form a lake of great extent which is spoken of as the Hopi Lake. The lake deposits occur as far north as Jeddito Wash and south nearly to Five Buttes, and in an east-west direction they are traceable from Ganado to Dilkon.

"The present valleys of the Hopi region must have been cut at the close of the Pliocene and during the Pleistocene, and they were largely infilled either during an interglacial stage or toward the close of the Pleistocene. From the scarcity of volcanic debris in the present valley fill it is concluded that the Hopi volcanoes were eroded almost to the present stage before this infilling took place."

c. Soils and Erosion:

The following information is taken from the "Soils and Erosion Report" by L. A. Hill:

"The range land soil types have been grouped into five land classes on the basis of their qualities as potential grazing land, assuming that soil moisture is the most important factor limiting the production of native vegetation in this region.

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"In grouping the soils, a base grade is given each soil type on the basis of its normal profile characteristics representing the normal maximum productive capacity of the type under optimum conditions prevailing in the Unit.

"The percent run-off, moisture penetration, water-holding capacity, slope, amount and kinds of salts present, erosion, dispersion ratio, structure of profile and organic matter content will modify the basic grade of each type.---

"A soil which is permeable, yet will hold the moisture in the surface twelve or eighteen inches, is the strongest grassland; whereas, a soil which permits moisture to penetrate rapidly to greater depths is better adapted to the browse type of vegetation.-------"

The group "A" soils obviously have a high permeability and are level enough to absorb the normal precipitation expected. In case of severe flash storms, considerable run-off may be expected after the top soil is saturated, due to the less permeable sub-strata.

Laboratory analyses and the stands of native vegetation show these soils to have a high-water holding capacity.

Group "A" soils are adaptable to galleta, blue grama, sage and woodland types of vegetation.

The normal forage production reflects a high degree of moisture utilization.

Erosion is not a menace now and, with the scarcity and lack of possibilities of developing stock water, it should never

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become so.

Generally speaking, little improvement can be expected of the Group "A" soils in Unit No. 7 for they are already producing a maximum amount of forage, and as long as the proper forage utilization is maintained there is no need for improvement measures.

Contour range land furrowing on the gently sloping Buell, Pinedale, Floy or Todilto soils may prove profitable.

Areas in need of mechanical erosion control:

Quadrangle 110°15' x 35°30' - 3"W x 8"S.
Gully heads 4 to 6 feet deep on
Balakai Mesa.

Group "B" soils are widely scattered over the Unit. The rate of moisture penetration is about the same as on Group "A" soils but varies from moderate to rapid, depending upon the texture.

The water-holding capacity is lower than on the Group "A" soils. The Todilto loamy sands and sands make up a large part of the Group "B" soils.

Galleta and blue grama are the principal vegetative types on the soils but on wind blown and overgrazed areas, Mormon tea, Snake weed, Yellow brush and Rabbit bush have invaded and are partially stabilizing erosion. The Group "B" soils in the northern portion of the Unit are covered with pinon-juniper woodland.

Group "B" soils can be used in construction without extraordinary care, except the White Cone and Todilto shallow

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phase soils. The variegated parent materials of the White Cone shallow phase would warrant special investigation of each individual area.

"The Todilto, Crown, Oraibi, and areas of the Buell soils are affected with wind erosion, but erosion on the Todilto and Buell soils is more or less stabilized. --- Erosion on Crown and Oraibi soils is quite active. Both gully and sheet erosion is active on the White Cone, Pinedale and Dinnehotso soils."

Except for the few special areas listed below, proper range management is the only feasible improvement practice that can be employed on these soils.

Areas in need of mechanical erosion control are as follows:

Quadrangle 110°30' x 35°15' - 12S x 9½"W
Gully heads in a saccaton flat.

Quadrangle 110°00' x 35°15' - 11½"S x 5"W
Deep gully heads

Quadrangle 110°00' x 35°30' - 3"S x 12¼"W

Quadrangle 110°00' x 35°30' - 2-1/8"S x 11"W

The rate of moisture penetration on Group "C" soils is quite variable, ranging from moderately rapid to rapid. Penetration is slow where sheet erosion has been or is prevalent.

"Deep gullies have materially lowered the water table. Generally speaking, the water-holding capacity is quite low.

"Vegetation is relatively scarce but is of the same type as that of Groups "A" and "B" soils.

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The residual soils can be used with due care but the alluvial soils are poor materials for construction.

Erosion is generally severe and is the result of over-grazing.

"Group "C" soils will not respond to a range program as rapidly as the soils in Groups "A" and "B", but improvement can be accomplished through grazing control. The following areas are in need of mechanical structures to hasten recovery after range control has been obtained:

25,000 acres at and west of White Cone.
(White Cone Flat)

Quadrangle 110°30' x 35°30' - 10½"W x 15½"S. Severe sheet and wind erosion due to over-grazing.

The following areas are headcutting and are in need of mechanical erosion control:

Quadrangle 110°00' x 35°30' - 2¼"S x 6¼"W

Quadrangle 110°00' x 35°30' - ½"S x 4½"W

Quadrangle 110°00' x 35°30' - 3 3/4"S x 4"W

Quadrangle 110°00' x 35°30' - 1 5/8"S x 11 5/8"W

Quadrangle 110°00' x 35°30' - 2 1/8"S x 11¼"W

Moisture penetration on Group "D" soils is very low because of the excessive slope.

The water-holding capacity is very low. The vegetation is confined to a sparse cover of browse and annuals.

Erosion is mostly geologic.

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These soils are not recommended for construction purposes because of the excessive salt concentrations.

Little or no improvement is feasible.

Mechanical structures could be put in on the area in Quadrangle 110°00' x 35 30' - 3"S x 13¼"W, to keep gully heads from encroaching upon more valuable land farther up.

Practically all precipitation escapes as run-off from Group "E" soils.

Scattered woodland species and drought-resistant browse species are sometimes found but, for the most part, the soil is barren.

Construction material is not available except stone for masonry.

No improvement or erosion control measures are feasible.

The following table gives the soil types and acreages of the various Rangeland soil groups by Sub-units:

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TABLE II

TOTAL ACREAGE OF SOIL TYPES IN RANGE LAND SOIL GROUPS
BY SUB-UNITS, LAND MANAGEMENT UNIT NO. 7

Soil Type	Group A	Group B	Group C	Group D	Group E	Totals	Percent Unit Total
			SUB-UNIT NO. I				
Buell Loamy Sand	4,463	20,477	4,635	1,283		30,856	3.34
Buell Sandy Loam	39,658	14,239	4,276	9,422		67,595	7.31
Buell Clay Loam	7,134	1,931		3,718		12,783	1.40
Pinedale Sandy Loam	1,844	2,721	3,694			8,259	.89
Floy Sandy Loam	1,182		3,095			4,277	.46
Todilto Loamy Sand		216				216	.02
Todilto Sandy Loam	2,417					2,417	.26
Concho Sandy Loam		999				999	.11
Concho Clay Loam		1,884				1,884	.20
Concho Clay			1,641		325	1,966	.21
Crown Loamy Sand	534	2,370				2,904	.31
Crown Sandy Loam		1,324	10,218			11,542	1.25
Crown Clay Loam		2,202				2,202	.24
Craibi Loamy Sand		61				61	.01
Soil Remnants			8,172	12,981	4,667	25,820	2.79
Rough Broken Land (Undifferentiated)				17,552	1,607	19,159	2.08
Rough Stony Land (Undifferentiated)				202	7,424	7,626	.83
Totals:	57,232	48,424	35,729	45,158	14,023	200,566	21.71
Group Percentage:	6.19	5.24	3.86	4.91	1.51	21.71	

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TABLE II (Continued)

Soil Type	Group A	Group B	Group C	Group D	Group E	Totals	Percent Unit Total
			SUB-UNIT NO. II				
Buell Sandy Loam	209		273			482	.05
Todilto Loamy Sand		29,637	3,367			33,004	3.60
Todilto Sandy Loam	19,338	14,474	2,624	710		37,146	4.00
Todilto Sandy Loam, (Hard sub-soil phase)	14,028	8,324				22,352	2.42
Pinedale Sandy Loam			68			68	.03
White Cone Clay Loam			7,969			7,969	.86
Crown Loamy Sand		4,526	1,306			5,832	.63
Crown Sandy Loam	3,050	14,646	881			18,577	2.00
Crown Clay Loam		3,190	3,379			6,569	.71
Crown Clay			2,897			2,897	.31
Concho Sandy Loam		2,080				2,080	.23
Concho Clay Loam		9,484				9,484	1.03
Concho Clay		3,867	3,297			7,164	.78
Oraibi Loamy Sand			4,888			4,888	.53
Oraibi Sandy Loam		349				349	.04
Oraibi Clay			522			522	.02
Dinnebito Sandy Loam	3,316	2,669				5,985	.65
Soil Remnants			4,843	18,964	970	24,777	2.68
Rough Broken Land (Undifferentiated)				16,008	2,[illegible]65	18,373	1.99
Rough Stony Land (Undifferentiated)				285	1,541	1,826	.20
Rough Igneous Stony Land (Undifferentiated)				3,609	8,837	12,446	1.35
Dune Sand				672		672	.07
Totals:	39,941	93,246	36,314	40,248	13,715	223,462	24.18
Group Percentage:	4.32	10.09	3.90	4.39	1.48	24.18	

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TABLE II (Continued)

Soil Type	Group A	Group B	Group C	Group D	Group E	Totals	Percent Unit Total
			SUB-UNIT N , III				
Todilto Loamy Sand	33	24,293	6,9[illegible]0			31,256	3.38
Todilto Sandy Loam	15,609	20,162	298			36,069	3.90
Todilto Sandy Loam (Hard sub-soil phase)		2,699				2,699	.29
Todilto Sandy Loam (Shallow phase)	7,022	15,734	8,123			30,879	3.34
Cove Sandy Loam		4,071	6,104			10,175	1.10
Cove Loamy Sand			777			777	.08
Concho Sandy Loam	376					376	.04
Dinnehotso Sandy Loam		7,993	2,097			10,090	1.09
Dinnehotso Clay Loam	990	1,735	14,388			17,113	1.85
Crown Clay Loam	13,236	279				13,515	1.46
Crown Clay Loam			537			537	.06
Oraibi Sandy Loam			388			388	.04
Oraibi Loamy Sand			349			349	.04
Oraibi Clay			764			764	.08
Tolani Sandy Loam			1,405			1,405	.15
Tolani Clay Loam		285	4,136			4,421	.47
Tolani Loamy Sand		122				122	.01
Tolani Clay			4,135			4,135	.44
Dinnebito Sandy Loam	4,866	3,159			3,430	11,455	1.24
Dinnebito Clay Loam	1,197	1,502				2,699	.29
Soil Remnants			4,271	72,003		76,274	8.29
Rough Stony Land (Undifferentiated)				7,649	3,917	11,566	1.25
Rough Broken Land (Undifferentiated)					25,901	25,901	2.80
Rough Igenous Stony Land (Undifferentiated)				382	7,444	7,826	.85
Totals:	43,329	82,034	54,702	80,034	40,692	300,791	32.54
Group Percentage	4.67	8.88	5.92	8.66	4.41	32.54	

