LAND MANAGEMENT UNIT NO. 7

RANGE MANAGEMENT BRANCH REPORT

September, 1937

I. FOREWORD

A. LOCATION, Political History and Land Surveys:

Land Management Unit No. 7 comprises 924,082 surface acres and is located 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 the 35°30' parallel of latitude and west of the 110°00' meridian of longitude was made Reservation by an Executive Order on December 16, 1882. That portion south of the 35°30' parallel of latitude, except for the railroad and other patented lands which have not yet been reconveyed to the United States Government, was made Reservation by the Congressional Act of June 14, 1934. Those portions east of the 110°00' meridian of longitude were made Reservation in 1890 and 1908. (See Map No. 2).

Practically all of the Unit has been surveyed. The oldest survey is on that land included by the Congressional Act of June 14, 1934. This survey was made in 1882 and approved in 1883. Rock and wooden markers were used and only a very few of these can now be found and identified. Subsequent surveys are marked with iron corners. At the present time, accurate loca-

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tions of land lines are very difficult to make.

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 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. 5).

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.	76,745	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

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Area and Boundaries:

924,082 acres is the computed area of this Unit.

The boundaries are usually well defined and easy to follow in the field. The south boundary is the south boundary of the Navajo reservation and is fenced. The Unit is bounded on the west by Units No. 5 and No. 6, on the north by Unit No. 4, and on the east by Units No. 10 and No. 17. (See Map No. 2)

No changes in the present boundaries are recommended at the present time. There does, however, appear to be quite a lot of movement of people and livestock across the boundary of Units No. 4 and No. 17 in the north end of this Unit.

II. BASIC INFORMATION

A. GENERAL DESCRIPTION:

1. Elevation, Topography, Precipitation and Temperature:

The elevation varies from approximately 5,300 feet to 7,500 feet. (See Table No. II). 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

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badlands of the Painted Desert. The principal drainages on the Unit are the Joddito, Coyote, Bida-ho-chee and Cottonwood (Pueblo Colorado) Washes. All of these drain in a southwesterly direction except Coyote Wash which flows to the northwest. All of the washes have cut channels of varying depths. The Joddito, however, "fans out" on the lower end.

Climatological data for this Unit were 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. 11).

Table II — CLIMATOLOGICAL DATA * — LAND MANAGEMENT UNIT NO. 7

Area or Station	Elevation	Avg. An. P'cpt'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	9⅛"	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°	-20°	Oct. 18	May 20	145
Indian Wells	5770	10"-10½"	53°	100°	-11°	Oct. 13	May 23	240
White Cone Flats	6200-6300	12⅛"	51°	99°	-12°	Oct. 12	May 21	153
Top Mesa Opposite Keams Canyon	6500	12½"-13"	50°	98°	-15°	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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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 areas 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. The Shinarump conglomerate and Moenkopi formations occur just south of the Unit but neither is found within it.

(1) Chin Lee Formation:

"The Chin Lee formation exceeds 1000 feet in thickness and is exposed throughout the southern portion of the Unit. The hitherto unmapped portion of the Hopi Buttes area is assigned

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to division "A" of the Chin Lee in this report. The pink sandstones in the western margin of the Unit west of Montezuma's Chair may represent the eastern limits of the Navajo-Wingate but from observations throughout the area it has been concluded that these sandstones represent a sandy phase of the Chin Lee siltstones.

"The upper part of the Chin Lee, division "A", is composed of massive to thin bedded, pink and red sandstones and siltstones interbedded with dark red shaly siltstones. The upper division here closely resembles the same division near Moenave in being more sandy than the same division in the Chin Lee valley. The silty zones weather into well rounded boulders and 'stone babies' which are characteristic of this formation at several localities. Grayish green deoxydized spots and streaks are also common in this horizon.

"Division "B" is made up of hard, cherty limestones and limestone conglomerates interbedded with dark red shaly silts and clays. The limestone beds seldom exceed eighteen inches in thickness and their resistance to erosion causes division "B" to stand as high escarpments wherever it is found.

"Division "C" is distinguished by its variety of color, the abundance of petrified wood and its tendency to weather into low rounded hills. It is made up principally of clays and marls varying in color from red and gray to purple, yellow, orange and even black. Division "C" is the chief source of the petrified

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wood in the Chin Lee although the other three formations contain it in lesser amounts. The wood of the Chin Lee is noted for its bright colors as well as its abundance.

"Division "D", the lower division, has not been identified in this Unit but it occurs just south of the boundary. It is made up of dark brown coarse grained sandstone and conglomerates overlying red and brown silts and clays. The resistant cap of sandstone causes it to weather into low mesas.

b. Jurassic Formations:

(1) Morrison Formation:

"The Morrison of this Unit is confined almost entirely to the western margin of the Unit and almost all of the exposures are seen as brown to red sandstone cliffs in the lava capped mesas and buttes. The Morrison is usually of well sorted white quartz grains poorly cemented with lime, although in some places it varies to a white, red, and green sandy clay.

c. Cretaceous Formations:

(1) Dakota Formation:

"The Dakota is composed of massive buff colored sandstone and coal with some gray clays. Stringers of pebbles are common in the lower portion of the sandstone. The contact with the underlying Morrison is marked by an erosional unconformity and it is usually in these old channels that the

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lenses of coal occur. The Dakota overlies the Morrison in most of the Buttes in the western margin of the Unit and it is this formation which yields the coal in the mines at Round Top and Montezuma's Chair. Commercial coal deposits may also be found in some of the other buttes in this region; especially at Egloffstein Butte.

(2) Mancos Shale:

"The Mancos includes all the beds between the Dakota and the Mesa Verde formation. It consists of drab, sandy clay shale with thin platy sandstone members. The shales are gypsiferous and locally contain numerous fossils. It is conformable with the beds above and below but in its entirety is lithologically unlike them. The contact with the Mesa Verde is usually gradational and must be arbitrarily drawn within 100 to 200 feet of shales and sandstones which have features of both formations.

"The Mancos in this Unit occurs as long low slopes at the base of the Mesa Verde in the northern part of the Unit. Its lower limits are concealed beneath alluvium and the contact with the underlying Dakota could not be found.

(3) Mesa Verde Formation:

"The Mesa Verde in this Unit forms a southern extension of Black Mesa, and it is the resistant sandstone of this formation 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. The sandstones are buff, brown, and red in color and are usually medium to coarse grained in texture. Stringers of coarse sand and fine gravel are found in some places. 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. The sediments are entirely fresh water in origin and were deposited in lakes and streams during middle or late Pliocene time. The deposits include gray and white sandstone loosly cemented with lime overlying red and gray clays. 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. The ash is very fine at the base but near the top are angular fragments of lavas and sandstone as much as a foot in diameter.

(5) Volcanics:

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

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plains and irregular badlands are diversified by groups of castle and chimney-like buttes, by wall-like dikes, and by lava capped mesas that stand out conspicuously among the delicately tinted sediments by reason of their somber color.

"Although the original cones have long since been removed there is no difficulty in recognizing where they stood.

"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. While some of the vents were erupting quantities of ash and lapilli, others were pouring out masses of lava.

"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 breccia.

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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 layer 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." 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

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form a lake of great extent which is spoken of as the Hopi Lake. The lake deposits occur as far north as Keidito Wash and south nearly to Five Buttes, and in an east-west direction they are traceable from Ganado to Dilkon.

"Most of the Hopi Volcanoes rose along the southwestern margin of the lake, though many formed islands within it. The lake beds are accordingly admixed with ashes and interbedded with numerous flows of lava.

"The first products of eruption assumed dips in conformity with the Pre-volcanic slopes, but the later ejecta were laid down horizontally between fresh water deposits of mud, sand and gravel. In places the coarser tuffs and breccias were deposited in irregular channels on the lake bottom.

"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.