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TABLE II (Concluded)

Soil Type	Group A	Group B	Group C	Group D	Group E	Totals	Percent Unit Total
			SUB-UNIT NO. IV				
Todilto Loamy Sand	3,626	9,025				12,651	1.37
Todilto Sandy Loam	7,074	461	409	4,762		12,706	1.37
Todilto Sandy Loam (Hard sub-soil phase)	25,374					25,374	2.75
Cove Sandy Loam	4,066					4,066	.43
Crown Loamy Sand			1,397			1,397	.15
Crown Sandy Loam		351	3,046			3,397	.37
Crown Clay Loam			3,872			3,872	.42
Dinnehotso Sandy Loam		16,331				16,331	1.77
Dinnehotso Clay Loam		5,828	8,452			14,280	1.55
Dinnehotso Clay		5,288	14,622	214		20,124	2.18
Dinnebito Sandy Loam	370					370	.04
Tolani Sandy Loam		260	214			474	.05
Tolani Clay Loam			455			455	.05
Cottonwood Clay Loam	3,190					3,190	.35
Soil Remnants				19,933		19,933	2.16
Rough Stony Land (Undifferentiated)				800	10,795	11,595	1.25
Rough Broken Land (Undifferentiated)				5,476	17,145	22,621	2.46
Rough Igneous Land (Undifferentiated)				26,142	285	26,427	2.85
Totals:	43,700	37,544	32,467	57,327	28,225	199,263	21.57
Group Percentage:	4.73	4.32	3.77	5.69	3.06	21.57	
GRAND TOTALS:	184,202	261,248	159,212	222,767	96,653	924,082	100.00
GROUP PERCENTAGE:	19.91	28.53	17.45	23.65	10.46	100.00	

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d. Climatological Data:

Climatological data for this Unit was based upon elevation, vegetation and information from Land Management Reports on Units Nos. 4, 5 and 6. The annual precipitation is probably about 11-1/2 inches, the growing season approximately 140 days, and the average annual temperature 51°F. (See Table No. III).

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No.

TABLE III CLIMATOLOGICAL DATA*- - LAND MANAGEMENT UNIT NO. 7

Area or Station	Elevation	Avg. An. P'opt'n	Avg. An. Temp.	Max. Temp.	Min. Temp.	Avg. Dt. 1st Klg. Frost	Avg. Dt. Lst. Klg. Frost	Avg. Lgth. Growing Season
Southern Extremity	5350-5400	9½"	54°	101°	-10°	Oct. 15	May 15	150
Northeast Extremity Balah Kai Mesa	7400-7500	16"-17"	45°	94°	-15°	Oct. 5	May 25	130
Western Extremity Jeddito Wash	5250-5300	9"	55°	101°	-10°	Oct. 15	May 20	145
Indian Wells	5770	10"-10½"	53°	100°	-11°	Oct. 13	May 23	140
White Cone Flats	6200-6300	12½"	51°	99°	-12°	Oct. 12	May 21	135
Top Mesa Opposite Keams Canyon	6500	12½"-13"	50°	98°	-13°	Oct. 12	May 27	135

*These figures are estimates based upon elevation, vegetation and previous reports submitted on Land Management Units Nos. 4, 5, and 6.

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c. Relative Humidity, Evaporation & Wind Movements:

There are no records on the relative humidity, evaporation, and wind movements for this area but we do know that the relative humidity is low, probably ranging from 50 to 60 percent. Evaporation from soils and water storages is high. The highest evaporation occurs during May and June and it is estimated to approximately 70 inches per year. Prevailing wind is from the southwest. The highest wind velocity occurs during March and April. Records at Winslow have shown the velocity as high as 87 miles per hour. The great amount of dust and sand carried by these winds often results in damage to vegetation and structures.

3. ECOLOGICAL ZONATION:

a. Vegetative Zones and Types:

Vegetation on Unit No. 7 falls in the upper Sonoran Zone. For general purposes it can be grouped into four vegetative types: namely, grassland, browse, woodland, and waste.

Table No. IV shows the surface acres, percent of area, forage acres, carrying capacity, and percent of carrying capacity for each major vegetative type.

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TABLE IV VEGETATIVE TYPES

Forage Types	Surface Acres	Percent of Area	Forage Acres	Carrying Capacity	Percent C. C.
Grassland	468,468	50.70	78,862	31,544	61.68
Weeds	2,304	.25	123	49	.10
Sagebrush	62,748	6.79	11,595	4,638	9.07
Browse	157,846	17.08	19,673	7,869	15.39
Woodland	192,085	20.79	17,599	7,039	13.76
Waste	37,906	4.10	0	0	0
Cultivated	2,725*	.29	0	0	0
Totals:	924,082	100.00	127,852	51,139	100.00

*This figure does not agree with the acreage obtained by Agronomy because the Agronomy acreage includes only the actual acreage farmed. Also, the range survey was made in 1935 and the Agronomy survey in 1937.

The following is a list of the most common vegetative species found on this Unit:

GRASSES

Blue grass	Bouteloua gracilis
Galleta	Hilaria jamesii
Alkali sacaton	Sporobolus airoides
Sand dropseed	Sporobolus cryptandrus
Three awn	Aristida spp.
Spiny muhley	Muhlenbergia repens
Ring grass	Muhlenbergia torreyi

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SHRUBS:

Chamise	Atriplex canescens
Greasewood	Sarcobatus vermiculatus
Shadscale	Atriplex confertifolia
Salt bush	Atriplex cuneata
Snake weed	Gutierresia spp.
Yellow bush	Crysothamnus greenii
Rabbit brush	Crysothamnus biglovii
Mormon tea	Ephedra spp.
Big Sage	Artemisia tridentata
Sand sage	Artemisia filifolia

WEEDS

Russian Thistle	Salsola pestifer
Croton	Croton texensis
Colorado beeweed	Cleome serrulata
Lambs quarter	Chenepodium spp.

TREES

Pinon	Pinus edulus
Juniper	Juniperus spp.

The condition of vegetation is very poor on many parts of the Unit especially around trading posts and old water supplies. The largest and most outstanding of these areas are at Comah Springs, Seba-dalki Day School, Jeddito Trading Post, Indian Wells Trading Post, Skunk Springs, Montezuma's Chair, Saybitoh

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Well and Dilkon Dipping Vat. Numerous smaller areas are scattered over the entire Unit near old hogan locations and permanent water supplies. Such indicators of overgrazing as Snakeweed, Yellow bush, Rabbit brush and Russian thistle are found on all parts of the Unit.

"Bedding-out", proper distribution, and an adjustment in the numbers of livestock to the present estimated carrying capacity of the range would largely eliminate the present severe damage to the vegetation. Almost without exception, the vegetation on these areas farthest from permanent water is in the most vigorous condition and exhibits a higher percentage of higher palatability perennial grasses. (See Map No. 3).

b. Poisonous Plants (See Map No. 3)

Poisonous plant species found on Unit No. 7 include Whorled milkweed (Asclepias gallicides), Lupine (Lupinus spp.), Loco (Astragalus spp.), Death Camas (Zygadenus spp.) and Rayless goldenrod (Haplopappus heterophyllus).

Two areas are heavily infested with Whorled milkweed; one is near Castle Butte Trading Post and the other is five miles north of Indian Wells Trading Post. No death losses were reported but they would probably occur if they were grazed. If possible, these two areas should be treated to prevent further spread.

Lupine is found in scattering stands on the mesas west of Jeddito Trading Post but no death losses were reported.

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Loco is scattered over the larger portion of the Unit but is most concentrated in Na-ah-tee Canyon. Very few losses were reported.

Death camas and broadleaf milkweed are not sufficiently abundant to be of importance.

Rayless goldenrod is found in scattering stands in the southern end of the Unit. Very few losses were reported but some may occur when snows cover up the other vegetation or during severe droughts. This plant is locally known as "Rosilla".

4. DEVELOPMENTAL IMPROVEMENTS:

a. Population and Population Centers:

Approximately 1,856 people or 232 consumption groups with an average number of 8 people per group live in Unit No. 7. They are scattered over the entire Unit with heavy concentrations along Jeddito Wash, White Cone Flat, and Indian Wells. They are distributed by Sub-Units as follows:

Sub-Unit	People	Consumption Groups
1	463	57
2	673	79
3	507	71
4	213	25
Totals:	1,856	232

The availability of farmland and stock water probably are the major reasons for these concentrations. In almost every case, permanent water is available within one-quarter to two miles from hogan locations. Several Hopis farm along the Jeddito Wash but live in the Hopi villages in Unit No. 6. Quite a number of

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people in this vicinity are part Navajo and part Hopi but they consider themselves Navajo. (See Map No. 4).

b. Roads and Telephones:

Highways, secondary roads, car trails, and wagon roads make practically all areas accessible to car. One primary road enters the south boundary north of Holbrook and leaves the Unit at Keams Canyon. A secondary road enters the south boundary north of Winslow and leaves the Unit south of Badger Butte. Another secondary road runs from Indian Wells west by way of Dilkon to Leupp.

There is a moderate supply of telephones on the Unit, one being located at each of the following places: Seba-dalki Day School, Cedar Springs, Dilkon, Indian Wells, Bida-ho-chee, White Cone and Jeddito, with a switch board at Indian Wells. (See Map No. 9 for roads and telephone lines).

c. Trading Posts, Schools and Hospitals:

There are eight trading posts serving the Unit; namely, Jeddito, White Cone, Indian Wells, Bida-ho-chee, Na-ah-tee, Dilkon, Teestoh, and Castle Butte. Some trade goes off the Unit to Greasewood, and Steamboat in Unit No. 17, to Keams Canyon in Unit No. 6 and to Winslow, Holbrook and other stores along the Highway 66.

School facilities are very scarce, there being only one day school, which is Seba-Dalki. However, a number of childfen attend the boarding schools at Leupp and Keams Canyon. The Dilkon-

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Indian Wells country is badly in need of a school.

There are no hospitals on the Unit. The hospitals at Keams Canyon and Leupp are used to some extent by these Indians and a field nurse from Leupp visits Seba-Dalki and Cedar Springs about once a week.

C. EFFECT OF ENVIRONMENT ON HUMAN ACTIVITIES:

For many years, the people in the southern end of this Unit have lived close to and grazed their livestock with white stockowners. The type and quality of the Indian livestock have been greatly improved through the use of white-owned sires. The association of these people with English and Spanish speaking peoples has resulted in a large number of them being able to speak English or Spanish.

The lack of woodland in the southern portion has had an influence upon the type of hogans in this section. Hogans are often made of rock and brush. Much of their fuel consists of various browse plants, such as Chamise, Rabbit brush and greasewood.