•Williams, Howell. Pliocene Volcanoes of the Navajo-Hopi Country. Geological Soc. Am. Bull. Vol. 47 pp. 111,172, 1933.

Tom C. Meeks
Junior Geologist
Sept. 1937.

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C. SOILS AND EROSION:

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

"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.

"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." ——

GROUP "A" SOILS:

"Group "A" soils have the following limitations:

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Slope - 5% or less.

Erosion - Occasional gullies and slight wind.

Alkali - Less than 0.2 of 1% white alkali and no black.

Drainage - Good.

Soil - Permeable with good water-holding capacity in surface 24" to 30". Deep fertile "A" horizon and not susceptible to wind erosion.

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 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.

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Contour range land furrowing on the gently sloping Busell, Pinedale, Riley or Tedilto soils may prove profitable.

Areas in need of mechanical erosion control:

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

GROUP "B" SOILS:

"Group "B" range soils have the following limitations:

Slope - 10% or less.

Erosion - Moderate water erosion with occasional deep gullies. Slight to moderate wind erosion.

Alkali - 0.2 of 1% white alkali and slight black.

Drainage - Moderately good."

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 Tedilto 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.

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Group "B" soils can be used in construction without extraordinary care, except the White Cone and Todilto shallow 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 9-1/2" W.
Gully heads in a saccaton flat.

Quadrangle 110°00' x 35°15' - 14-1/2" S x 5" W
Deep gully heads

Quadrangle 110°00' x 35°30' - 5" S x 12-1/4" W

Quadrangle 110°00' x 36°30' - 2-1/8" S x 11" W

GROUP "C" SOILS:

"The following limitations are recognized in Group "C" soils:

Slope - Less than 30%.

Erosion - Moderate water erosion, moderate to severe wind erosion, frequent shallow gullies and occasional deep gullies.

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Alkali - 0.8 to 0.5 of 1% white alkali, and/or less than 0.1 of 1% black alkali.

Drainage - Fair; higher water table

Soil - Fair fertility, permeability and water-holding capacity. Fine granular structure which is susceptible to wind erosion.

The rate of moisture penetration on these 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.

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 overgrazing.

"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' - 10-1/2" W x 15-1/2" S
Severe sheet and wind erosion due to overgrazing.

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

Quadrangle 110°00' x 35°30' - 2-1/4" S x 6-1/4" W

Quadrangle 110°00' x 35°30' - 1/2" S x 4-1/2" W

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

Quadrangle 110°00' x 35°30' - 1-3/8" S x 11-3/8" W

Quadrangle 110°00' x 35°30' - 2-1/8" S x 11-1/4" W

GROUP "D" SOILS:

"These soils have the following limitations:

Slope - Greater than 30%

Erosion - Severe sheet, wind, and gully erosion.

Drainage - Water table 6 inches or less from surface.

Alkali - Greater than 0.5 of 1% white alkali or more than 0.1% black alkali.

Soils - Low permeability, fertility and water-holding capacity. Structureless materials or susceptible to wind erosion."

Moisture penetration 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.

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

Little or no improvement is feasible.

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Mechanical structures could be put in on the area in Quadrangle 110°00' x 35°30' - 5" S x 13-1/4" W, to keep gully heads from encroaching upon more valuable land farther up.

GROUP "E" SOILS:

"These soils have the following limitations:

Slope - Greater than 30% (barren because of slope).

Erosion - Geologic or ruined by gullies.

Alkali - Excessive (barren because of alkali).

Soil - Unfavorable to plant growth."

Practically all precipitation escapes as run-off.

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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Mechanical structures could be put in on the area in Quadrangle 110°00' x 35°30' - 5" S x 13-1/4" W, to keep gully heads from encroaching upon more valuable land farther up.

GROUP "E" SOILS:

"These soils have the following limitations:

Slope - Greater than 30% (barren because of slope).

Erosion - Geologic or ruined by gullies.

Alkali - Excessive (barren because of alkali).

Soil - Unfavorable to plant growth."

Practically all precipitation escapes as run-off.

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 III — 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	4,633	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
Conche Sandy Loam		999				999	.11
Conche Clay Loam		1,884				1,884	.20
Conche 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
Oraibi Loamy Sand		61				61	.01
Soil Remnants			8,172	12,961	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	46,158	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 III (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	3,060	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	3,318	2,669				5,988	.65
Soil Remnants			4,842	18,964	970	24,777	2.68
Rough Broken Land (Undifferentiated)				16,008	2,385	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,[illegible]	93,246	36,314	40,248	13,718	223,462	24.18
Group percentage	4.32	10.09	3.90	4.39	1.48	24.18	

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Table III (Continued)

Soil Type	Group A	Group B	Group C	Group D	Group E	Totals	Percent Unit Total
			SUB-UNIT NO. III				
Todilte Loamy Sand	33	24,293	6,933			31,258	3.38
Todilte Sandy Loam	15,609	20,162	298			36,069	3.90
Todilte Sandy Loam (Hard sub-soil phase)		2,699				2,699	.29
Todilte 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
Dinnebetso Sandy Loam		7,993	2,097			10,090	1.09
Dinnebetso 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 Igneous Stony Land (Undifferentiated)				382	7,444	7,826	.85
Totals	45,329	82,034	54,702	80,034	[illegible]	[illegible],791	32.54
Group Percentage	4.37	8.83	5.92	8.66	[illegible]	2.54	

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Table III (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
Dimmehotso Sandy Loam		16,331				16,331	1.77
Dimmehotso Clay Loam		5,828	8,452			14,280	1.55
Dimmehotso Clay		5,288	14,622	214		20,124	2.18
Dimmebito 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 - -	45,700	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	211,268	169,212	222,767	96,653	924,082	100.00
GROUP PERCENTAGE	19.92	23.53	17.45	23.66	10.46	100.00	

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D. VEGETATIVE TYPES:

The vegetation for this Unit can be broadly grouped into four major types; namely, Grassland, Browse, Woodland and Waste. All lands typed as inaccessible, barren and barren with weeds have been termed waste. (See Table No. IV).

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	7,029	13.76
Waste	37,906	4.10	0	0.	0
Cultivated	2,725*	.29	0	0	0
Total - -	924,082	100 %	127,862	51,139	100 %

*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.

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Grasses	
Blue grama	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
Shrubs	
Chamiso	Atriplex canescens
Greasewood	Sarcobatus vermiculatus
Shadescale	Atriplex confertifolia
Salt bush	Atriplex cuneata
Snake weed	Gutierrezia spp.
Yellow bush	Crysothamnus greenii
Rabbit brush	Crysothamnus bigelovii
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	Chenopodium spp.

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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 Chair, Saybitch 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 those areas farthest from permanent water is in the most vigorous condition and exhibits a higher percentage of higher palatability perennial grasses. (See Map No. 4).

E. POISONOUS PLANTS: (See Map No. 5)

Poisonous plant species found on Unit No. 7 include Whorled milkweed (Asclepias galliciides), Lupine (Lupinus spp.), Loco

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(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 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-tes 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 doughts. This plant is locally known as "Rosilla".

F. WATER DEVELOPMENTS AND 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

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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:

76	Government Surface Tanks	- - - Temporary
4	" " "	- - - Semi-permanent
14	Indian Surface Tanks	- - - Temporary
75	Developed Springs	- - - - - - - Permanent
1	" "	- - - - - - - Temporary
2	Undeveloped "	- - - - - - - Permanent
3	" "	- - - - - - - 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% 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 buck pasture near Dilkon. Re-development of a few springs and maintenance work on

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several other supplies should result in a fair amount of water on this Unit. (See Map. No. 8).

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, Cedar Springs and Jeddito. (See page 147 of this report). The range adjacent to all four of these vats is in a critical condition. The land is practically barren and wind erosion is very severe, especially at Dilkon, Cedar 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 men 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. For further information and description of the above fences and description of the other fenced areas see page 148 of this report.