The people in the northern portion of the Unit have not had so many contacts with white stockmen. Their livestock and customs are more like those Indians who live in the more isolated parts of the Reservation. They rely heavily upon the woodland, which is abundant, for fuel and hogan material. The people in this section trade with the Hopis in Unit No. 6, exchanging wood and meat for agricultural crops.

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The lack of adequate school facilities has resulted in a large number of the people in Unit No. 7 being uneducated. Hospitals are relied upon very little, probably because of the great distances from trading posts, and make few trips in for supplies.

All of the above factors have a tendency toward causing these people to be more backward than many of the other Indians on the Reservation.

D. HUMAN ACTIVITIES:

1. LIVESTOCK AND RANGE:

a. Present Resources:

(1) Area and Carrying Capacity:

The present estimated maximum yearlong carrying capacity is 51,139 sheep units or 613,668 sheep months.

All of Unit No. 7 may be classed as yearlong range and is adapted to the grazing of either cattle or sheep. Browse is moderately abundant and there are enough trees in the northern portion (Balakai Mesa) to afford ample protection from winter storms. The central and southern portions are more open and more livestock losses occur here than in the higher portions of the Unit farther north. However, snow does not usually get so deep nor last so long on these portions so that few losses should occur if the range is not carrying too many livestock. Most of the death losses that occurred last winter resulted from an overstocking of the range to such an extent that many animals entered the winter in a weakened condition. Therefore, the proper adjustment of livestock numbers and the proper animal husbandry practices

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would do much toward eliminating winter death losses.

Table V is an analysis of the area and carrying capacity estimates by Sub-Units:

TABLE V — AREA AND CARRYING CAPACITY — F.A.R.= 2.5

Sub-Unit	Surface Acres	Percent of Area	C.C. S.Y.L.	Percent of C.C.	S. A. per S.Y.L.
1	200,566	21.70	9,727	19.02	20.6
2	223,462	24.18	12,445	24.34	18.0
3	300,791	32.56	17,505	34.23	17.2
4	199,263	21.56	11,462	22.41	17.4
TOTALS:	924,082	100.00	51,139	100.00	Av. 18.1

There is no essential difference between the sub-units as to the surface acre requirement per sheep unit yearlong. Sub-Unit No. 1 includes part of Balakai Mesa, the west slope of which is somewhat broken and steep, resulting in a few small inaccessible areas. In the more dense woodland areas, the stand of grass is not so thick as on the more open country farther south. Sub-Units Nos. 3 and 4 include practically all the Painted Desert formations which have a very low carrying capacity. In Sub-Unit No. 2 there is one large area - White Cone Flat - which is severely overgrazed.

(2) Seasonal Use and Class of Stock:

Unit No. 7 is used as a year-long range. The vegetation will allow for this range to be used year-long in the future. If seasonal use would be desirable, any part of the range may be used

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at any season of the year desired. Browse is moderately abundant in all parts of the Unit but the southern portion offers less protection during winter storms than does the northern portion. The abundance of sage brush and woodland in the northern portion makes this area valuable as winter range. Snows sometimes get quite deep on the northern portion but probably fewer losses occur in this region than on the southern part where there is less browse and less protection. Excessive numbers of livestock and the present improper herding practices are the chief causes of losses rather than inclement weather conditions or a lack of browse. Therefore, a proper adjustment of the numbers of livestock and proper animal husbandry practices would materially reduce such death losses. The range in this Unit is adapted to the grazing of either cattle or sheep but since sheep more nearly fit into the living conditions of the Navajo, they should be considered above cattle.

(3) Range Improvements:

Water developments are rather numerous but permanent waters are not well distributed. Oftentimes, several springs are located within one to three miles of each other. The survey shows a total of 244 water developments, 136 of which are permanent supplies. There is an average of one permanent water for every 6,934 surface acres, which should be sufficient if they were properly distributed. Classification of the livestock water is as follows:

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76 Government Surface Tanks --- Temporary

4 Government Surface Tanks --- Semi-permanent

14 Indian Surface Tanks ------- Temporary

73 Developed Springs ---------- Permanent

1 Developed Spring ---------- Temporary

2 Undeveloped Springs -------- Permanent

8 Undeveloped Springs -------- Temporary

6 Deep Drilled Wells --------- Permanent

52 Shallow Dug Wells ---------- Permanent

1 Indian Shallow Dug Well ---- Permanent

7 White owned developments
on Patented Land

244 Water Supplies.

Approximately 75 percent of the surface tanks have not filled since they were built, due to their location and the low rainfall. The drainages are too flat and sandy. Permanent water is very difficult to obtain where it is needed because of the depth. One new well has been proposed for the proposed buck pasture near Dilkon. Redevelopment of a few springs and maintenance work on several other supplies should result in a fair amount of water on this Unit. (See Map No. 3).

There are four dipping vats serving this Unit and they are rather well located with reference to livestock concentrations. They are at Dilkon, Indian Wells, Comah Springs and Jeddito. (See Page No. of this report). The range adjacent to all four

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of these vats is in a critical condition. The land is practically barren and wind erosion is very severe, especially at Dilkon, Comah Springs and Jeddito. The use of the permanent water supplies at these locations for many years is the cause of the denudation rather than the presence of the dipping vats. If possible, the majority of the livestock should be kept away from these locations except at dipping time to allow the perennial vegetation to reclaim the denuded areas.

There are several fenced areas south of the 35°30' parallel of latitude, all except two of which were fenced by white stockowners or Indians. The Government built a buck pasture of approximately 320 acres near Indian Wells and one of approximately 640 acres near Cedar Springs. Neither pasture has livestock water within it and both are too small to be of value as buck pastures. The south boundary of the Unit is fenced with a good five-strand fence.

(4) Wildlife:

(a) Big Game Mammals:

Deer and antelope once ranged in what is now Unit No. 7 but the present livestock and human populations renders this area unsuitable to these animals.

(b) Small Game Mammals:

Prairie dogs, jack-rabbits and cottontails are found on the Unit. Prairie dogs are found on all parts of the Unit except in the Pinon and Big sage types and on the Painted Desert. Jack-rabbits are not common and cottontails are common only in the more

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sparsely populated portions.

(c) Migratory Waterfowl:

The only migratory waterfowl on the Unit are found during migration. No suitable breeding grounds are present. Several of the livestock reservoirs offer resting and feeding places but no more.

(d) Upland Game Birds:

Upland game birds are very scarce except Mourning Doves which are widely scattered over the Unit. A few Scaled Quail and no Gamble Quail were seen on the Unit. There is no evidence that there ever were turkey in this Unit. The present vegetative cover is not suitable for quail or turkey.

(e) Furbearers:

Coyotes are rather common but are of little value as furbearers because the Navajo will not kill them. Bobcats are common in the rougher parts of the Unit but are of little value as furbearers. Badgers, foxes and skunks are rare. Lions are seldom heard of.

(f) Rodents:

Prairie dogs and kangaroo rats are common on the Unit. They have very little value as furbearers or human food. Rock squirrels, chipmunks, wood rats, pocket gophers, and porcupines are fairly abundant but no important use is made of them. The same is true of miscellaneous mice.

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(5) Value of the Land:

The chief value of the land in this Unit is for watershed and grazing. It is an important watershed area because it includes the headwaters of one large drainage system - Jeddito Wash - and several smaller drainages. The agricultural value is limited because of lack of suitable soil, water storage and diversion possibilities. The present cultivated area is approximately 1,540 acres or .16% of the total area. Probably the maximum that the agricultural land can be increased would be about 17,064 acres or 2.2% of the total area. Value of this agricultural land, however, is high in comparison to the range land. The woodland areas in the northern part of the Unit have a definite value for the production of woodland products, such as posts, poles, mine props, and fuel wood. Many of these products can be used in Unit No. 6. It is doubtful if the present acreage of woodland can be increased but in the course of 125 to 150 years, the production may be increased providing proper grazing and woodland management methods are adhered to. In view of the scarcity of woodland products in much of the area, the woodland probably has a greater value per acre than does the rangeland. Outside of the 192,085 acres of woodland and the 17,064 acres of present potential agricultural land, the principal income from this Unit will be derived from grazing of domestic livestock, and the whole area is a part of the watershed and included in the Little Colorado River drainage, and anything that can be

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done in the way of controlling silt and water runoff will have a definite bearing upon the Little Colorado River stream channel and Meade Lake.

b. Utilization of Range Resources:

(1) Present Stocking:

Sheep dipping records for 1937 show a total of 27,488 grown sheep and 2,638 grown goats. The horse and cattle roundup which was completed in October 1937 shows a total of 1,483 grown cattle and 3,342 grown horses, or a total Indian stocking of 52,768 sheep units or an overstocking of 3.2 percent. If we deduct the 194,190 acres of white and railroad owned lands, which have a carrying capacity of 11,049 sheep units, Unit No. 7 would be 27.56 percent overstocked on the basis of sheep of the 1937 sheep and goat dipping records and the 1937 horse and cattle roundup count. There are several white stock owners who own their land and lease quite a quantity of land in this Unit. At times these men graze large numbers of cattle and a few horses so that the above figures of present stocking are not complete. It has been estimated that 800 head of white-owned cattle or 2,667 sheep units yearlong graze this Unit for approximately eight months each year. Also there is some range along Jeddito Wash which is used by Hopi livestock, their number being estimated at approximately 2,500 sheep units yearlong. A record of the stocking by sub-units was not obtained. In all probability the number of livestock shown in this report is low.

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NN003796

(2) Relation of Stock to Carrying Capacity:

As stated above, the estimated maximum carrying capacity is 51,139 sheep units yearlong, and the present stocking 52,768 sheep units yearlong, or an overstocking of 3.2 percent.

Table No. V, Page No. 28, shows the area, percent of area, carrying capacity sheep units yearlong, percent of carrying capacity, and surface acres per sheep unit yearlong.

The heaviest livestock utilization occurs around Indian Wells, Dilkon, and along Jeddito Wash. (See Map No. 5). In the southern portion of the Unit, there are areas which are too far from permanent water to be grazed year-round. Therefore, these areas do not show such heavy utilization.

(3) Distribution and Livestock Movements:

The heaviest livestock concentrations are adjacent to concentrated farm areas and population centers. This condition is especially true in the Jeddito Valley in Sub-Units 1 and 2, White Cone Flat in Sub-Unit 2, and Indian Wells in Sub-Unit 4. It seems the heavy livestock concentrations are in Jeddito Valley and White Cone Flat during the summer. During winter, many of these families move with their livestock to the wooded mesa areas at Balah Kai Mesa where fuel is more plentiful and protection from winter storms is more abundant. In the southern portion of the Unit, people tend to stay in one place throughout the year, principally because farmland is scattered and there are no woodland areas large enough to be of consequence, in the production of fuel and protection.