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C. 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. In 1935 and 1936 the U. S. Biological Survey poisoned prairie dogs along Peshbitoh Wash, in the White Cone Flat, and along the north side of the Jeddito Wash but re-infestation 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, 101,679 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.

D. PREDATORY ANIMALS:

Coyotes are the most abundant and are the cause of the most livestock losses from predatory animals. No losses were reported during the survey but some losses probably occur from time to time. The white ranchers south of the Reservation

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

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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.

I. 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 the 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.

J. OTHER GENERAL CONDITIONS:

Generally speaking, the whole Unit is accessible to livestock. However, there are a few canyons in the north end of the Unit and a few buttes and rims in the southern portion

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which are not easily accessible, but there is little area that is not grazed by livestock.

From the standpoint of soils, practically all of the soils should be grazed cautiously to prevent severe erosion. The sandy soils in the northern and western portions are highly susceptible to severe wind erosion when the vegetative cover is disturbed, and the heavy soils in the southern portion are very quickly destroyed by sheet and gully erosion once they get started.

The low carrying capacities of the many areas are due to over-grazing and not to the adaptability of the soils, with the exception of the rims and geological eroding areas of the Painted Desert formations in the southern end of the Unit. Those areas on which the vegetation is in a critical condition and on which induced or accelerated erosion is severe, have been overgrazed for many years and extreme care must be exercised to re-establish the vegetation and control erosion.

A quantity of wood products are available in the northern portion of the Unit, along Ka-ha-tee Canyon and on some of the Hopi Buttes. There are, however, quite extensive areas in the central, southern, and western portions that are almost entirely lacking wood products. In these latter areas, the people often use browse for fuel. When Chamise, Greasewood, or Shadescale are used as fuel, valuable range forage is being destroyed. Rabbit brush, Yellow bush, and Snakeweed are of but little value

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as forage, but when removed, the soil is left bare to the action of wind and water.

Coal is available at Say-bi-dagi Butte, Round Top Mountain and Montezuma's Chair. If coal or wood could be made available to those areas which have no fuel, the use of range browse plants for fuel could be largely eliminated. A quantity of wood from the northern portion of the Unit is hauled into and used in Unit No. 6.

The people are scattered over the entire Unit but heavier population concentrations are found along Jeddito Wash, White Cone Flat and at Indian Wells. The availability of farmland and stock water are probably the major reasons for these concentrations. In almost every case, permanent water is available within one-quarter to two miles of hogan locations. On the Jeddito Wash south of Jeddito Trading Post there are several Hopis farming in Unit No. 7. They live at the Hopi Villages in Unit No. 6. A few of these people have been farming in this vicinity for several years.

There are also quite a number of people in this vicinity who are part Hopi and part Navajo and who usually consider themselves as Navajos.

Highways, secondary roads, car trails, and wagon roads serve all parts of the Unit so that practically all areas are accessible to cars. One primary road enters the south boundary north of Holbrook and leaves the Unit at Keams Canyon. A

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secondary road enters the south boundary north of Winslow and leaves the Unit south of Badger Butte. (For other roads see map No. 3.) Primary and secondary roads are maintained from Keams Canyon.

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 bein only one day school, which is Seba-Dalki. However, a number of children attend the boarding schools at Leupp and Keams Canyon. The Dilkon-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.

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, BidaGho-chee, White Cone and Jeddito, with a switch board at Indian Wells. (See Map No. 3 for telephone lines).

The income from livestock is the largest source of commercial income in the Unit, being $44.27 per capita. The

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following table gives the principal sources and amounts of commercial income as taken from the traders records:

Table V — COMMERCIAL INCOME

Item	Amount	Percent	Per Capita
Livestock	$82,740.00	48.93	$44.27
Agriculture	1,350.00	.80	.72
Rugs	19,600.00	11.58	10.48
Jewelry	2,650.00	1.57	1.42
Wood and Pinons	4,160.00	2.46	2.23
Wages	58,700.00	34.71	31.41
Total - -	$169,100.00	100.00	$90.48

The consumption groups in this Unit are quite large, having persons per group. Table VI shows the number of people, number of consumption groups and the average number of people per consumption group, by sub-units:

Table VI — POPULATION

Sub-unit	No.1	No.2	No.3	No.4	Total
No. People					1,869
No. Consumption Groups					232
Avg. Persons per Consumption Group					

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III. LAND USE

A. CHIEF VALUE OF THE LAND:

The chief value of the land in this Unit is for watershed and grazing. This Unit is an important watershed area because it includes the headwaters of one important drainage system - Jeddito Wash - and several smaller drainages. The agricultural value is very limited because of the lack of suitable soil, and water storing or diverting possibilities. The present cultivated area is approximately .16% of the total area or 1,540 acres, and probably the maximum that agricultural land could be increased would be to about .22% or 1,764 acres.

However, the value of this agricultural land is high in comparison to the range land. The northern portion of the Unit has a definite value for the production of woodland products such as fuel, posts, poles and mine props for use on this Unit and on 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.

B. PAST AND PRESENT USE:

As was stated on Page 1 of this report, most of this area has long been Indian Reservation. The southern portion, however, was not added to the Reservation until 1934 and was used by both white stockmen and Indians. The whole area has long been

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severely overgrazed, with the result that there has been much loss of soil, water, and vegetation. As early as 1876 the Hashknife Cattle Company moved large herds of cattle into this country and overgrazing around permanent water supplies began immediately. The area is still being overgrazed because there are too many livestock for the range to support.

In the future, the greatest use that can be made of this land will probably be for watershed and grazing. Before the use of these lands can be controlled, the Government must own all the land inside the Reservation fence because white men now have some of these lands leased and trespass is committed by both Indians and white men. Until this is "locked" there will be continual friction between Indians and white men.

C. CARRYING CAPACITY:

The present estimated maximum yearlong carrying capacity is 51,139 sheep units or 615,668 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 the southern third of the Unit so that [illegible] losses should occur if the range is not carrying too

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many live stock. 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 would do much toward eliminating winter death losses.

D. PRESENT NUMBERS AND CLASSES OF LIVESTOCK.

The dipping records for 1937 show a total of 27,488 grown sheep, 2,638 grown goats, 1,199 grown cattle and 2,822 grown horses, or a total of 49,822 sheep units of livestock. On the basis of the total area and carrying capacity of the Unit, these figures would show an understocking of 1,617 sheep units or 3.16%.

The horse and cattle roundup which was completed in October, 1937, shows a total of 1,483 grown cattle and 5,342 grown horses. When we substitute the roundup records for the dipping records we find that the Indian stocking of the Unit is 52,768 sheep units or an overstocking of 3.2%. If we deduct the 194,190 acres of white and railroad land which have a yearlong carrying capacity of 11,049 sheep units, Unit No. 7 would be 27.56% overstocked on the basis of the sheep and goat dipping records and the horse and cattle roundup count.

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There are several white stock owners who own and lease quite a lot of land in this Unit. At times, these men graze large numbers of cattle and a few horses on this land so that the above figures on the present stocking are not complete. It is estimated that there are 800 head of white owned cattle that graze in this Unit for about eight months each year, which is equal to 2,667 sheep units yearlong. Also, some range along the Joddito wash is used by Hopi livestock, their numbers being estimated at approximately 2,500 sheep units yearlong.

Table VII is an analysis of the area and carrying capacity estimates by sub-units:

Table VII AREA AND CARRYING CAPACITY

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	17,396	34.23	17.2
4	199,263	21.56	11,462	22.41	17.4
Total -	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

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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.

E. UTILIZATION:

The most severe utilization is synonymous with those areas on which the vegetation is in the most critical condition, as pointed out on Page 27. The heaviest utilization is around Indian Wells, Dilkon, along the Jeddito Wash, and along Coyote Wash. Map No. 4 represents the present relative utilization. Estimates were made considering that 25% to 30% of the grazing season had been completed. (September 11, 1937). Assuming that spring growth will begin about April 1 and that there will be six and one-half months during which the present forage must be grazed, the present utilization must be estimated as being well over proper.