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NN003797

There are a number of people that move from Unit 4 and Unit 17 to Balah Kai Mesa in the winter. Apparently there are few long shifts of livestock but the movements that do occur are of major importance in the use made of the range. The relative range utilization and livestock movements are shown in Map No. 5.

(4) Seasonal Use:

As explained in the preceding paragraph, Jeddito Valley and White Cone Flat are used most heavily during the summer and Balah Kai Mesa is used most heavily during the winter. On the whole, the Unit may be said to be used yearlong. The vegetation and climate permits yearlong use for this area. If seasonal use is desired in the future to obtain more efficient and satisfactory use of all resources, any part of the range may be used at any time of the year desired with the possible exception of Balah Kai Mesa, which probably under the most efficient system of grazing should not be used during the dry spring and early summer seasons.

(5) Animal Husbandry Practices:

(a) Selection:

The same errors that are made on the remainder of the Navajo Reservation in the selection of breeding stock are found on this Unit. Probably the most important error is the sale of all the more growthy and vigorous livestock and the retention of runts and less thrifty animals for the breeding herd or flock. The better livestock are usually found in the larger herds and flocks in the southern portion of the Unit. The larger owners tend to

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exercise more breeding control and better grazing methods which results in more uniform and better condition and proper increase at selling time. Also they buy more sires than the smaller operators. The smaller owners invariably raise their own sires, practice no breeding control, and are forced to sell only those animals which the traders will take. This practice results in the running down of their flocks. Generally speaking the cattle are more desirable in type and quality than the sheep. The reasons for this are the purchasing of bulls by the Government and the Navajo use of white owned bulls in the southern part of the Unit.

(b) Bucks and Bulls)

A number of slightly improved bucks and bulls are found in the southern portion of the Unit. Many of the sires are too old to be of but little service, and all sires are often in poor condition at breeding time. Very few of the sires are given extra care during winter and spring. Oftentimes improved bucks and bulls die during the first winter. Sires should be imported early and given extra care until they become acclamated to the climate and learn the range.

(c) Breeding and Lambing:

Invariably all lambing is too early, resulting in death losses of lambs and calves, ewes and cows among the flocks of the smaller owners. Lambs are born in all seasons of the year, resulting in an uneven lamb and calf crop at selling time. Many cows and ewes lamb too young. All of these errors can be corrected through proper bfeeding control.

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NN003799

(d) Docking and Castrating:

While lambs are often undocked and ewe lambs docked too long, buck lambs and bull calves should be castrated younger than is the case in most instances. The proper docking of sheep should result in increased sales and increased lamb crop. Proper castrating of ram lambs and bull calves should increase the income from these animals. One reason for the practice of not castrating young enough is an attempt to increase the weight of the animals at selling time. The fact is that such a practice results in just the opposite as well as a decrease in the price per pound.

(e) Shearing:

Practically all the shearing is done by hand although many of the larger owners and some of the smaller ones would probably use machine shears if they were made available. The wool is unsorted and is not kept clean and is not tied. Shearing dates are usually too early, resulting in some death losses, lighter fleeces, high foreign material content, and a handicap to bucks at breeding time. Cases have been noted where some of the smaller owners partially shear sheep during mid-winter so as to trade the wool for groceries and clothing. Much of the wool clipped is used in the manufacture of blankets and is the wool in its virgin state. Shedding of wool is not caused from shearing too late but is due to a feverish condition which may be induced by too early lambing or lack of water.

(f) Herding:

The most common errors in herding practices are: corralling in the same place for a long period of time, herding too closely,

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trailing from water to feed and back to the corral, corralling too early in the afternoon, keeping flocks in too late in the morning, herding too fast, and grazing the same spot for months at a time. Wet ewes, dry ewes, bucks, and wethers are very often not separated at lambing time.

Cattle are seldom properly handled when gathered for market or for any other purpose.

(g) Salting:

Survey of trader records show a total of 4.7 tons of salt were sold to the Indians in this Unit. On the basis of the 1937 dipping records, an average of approximately 147 tons would be required annually. Although the abundance of salt-bearing forage and the salt content of stock water may materially reduce the salt requirements in breeding animals, a larger quantity of salt is required for these livestock than was used last year.

(h) Supplemental Feeding:

Outside of the feeding of some hay and grain to horses and a small amount of canned and dried milk to lambs during the winter and early spring, supplemental feeding is practically unknown. 226 tons of hay, 23 tons of oats, and 18 tons of corn were purchased by these Indians in 1937. Most of this feed was fed to horses but some may have been fed to sheep and cattle during the severe winter snowstorms that year. Supplies of water and suitable land are so small that the possibility of raising hay or other crops

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for supplemental feed is negligible. Therefore, this range must be mentioned in such a way that little supplemental feed will be necessary. Supplemental feeding of such feeds as cottonseed cake, grain or alfalfa hay to bucks and bulls should be an important part of our future program.

(6) Livestock Pests and Diseases:

Grub-in-the-head, ear ticks, and lice are probably the most abundant sheep pests but they are controlled to a large extent by dipping in the spring and early summer. Scabies infestation was severe at one time but no cases have been reported for several years.

Lice, heel flies, and horn flies are the most damaging cattle pests. Heel flies and horn flies cause considerable damage during spring and summer, and lice cause most damage in the spring.

Dourine in horses was serious at one time but no cases have been reported since 1928. Black leg may cause some losses in cattle but none have been reported.

(7) Range Rodents:

Prairie dogs and kangaroo rats are doing considerable damage to the range in parts of this Unit.

Prairie dogs are scattered over practically all of the Unit but are more concentrated along White Cone Flat, near Cedar Springs, and northwest of Teestoh Trading Post. (See Map No. 6). In 1935 and 1936 the U. S. Biological Survey poisoned prairie dogs along Peshbitoh Wash, in the White Cone Flats, and along the north

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NN003802

side of the Jeddito Wash but reinfestation is heavy and considerable damage is being done in these areas at the present time. All of the areas mentioned above are badly in need of prairie dog control. There are approximately 174,840 acres infested with prairie dogs, 103,679 acres of which have an average of three dens per acre and 68,703 have an average of one den per acre.*

Kangaroo rats are doing considerable damage, especially along the Jeddito Wash, and are scattered over the rest of the Unit also.

(8) Predatory Animals:

Coyotes are the most abundant and are the [illegible] of the most livestock losses from predatory animals. No los[illegible] were reported during the survey but some losses probably occur from time to time. The white ranchers south of the Reservation claim that coyotes from the Reservation cause them considerable loss. The heaviest concentration of coyotes was found on Balakai Mesa but they are also numerous in the southern portion of the Unit.

A few bobcats are found in the rougher woodland areas and in the Hopi Buttes country, but they probably cause few losses.

(9) Poisonous Plants:
(Refer to Map No. 3)

Poisonous plant species found on Unit No. 7 include Whorled milkweed (Asclepias gallioides), Lupine (Lupinus spp.), Loco (Astragalus spp.), Death camas (Zygadenus spp.), and Rayless goldenrod (Haplopappus heterophyllus).

*From Biology Branch Report by
Gale Monson, Jr. Biologist, 1937.

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Two areas are heavily infested with Whorled milkweed; one is near Castle Butte Trading Post and the other is five miles north of Indian Wells Trading Post. No death losses were reported but they would probably occur if they were grazed. If possible, these two areas should be treated to prevent further spread.

Lupine is found in scattering stands on the mesa west of Jeddito Trading Post but no death losses were reported.

Loco is scattered over the larger portion of the Unit but is most concentrated in Na-ah-tee Canyon. Very few losses were reported.

Death camas and broadleaf milkweed are not sufficiently abundant to be of importance.

Rayless goldenrod is found in scattering stands in the southern end of the Unit. Very few losses were reported but some may occur when snows cover up the other vegetation or during severe droughts. This plant is locally known as "Rosilla".

c. Marketing:

(1) Home Consumption:

Very few records were obtained on the number of livestock and livestock products consumed at home. On the basis of what meager information was obtained, there seems to be a tendency for those people with the least agricultural land or wage income to consume more livestock and wool per capita. There seems to be some correlation between the size of the flock and the number of

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rugs sold. The larger owners apparently weave fewer rugs than the smaller owners. How much of the wool went into the rugs woven by the smaller owners was purchased from traders, large livestock owners, and miscellaneous is not known. In the light of the present information, all we can say is that a percentage of livestock is consumed at home and that some of the wool is used for rug making.

(2) Sale by Trade and Barter:

The majority of the income from livestock is derived from the sale of live animals. (See Page No.). A small amount of beef and mutton are sold to the traders at Keams Canyon Agency and Seba-Dalki Day School. Some barter, no doubt, is carried on between the Indians themselves, and some trading of cows or horses or some sheep to another for agricultural products.

2. FARMING:

a. Present Resources:

(1) Present Farmland:

(a) Acreage and Type:

There are 1,540 acres of flood-irrigated farmland. None was classed as dry-farm or irrigated.

(b) Location and Distribution:

Location of farmland is shown on Map No. 10 and is distributed by sub-units, as follows:

Sub-Unit No. 1 - 268 Acres

Sub-Unit No. 2 - 820 Acres

Sub-Unit No. 3 - 236 Acres

Sub-Unit No. 4 - 216 Acres

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Principal concentrations are along Jeddito Wash and at Indian Wells. The remainder of the land is quite widely scattered. There are 173 acres of land along Jeddito Wash which is owned by Hopi Indians. There are an additional 16 acres which are jointly owned by Hopi and Navajo.

(c) Agricultural Soils:

Table No. VI is a summary of the agricultural soil groups by Sub-Units as taken from the "Soils and Erosion Report" by L. A. Hill:

TABLE NO. VI — POTENTIAL AGRICULTURAL SOIL TYPES BY AGRICULTURAL SOIL GROUPS (Acres)

Sub-Unit	A	B	C	D	Total
No. 1	-	7,490	13,743	-	21,233
No. 2	10,817	37,397	9,570	2,643	60,427
No. 3	9,203	21,637	14,852	18,199	63,891
No. 4	260	29,120	19,314	15,110	63,804
*Totals:	20,280	95,644	57,479	35,952	209,355

*The amount of potential farmland that can be developed is limited by the water supply. Therefore, this total figure does not agree with the actual acreage of potential agricultural land.

The slope, erosion, alkali, drainage, soil texture, soil permeability, and water holding capacity are the limiting factors in the classification of agricultural land.

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(d) Yields:

No actual measurements of property-use were made on this Unit. All yields were ocular estimates made in the field at the time of the survey. Due to the low rainfall during the summer of 1937, the yields may be below the average for a 10-year period. The principal crops are corn, beans, melons, oats, and blue stem pasture.

The following table, (Table No. VII), shows the present average production and expected average production of the above crops:

TABLE NO. VII PRESENT AND EXPECTED CROP YIELDS

Crop	Present Average Production	Expected Average Production
Corn	11 bu.	20 to 25 bu.
Beans	95 lbs.	200 to 250 lbs.
Melons	1,000 lbs.	1,500 to 2,000 lbs.
Oats	800 lbs.	1,500 lbs.
Bluestem	800 lbs.	1,500 lbs.

(2) Potential Farmland:

(a) Acreage, Type and Location:

By diversion and economical use of flood water, an additional 224 acres of land may be put under cultivation. All potential land falls in the agricultural land classifications

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"A" and "B", there being five acres of "B" land and 219 acres of "A" land, and is distributed as follows:

Sub-Unit No. 1 - 28 Acres

Sub-Unit No. 2 - 71 Acres

Sub-Unit No. 3 - 24 Acres

Sub-Unit No. 4 - 101 Acres

(b) Expected yields:

Refer to Table No. VII, Page No. 45.

(3) Wildlife and Agricultural Land:

(a) Rodents:

Rats, prairie dogs and ground squirrels do considerable damage to crops in the southern and central portions of the Units. The principal damage is done during the planting season by the removal of seed.

(b) Plant Diseases and Insects:

No diseases of agricultural crops were reported in this Unit.

Crop pests include cut worms, grasshoppers, army worms, potato bettle, plant lice, wire worms, and corn borers. Cut worms appear to be the principal source of insect damage. Grasshoppers reach epidemic proportions once in a great while. Army worms, potato bettles, plant lice, wire worms, and corn borers are of miscellaneous consequence but all of them together do cause some damage to agricultural crops.

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109°30' x 37°15'

9Y-26 Indian Constructed Reservoir - Temporary.
Location: 3.7 W. x 4.7 S.
Capacity: About 10,000 sheep days.
Condition: Has no spillway. Drainage very short.
Remarks: Probably holds water two or three weeks after a heavy rain in immediate vicinity. Not worth developing.

9Y-27 Developed Spring - Permanent.
Location: 3.3 W. x 6.1 S.
Capacity: 1/2 gal. per minute. 500 sheep per day.
Condition: Fair. No repairs needed immediately.
Remarks: Sample taken 8-27-36.

9Y-28 RCW Reservoir - Temporary.
Location: 2.0 W. x 9.6 S. About 5 miles north of Boundary Butte.
Capacity: 0
Condition: Good. No repairs needed.
Remarks: This development is worthless. Has never held any water, and indications are that it never will.

9Y-29 Developed Spring (II) - Permanent.
Location: 1.6 W. x 9.5 S. 5 miles north of Boundary Butte on main road.
Capacity: 4 gal. per minute. 2000 sheep per day.
Condition: Good. No repairs needed.
Remarks: Sample taken 8-27-36.

9Y-30 Shallow Well - Permanent.
Location: 2.2 W. x 14.3 S. At Boundary Butte Dipping Vat
Capacity:
Condition: Good.
Remarks: There is no pump; and, as the well is fairly deep, water is not used except at dipping time. Other water close.

9Y-31 RCW Spring & Trough - Permanent.
Location: 2.8 W. x 14.9 S. One mile north of Boundary Butte just on east side of main road.
Capacity: 1 1/2 gal. per minute. 2500 sheep per day.
Condition: Good. No repairs needed.
Remarks: Sample taken 8-27-36.

9Y-64 RCW Reservoir #38 - Temporary.
Location: 2.6 W. x 2.1 S. In head of Piute Spring Canyon.
Capacity: 2.1 Ac. Ft. 1000,000 S. D.
Condition: Good. No repairs needed.
Remarks: Has about 6' water at present. Silt fence just recently completed. Black brush range.

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(4) Present Utilization of Farm Resources:

(a) Present Crops:

The most important crops, as stated above, are corn, beans, melons, oats, and blue stem pasture. The present yields can be increased by: the proper subjugation of the present farmland, more efficient use of water, better selection of seed, correct use of simple farm machinery, crop rotation, fall plowing, strip cropping where wind erosion is serious, and improved seed bed preparation.

The following table, (Table No. VIII), shows the crop acreages by sub-units:

TABLE NO. VIII CROP ACREAGES BY SUB-UNITS

Sub-Unit	Corn	Melons	Beans	Oats	Peaches	Idle	Total
1	216	20	8	15	Meadow 6 1	2	268
2	783	15	12	-	Meadow 5	5	820
3	211	17	-			8	236
4	195	12	4			5	216
TOTAL	1405	64	24	15	Peaches 1 Meadow 11	20	1540

(5) Present Farm Methods:

(a) Type of Farming:

Extensive farming is the general practice. More intensive farming, however, appears to be practiced by a few Hopi farming along Jeddito Wash. Corn is planted by hand directly behind the plow or is put in the ground with a stick or hoe. A hoe and horse

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drawn blades are used for weeding and cultivation. Water used on the farm comes from small floods in contributing watersheds. No irrigation water is taken from the large drainages. The proper use of this water is seldom made, resulting in excessive erosion and a minimum moisture penetration.

(b) Location of Farms:

Farms are located on alluvial fans, the soil on which is usually a sandy loam, loamy sand or sand. Soils of this type are subject to severe wind erosion and severe wind erosion is prevalent in many cases.

(c) Harvesting and Storing:

All crops are harvested by hand. As soon as the crop is harvested, livestock are allowed to graze the fields. A pulverization of surface soil by the trampling of livestock and complete removal of all stubble and other vegetation are conducive to severe wind erosion.

Corn is dried in the sun, shelled, sacked, and stored in under-ground bins or sold to the traders. The small acreage or bins present no harvesting problem at the present time. A great deal of the corn is consumed by Indians while it is in the milk or dough stage. Instances have been noted where large families have consumed the entire crop while it is in the "roasting-ear" stage.

(6) Marketing:

(a) Home Consumption:

No records on the home consumption of farm crops were

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obtained. In all probability almost all of the agricultural products are consumed at home.

(b) Sale and Trade:

The figures obtained from the traders show that an extremely small amount of agricultural products were purchased from the Indians. No doubt, there is some barter among the Indians. Now and then one Indian will trade agricultural products for livestock and fuel.

3. WOODLAND:

a. Present Resources:

(1) Acreage and Location:

In Unit No. 7 the total woodland area is 192,290 acres and is composed of Juniper and Pinon, averaging about 68 percent Juniper and 32 percent Pinon. The major portion of the woodland is in Sub-Unit No. 1 at Balah Kai Mesa. There is only a small amount of woodland on any of the Hopi Buttes. (See Map No. 11)

(2) Density and Condition:

171,500 acres fall in Density III, having an average crown cover of 10 percent and an average composition of 74 percent Juniper and 26 percent Pinon. 20,790 acres fall in Density II with an average crown cover of 36 percent and composition - 84 percent Pinon and 16 percent Juniper. Density II stands are found almost entirely on Balah Kai Mesa in the northeast corner of the Unit.

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Woodland falls in Conditions "A", "B", and "C", there being 7,740 acres in Condition "A", 10,440 acres in Condition "B", and 174,110 acres in Condition "C". All of Condition "A" and the majority of Condition "B" are found on Balah Kai Mesa.

(3) Available Products:

In Sub-Unit No. 1 only the stands in Condition "A" and "B" are considered in good enough condition for further cutting of live trees. There are 18,180 acres of full-use stands in the Unit. In this area, 111 Juniper mine propers and 14 Juniper posts per acre are available. The present volume of live trees averages approximately 550 cu. ft. per acre. The average annual increment 2.54 cu. ft.

In the stands of Condition "C" and "B" the amount of dead fuel wood averages 60 cu. ft. or 1½ cords per acre. The stands in Condition "C" are approximately 4 cut. ft. or 1/100 a cord of dead fuel wood per acre. The average for the whole Unit is approximately 1/4 cord per acre. On this basis, the total volume of dead fuel wood would be approximately 27,270 cords in stands of Condition "A" and "B", and 16,970 cords for stands in Condition "C", or a total of 44,240 cords.*

Good yields of pinon nuts may be expected in stands of Condition "A" and "B". Stands of Condition "C" of the average composition are 75 percent Juniper and 26 percent Pinon, and an average crown cover of 10 percent, with the result that little return can be expected.

*Based on ricked cord of 40 cu. ft.

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The use of browse plants such as Chamise, Greasewood, and Rabbit Brush, is a serious practice in the southern portion of the Unit where little wood is available.

(4) Grazing Values:

The grazing value of all the woodland in Unit No. 7 is rather high but is not so high as that on the more open areas in the central portion of the Unit, the reason being density, usually lower, and the terrain more broken.

(5) Watershed Value:

The watershed value of the woodland is relatively important since the most important woodland stands are located on the headwaters of Leams Canyon, Jeddito and Beshbitoh Washes. The high mesa escarpments in rocky areas contribute a great amount of runoff. Grass and shrubs usually do not grow as abundant on these areas as do trees. Therefore, the woodlands have a very important watershed value. In the southern portion of the Unit, the value as watershed areas are not so important because of their small extent, and the type of soil on which they grow. One exception to the latter, however, is located in the upper part of Na-ah-teh drainage where the stands are rather dense and vigorous.

(6) Wildlife:

The principal wildlife found in the woodland stands consists of the following: rock squirrels, chipmunks, wood rats and mice. Porcupine are rather common in many of the scattered Pinon stands. During the summer, such predatory animals as coyotes are

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abundant in the woodland stands in the northern portion of the Unit. Bobcats are common on Balha Kai Mesa.

b. Utilization of Woodland Products:

(1) Cutting Practices:

Much of the woodland in Unit No. 7 has been subjected to severe cutting for many years. Only the rougher, more inaccessible portions still remain in normal condition. In the vicinity of Jeddito Trading Post adjacent to hogans, cutting has been very severe. The same is true on top of the mesas on each side of Keams Canyon and Talahoga Canyon, and at Blue Bird Springs a heavy over-cutting has also occured in some of the less expensive stands in the southern part of the Unit. Least cutting is found in the rough, more inaccessible areas at Balha Kai Mesa and at Na-ah-tih Canyon.

(2) Pests and Diseases:

Most insect infestations were found to be of an endemic nature and, therefore, not serious. The most common species is ips. One small area on the Balha Kai Mesa is found to be intensively damaged by this bark boring bettle but it is not certain that it has been the primary cause of the death of trees. It is likely that some fungus blight has been responsible for the initial attack. Intensive infestations of tent caterpillars were found on some of the best Pinon stands on Balha Kai Mesa, and most of the woodland stands in this Unit are seriously infected with Mistletoe and an unidentified form of blight. The blight attacks Juniper most, causing high mortality in places. Mistletoe is prevalent in

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both Pinon and Juniper.

Porcupines have done a great deal of damage to Pinon particularly in reduction of stands in the northern part of the Unit. Near canyons, mesas, and escarpments, 40 percent of the Pinon has been seriously damaged, some of it fatal.

(3) Fire Damage:

Negligible

(4) Wind Damage:

Negligible

(5) Grazing Damage:

Grazing has been a cause of serious damage to reproduction in Condition "C" areas and of moderate to no damage in Condition "A" and "B" areas. Grazing damage is due principally to overstocking and to grazing of the woodland areas during the dry spring and summer months.

c. Marketing:

(1) Home Consumption and Sales:

Most of the woodland products that are used are consumed at home. However, a quantity of fuel is used by the Hopi in Unit No. 6. Also, some fuel wood and posts are used in Units Nos. 17 and 4, and a small amount of wood is sold to the traders. Also, there is a quantity of wood traded to the Hopi Indians for agricultural products. No information is available but probably some wood is sold to Hopis for cash.

Most of the pinon nuts that are harvested are sold to the traders for cash or exchanged for household supplies and groceries.

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4. INCOME:

The following table, (Table No. IX), shows an analysis of the commercial and non-commercial income for Unit No. 7:

TABLE NO. IX INCOME*

Item	Commercial			Non-Commercial	Total Income	% Total Income	Total per Capita Income
	Amount	%	Per Capita				
Wages	$58,710.00	31	31.63	-	$58,710.00	24	31.63
Livestock	97,710.00	51	52.65	$27,240.00	124,950.00	50	67.33
Agri.	1,760.00	1	.95	29,120.00	30,880.00	13	16.64
Rugs	25,930.00	13	13.97	-	25,930.00	10	13.97
Misc.	7,820.00	4	4.21	-	7,820.00	3	4.21
TOTALS:	191,930.00	100	103.41	56,360.00	248,290.00	100	133.78

*Wage income was obtained from various Government Agency reports, and trader reports. The non-commercial income was obtained from the Indians, from the traders, and from the Agronomy acreage figures.

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The commercial income from livestock is further broken down as follows:

Sheep, goats and lambs --	$34,740.00
Wool and mohair ----------	36,030.00
Cattle ----------	18,710.00
Meat ----------	6,220.00
Pelts and hides ----------	2,010.00
TOTAL:	$97,710.00

Commercial income from Agriculture is broken down as follows:

Corn ----------	$ 1,620.00
Hay ----------	90.00
Beans ----------	10.00
Melons ----------	30.00
Peaches ----------	10.00
TOTAL:	$ 1,760.00

Miscellaneous commercial income came from the following items in the amounts shown:

Pinons ----------	$ 4,070.00
Wood ----------	880.00
Jewelry ----------	2,820.00
Squaw belts ----------	30.00
Blankets ----------	20.00
TOTAL:	$ 7,820.00

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The commercial income from wages is broken down as follows:

S. C. S. - Irregular	$11,270.00
Navajo Agency - Regular	1,190.00
Indian Service Roads	3,500.00
E. C. W.	37,030.00
Traders	5,720.00
TOTAL:	$58,710.00

The non-commercial income is broken down as follows:

Agriculture:

Corn	$26,500.00
Oat hay	80.00
Melons and squash	2,050.00
Beans	150.00
Orchards	160.00
Meadow	180.00
TOTAL:	$29,120.00

Livestock:

Sheep and goats	$25,300.00
Cattle	1,940.00
TOTAL:	$27,240.00

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5. EXPENDITURES:

The following table, (Table No. X), is a summary of expenditures as taken from a survey of trader records:

TABLE NO. X INDIAN PURCHASES

GROSS PURCHASES:			
Food	$100,930.00	64%	$54.38 per capita
Clothing	42,850.00	27%	23.09 " "
Household Equipment	5,340.00	3%	2.88 " "
*Production Equipment	9,970.00	6%	5.37 " "
TOTALS:	$159,090.00	100%	$85.72

*Production equipment includes such items as wagons, harndess, saddles, plows, shovels, etc.

The difference between the total commercial income and the total gross purchases is $32,840.00. A small percent of this may represent a cash saving, but probably the most of it was spent in Holbrook and Winslow for cars, gasoline, oil and miscellaneous items which could not be obtained for this study.

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6. CONSUMPTION:

The following table, (Table No. XI), is a summary of the food consumption of the Indians in Unit No. 7:

TABLE NO. XI FOOD CONSUMPTION

			Per-cent	Per Capita
Home Produced (Non-commercial income)		$ 56.360.00	36	$30.36
Purchased from Trader		100,930.00	64	54.38
Resales	$ 2,960.00			
Imports	97,970.00			
TOTALS:		$157,290.00	100	$84.74
Food Imports:				
Non-producible		$ 43,900.00	45	$23.65
*Producible		54,070.00	55	29.13
Raw Agri. Products	$22,040.00			
Flour	32,030.00			
TOTALS:		$ 97,970.00	100	$52.78

*Under proper use of agricultural land, these imports may be produced. It is doubtful if flour can be produced because of the lack of suitable land and water for the production of wheat.

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II. SUB-UNITS:

Unit No. 7 has been divided into four Sub-Units for the purpose of facilitating administration and analyzing data. (See Map No. 9). The boundary between Sub-Units Nos. 1 and 2 is more easily distinguished in the field than are the other sub-unit boundaries since most of it follows along the top of a mesa escarpment. The south boundary of Sub-Unit No. 2 follows the 35 30' parallel of latitude or the line which was the southern boundary of the Navajo Reservation until 1934. (See Map No. 1). This boundary is difficult to follow. Except for the headwaters of Pumpkin Flower Wash, the boundary between Sub-Units Nos. 3 and 4 follows a drainage divide from north to south via Pumpkin Flower Butte to the south boundary of the Reservation.

These sub-unit boundaries were determined by a study of the topographical features, population concentrations, human customs, land status, trade areas, and livestock movements. Insofar as possible, an attempt was made to group similar conditions into one sub-unit.

Table No. XII, Page No. 60, is a summary of basic data broken down by sub-units insofar as was possible at the time of the survey.

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II. SUB UNITS:

A. SUB-UNIT NO. 1:

Sub-Unit No. 1 is in the northern portion of the Unit and includes the majority of the woodland and big sage. This sub-area is higher in elevation, has more severe winters, and probably gets more precipitation than the other parts of the Unit. This broken tree-covered area is preferred by the Indians as winter range. Although snow may get quite deep at times, the southern slopes are usually covered for only short periods and the shelter of the trees, the protection offered by the numerous canyons, and the abundance of browse, make this area valuable as winter range. Vegetation is in moderately vigorous condition except near Jeddito Trading Post where we have a critical area which is badly in need of immediate protection from overgrazing. Livestock water is moderately abundant. The livestock on this sub-unit are not of such improved type and quality as in other parts of the Unit. There is some crossing over of livestock from this sub-unit into Units 4 and 17, and into Sub-Unit 2 of this Unit. The shifts out of Sub-Unit 1 are made in the spring when the Indians go to localities where they can farm. Practically all of the sheep dip at Jeddito Dipping Vat. Most of the trade goes to Jeddito Trading Post, however, some goes to Keams Canyon in Unit No. 6, to Steamboat in Unit No. 17, and White Cone in Sub-Unit No. 2 of this Unit. Probably very little trade goes off the Reservation. Some trade is carried on with the Hopis wherein wood is traded to the Hopis for meat and agricultural

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products. A number of farms are scattered over this sub-unit and there appears to be little possibility of developing an appreciable amount of new agricultural land. The chief value of the land in this sub-unit is for watershed, grazing, and woodland.

B. SUB-UNIT NO. 2:

Sub-Unit No. 2 is in the central part of Unit No. 7, lying south of the Mesa Verde capped mesas in Sub-Unit No. 1. Vegetation consists principally of Galleta, Blue grama, Sacaton, Chamise, Snakeweed, and Yellow brush. This range is adapted to year-long grazing. A very small amount of woodland is found in the southern and southwestern portions on the volcanic buttes. Except for two critical areas, vegetation is in fair condition. The smaller but most badly depleted area is at Comah Springs. Vegetation has been depleted to such an extent, due to heavy livestock concentration at this permanent water development, that wind erosion is very severe on this light textured soil. The second critical area is White Cone Flat where continued over-grazing has resulted in the depletion of vegetation to such an extent that wind, sheet and gully erosion is becoming very severe. Also, the whole Jeddito Valley is being threatened by severe erosion similar to that on White Cone Flat. The excessive concentrations of livestock in these valleys are because of the abundance of water, abundance of farmland, and the open topography of the range. Practically all of the farmland in this sub-unit is at White Cone Flat and along Jeddito Wash. One large potential agricultural project is located on Jeddito Wash in the

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southwestern portion of this sub-unit where there is no possibility of diverting water onto some valuable agricultural land. Practically all of the Hopis that are found in Unit No. 7 are located along Jeddito Wash in this sub-unit. Some crossing-over of livestock into Unit No. 17 occurs near White Cone. A number of Hopi livestock graze along Jeddito Wash in this sub-unit. The sheep are dipped at Comah Springs, Jeddito, and Indian Wells. Most of the people trade at Keatih in Sub-Unit No. 4, Teastoh in Sub-Unit No. 3, and White Cone in this sub-unit, but a few trade at Indian Wells, Sunrise, Dilkon, Jeddito, and Keams Canyon.

C. SUB-UNIT NO. 3:

Sub-Unit No. 3 is located in the southwestern portion of Unit No. 7. The lowest elevation in the Unit is in the southwestern part of this sub-unit where Coyote Wash leaves the Unit. A large area of barren bad lands - Painted Desert - exists along the southern boundary. Over the rest of the area, there are numerous volcanic buttes, the majority of which afford good grazing. Principal vegetative species are Galleta, Blue grama, Sacaton, 3 awn, Spiny muhley, Chamise, Shadscale, and Mor n tea. The whole of this area is suited for year-long grazing. There is a scarcity of woodland and fuel, the only woodland being on the volcanic buttes. These woodland stands are poor and furnish little fuel, resulting in the use of considerable browse for fire wood. Coal is available at Seba-dalki and Montezuma Chair Buttes. Livestock water is

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not abundant. Several areas of considerable size are served only by surface tanks, many of which are of little value. Permanent water is difficult to obtain because of its excessive depth. Much of the livestock is of good type and quality, showing influence of some very good sires. Practically all of the sheep are dipped at Comah Springs and Dilkon, a few being dipped at Indian Wells. Crossing-over to other sub-units or other Units is rather rare, however, one family does move into Unit No. 5. (See Map No. 5)/ At the present time approximately one-half of the land in this sub-unit is privately owned and is not under the jurisdiction of the Federal Government. Therefore, considerable trespass is committed by both the Indians and whites, and will continue until these lands have been purchased or otherwise reconveyed to the Federal Government. (See Map No. 13 and Table No. I). Two very outstanding critical areas exist - one at Dilkon where continued grazing has resulted in severe wind and water erosion, and the other at Seba-dalki Day School where wind erosion is endangering the school building and valuable range land. Farmland is scattered in small areas over the sub-unit and there appears to be little possibility of increasing this acreage. The principal value of this area is for watershed and grazing. Therefore, grazing should be so regulated as to properly conserve and improve the range. There are a number of white owned livestock that graze in this sub-unit.

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D. SUB-UNIT NO. 4

Sub-Unit No. 4 comprises the southeastern portion of Unit No. 7. The Painted Desert formation - Chin Lee shale - covers an extensive area in the southwestern part of the sub-unit. Several volcanic buttes are scattered over the area and are covered with sufficient vegetation to be classed as good grazing lands. The principal vegetative species are Galleta, Blue grama, Sacaton, 3 awn, Chamise, Shadscale, Salt bush, and Mormon tea. The only woodland available is on the volcanic buttes. These stands are poor and produce little fuel with the result that such browse plants as Chamise and Rabbit brush are used for fire wood. Apparently no coal is available. The closest supply of fuel wood is on Balkai Mesa in Sub-Unit No. 1. Stock water is not available in a few places. Permanent water cannot be obtained because of the excessive depth and many of the surface tanks are of but little value. However, with the development and maintenance of the present supplies, as recommended on Page , there should be sufficient water providing temporary supplies are used when they are available. Livestock are of fair type and quality, being very similar to those in Sub-Unit No. 3. Some crossing-over of livestock between this sub-unit and Sub-Unit No. 2 with possibly a small amount from this sub-Unit into Unit 17 occurs. These livestock movements are of little consequence since they do not involve administrative problems at present. Practically all of the sheep in this sub-unit dip at Indian Wells. The majority of the trade goes to Indian Wells and Bida-ho-chee but some trade goes off the Reservation to Holbrook and

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other places along Highway 66. Many of the farms are scattered but there is a concentrated farming area at Indian Wells. There is a possibility of increasing the farmland at Indian Wells. (See Page 46 and Map No. 10). Two critical erosion areas exist on this sub-unit, namely: the Indian Wells - Bida-ho-chee area including the valley between the two trading posts and the entire area along Cottonwood Wash. Overgrazing has resulted in severe wind, sheet, and gully erosion on these two areas. A quantity of land in this sub-unit is privately owned. (See Map No. 13 and Table No. 1). The status of these lands results in the same difficulties encountered in like lands of Sub-Unit 3. The chief value of these lands is for watershed and grazing, and inasmuch as the present intensity of grazing is highly destructive to the range, watershed and farms, grazing must be controlled. There are a number of white owned livestock that graze in this sub-unit.

III. THE EFFECT OF HUMAN ACTIVITIES ON THE NATURAL RESOURCES:

A. DESTRUCTION OF VEGETATION AND SOIL AND WATER LOSS:

1. IMPROPER RANGE MANAGEMENT:

Continued over-use of the range for a long period of time has resulted in severely over-grazed condition of the range adjacent to all old water developments, trading posts along Jeddito Wash and White Cone flat. The concurrent use of much of this area by Indians and whites has resulted in much destruction of vegetation and consequent severe erosion in the southern portion of this Unit. Those areas outlined as critical areas have been over-grazed for

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many years because of the permanent water supply in those places and the lack of water on other parts of the range. Most valleys are out by deep washes and wind erosion is removing and has removed a large part of the top soil on many areas. (See Map No. 8a). The destruction of the natural vegetation has increased the rate and amount of runoff and decreased the amount of water penetration until great soil and water losses are occurring.

2. IMPROPER WOODLAND MANAGEMENT:

The most important woodland stands in the area are on Balkai Mesa with lighter stands occurring on the volcanic buttes. (See Map No. 11). Grazing and improper cutting have resulted in approximately 90 percent of the total woodland area being in a poor condition. Only the rougher and more inaccessible portions, consisting of approximately 10 percent of the total area, still remain in normal condition, and these areas are of little present or potential value because of their inaccessibility. At more heavily populated sections such as near Jediito, Dilkon and Indian Wells, the woodland is in very poor condition and there is an almost complete lack of reproduction. Over-grazing the woodland areas has resulted in the depletion of the woodland stands and the lack of woodland reproduction.

B. CHANGE OF VEGETATION:

1. INDICATORS OF OVER-GRAZING:

Indicators of over-grazing, such as Snakeweed, Yellow brush, Rabbit brush, and Russian thistle, are found on all parts

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of the Unit. Those areas which are fartherest from permanent water have on them the least amount of these over-grazing indicator plants. In addition to decreasing the forage value, these over-grazing indicator plants are less adapted to the retention of soil and water, and annual weeds are effective only during the growing season. Therefore, the changes in vegetation, as the result of the mis-use of the range, has aided materially in the loss of soil and water. How much of the vegetative change is due to natural ecological changes is not known but certainly a large part of it is due to improper grazing use.

2. AVAILABLE FORAGE:

In many cases, probably the actual density of the ground cover has not been reduced below what it was before the introduction of domestic livestock but the available forage has decreased because the original species have been replaced, to some extent, by less palatable and less nutritious species. The volume growth of the forage species is a vital factor in determining the amount of available forage. Almost all of the palatable species near trading posts and old developed water supplies are low in vitality and are slow to respond to favorable moisture and temperature conditions so that a small amount of volume growth is obtained during the growing season. The low vitality may result in a high mortality of plants during growing seasons which have a low amount of precipitation. Several years may be required for vegetation to recover from the damage occurring during one season of low rainfall. Climatological records

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show that there is a rather wide variation from year to year in the moisture which falls during the growing season. Therefore, extreme care must be exercised so as not to over-graze any part of the range on the Unit if we are to decrease the soil and water losses now occurring. Rainfall during the summer growing season in 1937 was very slight and resulted in a meager production of forage. Most of the forage that was produced was a great distance from water supplies. The soil conditions and topography in different parts of the Unit also reflects upon the forage that might be produced. In Sub-Units Nos. 3 and 4, there is a large amount of waste land which will produce little forage under the most favorable conditions. In Sub-Unit No. 1, there is a large number of rims and escarpments and some dense woodland on which there is little range forage produced. In Sub-Unit No. 2, White Cone Flat is severely over-grazed. This area will produce a large amount of available forage if grazing could be deferred during the growing season for at least a few years.

C. DESTRUCTION OF FARMLANDS, SOIL AND WATER LOSS:

1. IMPROPER SUBJUGATION AND USE OF WATER:

Improper subjugation and use of water have resulted in the destruction of much farmland. This condition is especially true along Jeddito Wash. At one time, Jeddito valley was a large agricultural community and extended for miles up and down the valley. At the present time, the farms in this area are very scattered and the valley supports a scattering

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population. The fertility of the soil is not depleted because the flood water spreading over the land was high in silt, carrying considerable organic matter and nitrogenous material. Erosion is the sole cause for the abandonment of many of these farms. Numerous errors are made in farming practices such as: improper preparation of seeding bed, location of farms on badly wind-blown areas, farms are not level, bordering is not practiced, contour furrowing and listing is not practiced, the available water supply may be too much or too little, surplus water is seldom properly taken care of, no wind erosion control is practiced after the crop is removed, and plowing with the slope is a common practice.

2. IMPROPER CULTURAL METHODS:

Some of the most common cultural errors are: the crops raised are not soil binders, fall plowing is not practiced, fall and winter cover crops are not planted, crop rotation is not practiced, fields are usually left barren during the winter and spring, strip cropping, contour listing and furrowing are not practiced. The institution of these practices would result in the conservation of a large amount of the soil and water that is now being removed from these farms.

D. DESTRUCTION OF WILDLIFE AND WILDLIFE HABITATS:

At one time, antelope and deer were p robably native to this part of the country. Their use as food by the Indians and over-use of the range by domestic livestock has resulted in their complete disappearance. At the present time there is not sufficient

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forage available for antelope, deer, scaled quail, Gambel quail, or any of the other species of game. The widely scattered population makes this area unsuitable for large game animals, but with the proper control of grazing, quail should do well on this Unit. There is probably no possibility of developing water supplies suitable for water fowl. Possibly turkey could be introduced onto Balkai Mesa.

PART II

ESTABLISHMENT OF PROPER LAND USE

I. RECOMMENDED ADJUSTMENTS (Work Plan)

A. PROPER RANGE CONTROL:

1. GRAZING DATES:

The range in Unit No. 7 shall be grazed year-long. In the future, if seasonal use would be more practical, any part of the range may be used at any season of the year desired.

2. PROPER CLASS AND NUMBER OF LIVESTOCK:

The majority of the livestock should be sheep. Approximately 1,390 horses and 1,000 cattle should be allowed to graze the Unit. The number of horses was determined by allowing an average of 6 horses per consumption group, and the number of cattle is based upon the 1937 roundup count, minus the estimated number that should be culled. It is estimated that approximately 500 head of cattle

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should be culled out and sold.

3. SIRES AND THEIR CARE:

3 bucks per 100 ewes or approximately 1,200 bucks, and 4 bulls per 100 cows or 40 bulls, should be allowed on the Unit. Both bucks and bulls should be given extra care when not in use. Two buck pasture locations have been selected which will care for all bucks on the Unit (See Page of this report). At least one more pasture should be constructed for the care of bulls. Approximately 350 mares will be required to make the necessary replacements in the horses allowed on the Unit, and approximately 20 stallions will be required. These stallions should be owned and controlled by the Government and bred to selected mares. With two good jacks, there is a possibility of producing some mules to advantage.

4. BREEDING:

The breeding season shall be from November 10th to December 20th for sheep; from July 20th to November 20th for cattle.

5. SHEARING:

Shearing dates should be from June 10th to June 20th. The introduction of four shearing plants should be given immediate consideration.

6. RANGE WATER DEVELOPMENTS:

Maintenance and new developments recommended on Page of this report should be carried out as soon as possible. The Unit Manager and Range Riders should make frequent observations

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of all water developments so that they might be repaired and kept functioning at all times. From time to time additional water developments will be necessary, and to a large extent the observations of the Unit Manager and Range Riders should determine the class, location, and need for these developments. One maintenance crew should be stationed on this Unit to take care of all range improvements.

7. LIVESTOCK MAINTENANCE AND DISTRIBUTION:

As few livestock shifts as possible are to be made and still secure proper livestock distribution and management of the range. All excessive concentrations at permanent water supplies must be eliminated as soon as possible. The range adjacent to temporary water supplies must be used when water is available and feed near permanent water conserved for use during the dry seasons of the year. Excessive livestock water concentrations must be eliminated in the following critical areas:

1. Comah Springs.
2. Seba-dalki Day School and the area immediately west of Montezuma Chair.
3. Indian Wells and Bida-ho-chee Trading Posts.
4. Jeddito Trading Post and Skunk Springs.
5. Dilkon Dipping Vat.
6. Saybito Well on Cottonwood. (Pueblo Colorado Wash)
7. White Cone Flat.

Livestock must not be permitted to concentrate on farming areas.

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8. RELUCTION OF INJURIOUS RODENTS:

(See Page No. for costs.)

Retreatment of Type G-11	-	2,380 Acres
Retreatment of Type G- 5	-	57,925 Acres
Treatment of Type G- 9	-	35,000 Acres
Total	-	95,305 Acres

(See Map No. 7)

The above prairie dog control is needed at those places indicated on Map No. 7. Types G-11 and G-5 should be treated first.

9. CONTROL OF PREDATORY ANIMALS:

At the present time, no control is needed. However, if the numbers of coyotes and bobcats increase materially, control will be needed.

10. WILDLIFE DEVELOPMENTS:

Eighteen desilting plots have been recommended for planting according to diagram No. L-468 which will be of value to wildlife as well as of value in retaining silt. The locations and numbers of these tanks are stated in Table No. XIII, Page No. The planting of windbreaks on farms according to Diagram No. L-479 and the planting of stream channels according to Diagram No. L-470 will increase the food and protection for wildlife.

181 acres of windbreaks and 31 acres of erosion control plantings have been recommended.

Proper range control and the resulting increase in forage production will be very beneficial to wildlife.

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11. RANGE WATERSPREADING AND EROSION CONTROL:

Part II, Construction Program, Page , lists the water-spreading and erosion control projects. (See Map No. 10). There are approximately 94,900 acres of range land on which water can be spread and on which erosion control is needed. Those projects which have been given priority "1" are in need of immediate treatment to save land which will be destroyed if present erosion is not checked. In addition to this, there are 4,150 acres of rangeland which is badly in need of treatment from headcuts which are threatening rangeland. These projects are listed on Page No. of this report. (See Map No. 10).

12. RANGE PLANTING POSSIBILITIES:

No range reseeding has been recommended on this Unit. However, 31 acres of erosion control planting have been recommended which will protect a minimum of 323 acres of rangeland. See Table No. XIII, Page No. , and Map No. 10.

13. EDUCATION AND DEMONSTRATION:

Education and demonstration of the proper range management and animal husbandry practices should be carried on at all times. Individual and group advice and assistance should be given, especially at dipping, shearing, and selling times. The buck pastures should serve as excellent demonstration areas.

B. FARM IMPROVEMENT:

1. Present Farmland:

a. Subjugation and Flood Irrigation:

Farm number, acreage, present crops, suggested crops,

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present yields, expected yields, class of land, and costs of recommended work are shown on Page No. . Those farms on which no work has been recommended are not shown. A great quantity of work has been recommended which can be done by the Indians themselves on their individual farms under the supervision of the Unit Supervisor or an Agronomist. These latter areas are small and usually entail only a small amount of labor or changes in the present cultural practices. A list of these recommendations can be found on Page No.

b. Recommended Cultural Practices:

Numerous recommendations as to improved cultural practices have been made for farmland on this Unit. These practices usually can be carried out by the Indians themselves under the supervision of an Agronomist or the Unit Manager. The recommended cultural practices consist principally of contour listing, contour bordering, strip cropping, and fall plowing. The acreage of these areas is so small that the Indians should be able to do the necessary construction work:

Quad No.	Farm No.	Acreage	Recommendations
			SUB-UNIT NO. 1
13	1	2	Contour list between borders.
13	2	15	Contour borders
13	75	10	Strip crop and contour list.
13	76	1	Four small spreader dykes.

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Quad No.	Farm No.	Acreage	Recommendations
13	77	6	Fall plowing, contour border and strip crop.
13	78	2	Fall plowing, contour border and strip crop.
13	79	2	Dyke lower end of farm
13	80	2	Dyke lower end of farm
13	81	2	Dyke lower end of farm
13	82	1	Contour border
13	83	2	Contour border
13	84	2	Contour border
13	85	1	Check head. Contour border and list.
13	86	4	Strip crop and contour border.
13	87	2	Contour terrace
13	88	3	Contour border
13	89	1	Contour border
13	90	1	Contour border
13	91	3	Contour border
13	92	4	Terrace
13	93	2	Contour border
13	94	8	Contour border and strip crop
13	95	2	Contour border and strip crop
13	96	1	Contour border and strip crop
13	97	1	Contour border and strip crop
15	26	5	3 contour spreader dykes 50 ft. long

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Quad No.	Farm No.	Acreage	Recommendations
56	39	3	Contour border
56	40	5	Contour border
56	41	2	Spreader dyke at headcut. Contour terrace
56	42	5	Contour border
56	43	5	Contour border
56	44	3	Contour border
56	45	2	Contour border
56	47	2	Contour border and strip crop
56	48	1	Contour border
56	49	7	Contour spreader dykes, strip crop.
56	50	10	Contour spreader dykes, strip crop
56	51	7	Contour spreader dykes, strip crop
56	60	1	Contour border and protect head
56	61	2	Contour border and protect head
56	62	3	Contour border and protect head
56	63	1	Contour border
56	74	1	Bench terrace and irrigate from spring
60	4	2	Contour spreader dykes
60	8	4	Contour spreader dykes
60	16	12	Strip crop. Short contour spreaders
60	17	12	Strip crop. Short contour spreaders
60	18	12	Strip crop. Short contour spreaders
60	19	15	Contour list and strip crop.

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Quad No.	Farm No.	Acreage	Recommendations
60	20	15	Contour list and strip crop
60	23	10	Series of spreader dykes
60	24	3	Abandon
60	25	28	Spreader dykes
60	26	5	Contour list
60	28	3	Contour list
60	28	1	Contour list
15	2	2	Contour list and small spreader dykes
15	3a	6	Lister plant and strip crop.
		275	Total

SUB-UNIT NO. 2

15	3b	25	Strip crop. List. Plant windbreaks.
15	4	18	Border with slope
15	5	4	Strip crop. List. Plant windbreaks.
15	6	9	Strip crop and lister plant.
15	8	12	Contour list, strip crop & spreader dykes
15	25	9	Contour list, strip crop & spreader dykes
15	27	5	Contour list
15	28 & 29	18	Strip crop and lister plant
15	30	25	Strip crop and lister plant
15	31	10	Contour list
15	40	7	Lister plant and strip crop

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Quad No.	Farm No.	Acreage	Recommendations
15	50	25	Lister plant, strip crop & plant windbreaks.
15	52	5	Strip crop
15	53	3	Strip crop
15	54	4	Strip crop
16	30	4	Strip crop
16	31	24	Strip crop and plant windbreaks
16	34	40	Contour list and strip crop
16	45	80	Lister plant and strip crop
16	47	10	Strip crop
60	1	2	Contour list
60	2	3	Contour spreader dykes
60	3	5	Contour list and strip crop
60	5	20	Contour list, strip crop, spreader dykes
60	6	31	Spreader dykes, contour list between dykes
60	11	65	Contour spreaders. List between spreaders
60	21	11	Contour lister plant
60	29	6	Contour lister plant
60	31b	2	Several 40' contour spreaders. Contour list
60	32	1	Contour border
60	33	3	Contour terrace and strip crop
60	35	5	Strip crop
		491	Total

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Quad No.	Farm No.	Acreage	Recommendations
			SUB-UNIT NO. 3
22	4	12	Contour spreader dykes
22	6	2	Contour list
22	9	2	Contour spreader dykes, contour list
22	11	2	Contour border
22	13	3	Contour spreaders. Strip crop
22	16	4	Strip crop
22	20	7	Contour spreader dykes. Strip crop
22	33	1	Contour border
22	34	3	Contour border
22	35	2	Two 100 ft. contour spreader dykes
22	36	3	Strip crop. Contour borders
22	37	2	Contour spreader dykes.
22	41	4	Contour spreader dykes. Contour list
22	42	4	Strip crop. Spreaders
22	44	1	Construct dyke at lower end of farm
22	48	1	Strip crop. Contour spreader dykes
22	49	3	Contour borders
61	26	1	Small spreaders
61	29 & 30	4	Contour spreaders. Strip crop
64	2	12	Strip crop
64	9	5	Strip crop
64	11	10	Contour list. Spreader dykes
64	12	30	Strip crop
		118	Total

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Quad No.	Farm No.	Acreage	Recommendations
			SUB-UNIT NO. 4
58	18	3	Contour terraces
58	19	4	Contour terrace. Strip crop
61	7	4	Contour spreader dykes
61	8	5	Contour spreader dykes
61	10	1	Contour list between spreader dykes
61	11	2	Contour list
61	14	6	Contour border. Strip crop
61	20	2	Strip crop
61	21	4	Contour spreader dyke. Strip crop
61	24	4	Contour spreader dyke. Strip crop
61	38	4	Contour list
61	39	2	Contour border. Strip crop
61	41	2	Contour border. Strip crop
		43	Total
		927	GRAND TOTAL

c. Erosion Protection:

(1) Planting:

Planting for erosion control on agricultural land consists principally of windbreak plantings. Strip cropping is considered a cultural practice. Table No. XIII, Page No. 87, gives the farm number, farm area, acreage recommended for planting,

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location, and suggested species by sub-units. Many of the farms on this Unit are being damaged by wind erosion which is removing valuable top soil. At the present time, little effort is made to protect these areas. On small areas, one row of windbreaks will probably suffice but on larger areas rows 400 to 500 feet apart will be needed. Generally, the winds are from the southwest and the windbreaks should be planted perpendicular to the prevailing wind direction. In places where only a few trees or shrubs are needed to protect an isolated farm, it is thought that the Indians could do the planting and no cost estimates have been made. A list of these can be found in the farms enumerated on Page of this report.

(2). Engineering Structures

The larger engineering structures for the protection of erosion on farmland can be found under "Special Erosion Control Projects" on Page . Here it is also thought that the Indians can accomplish a great amount of work that has been recommended on individual farms since these structures are usually very small, consisting of small spreaders, dykes, and gully plugs. See list on Pages 76 to 82 of this report.

d. Protection from Pests and Rodents:

Fall plowing is recommended to help eliminate insect pests such as cut worms, grasshoppers, and army worms. The poisoning of insects on farmland will probably not be necessary except in years when they become so numerous as to be classed as epidemic.

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Rodent control, however, is constantly needed and should be carried out year after year. Kangaroo rats are the most serious rodent on farmland. 1,500 acres of annual Kangaroo rat control at 10¢ per acre has been recommended. (See Page No.).

e. Harvesting and Storing:

The present methods of hand harvesting are satisfactory for the present time but in the event that the new land is developed on the Jeddito and Bida-ho-chee Washes, the introduction of farm machinery will be necessary. Such farm machinery as machine mowers, rakes, hay wagons, lister planters, furrowers, and possibly hay balers, will be needed. Storehouses must be made rodent proof.

By diversion and economic use of flood water, approximately 494 acres of land could be put under cultivation in this Unit. On Page can be found the acreage, location, suggested crops, expected average yield, class of land, costs and recommendations of subjugating this potential farmland. Most of this potential farmland is scattered in small tracts over the Unit. The Jeddito project is the largest, having 180 acres of potential land. All potential farmland recommended for subjugation is Class A agricultural land.

C. WOODLAND MANAGEMENT:

1. CUTTING AND MARKING:

Only the stands in Conditions A and B are in good enough condition for future use (cutting of live trees). All trees to be cut should be marked by competent men. Diseased trees and trees which are expected to live for only a short time can be cut

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