Exceptions to the above generalization are a few of the predominately browse types and in some of the valleys in the southern end where livestock have not been so concentrated. One of the reasons why the range is so heavily utilized is because of the very dry summer season which has just passed. Large areas did not have enough moisture to turn the grass

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green and all the feed that is now available is feed that grew in the spring as a result of winter and spring moisture.

The browse has produced a very good growth as a result of last winter's moisture. In the light of the poor feed situation and high livestock prices, the only logical and business-like thing to do is to sell.

V. DISTRIBUTION AND LIVESTOCK MOVEMENTS

The heaviest livestock concentrations are adjacent to the concentrated farming areas and population centers. This condition is especially true in the Joddito Valley and in White Cone Flats. Extremely heavy livestock concentrations are found in these two areas in the summer. During the winter, many of these families move to the tops of the mesas and toward Balakai Mesa where fuel is more plentiful and the protection from winter storms is more abundant. These two areas are subjected to severe grazing and trampling during the entire growing season. In the southern portion of the Unit, the people tend to stay in one place throughout the year, principally because their farmland is scattered and there are no areas of consequence which produce fuel.

A number of people move into Units No. 4 and No. 17 in the summer to farm and back to Balakai Mesa in Unit No. 7 in the winter.

Apparently, very few long shifts of livestock are made but

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the movements which do occur are of major importance in the use made of the range.

For individual livestock movements see Pages 63 to 102 of this report and Map No. 6.

IV. ANIMAL HUSBANDRY PRACTICES

A. SELECTION:

The livestock on Unit No. 7 vary from average to poor grade Navajo livestock, to livestock of fair type and quality. The better livestock are usually found in the larger herds and flocks in the southern portion of the Unit. Generally speaking, the cattle are of more desirable type and quality than the sheep. The influence of the white man is manifest, to some extent, in the livestock in the southern end of the Unit. However, the same errors in the selection of breeding stock are made on this Unit as are made on all parts of the Reservation; namely, retention of cull lambs and calves for breeding purposes and the selection of inferior bucks and bulls from the same flock or herd in which they are to be used. The larger operators buy more sires than do the small operators, probably because they have more money with which to buy improved animals from off the Reservation.

Also, the larger owners do not have such a large number of "cut-backs" at selling time because they tend to exercise more breeding control and better grazing methods, which results in

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a more uniform and better conditioned flock at selling time. Small operators who have from one to three bucks cannot afford to herd them separately so that their lambs are born at all times of the year. The following practices would tend toward a more progressive selection of breeding stock:

1. Control the breeding season.
2. Rigid culling and selling of inferior and old breeding stock.
3. More rigorous selection of sires.
4. Better conditioning the animals intended for sale.

3. BUCKS AND BULLS:

The bucks and bulls on this Unit are of about the same average type and quality as those on the surrounding Units. Quite a number of improved or slightly improved bucks and bulls are found in the larger flocks and herds. Most of the small operators raise their own sires, which are usually of inferior type and quality. The improved sires are all imported from off the Reservation and the small owners do not have money to buy them.

At present, bucks and bulls are given little extra care except in a few cases. All sires should be cared for in pastures set aside for that purpose, and if feed conditions are below average, supplemental feeding should be practiced. Two pastures have been proposed which should care for all the bucks on this Unit.

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Many sires are being used which are too old. Bucks over six and bulls over eight years old should be replaced with young animals.

Bucks and bulls should be imported when yearlings and cared for in pastures or otherwise until they are two years old before being released for service. This would allow the animals to become acclimated before they are put to service.

C. BREEDING AND LAMBING.

Controlled breeding is practiced, to a limited extent, by a few of the larger owners but their lambing dates are usually too early. Too early lambing results in some death loss of lambs, calves, ewes, and cows. They die as a result of lack of feed, and cold weather. Generally speaking, lambing or calving should not begin before April 1 to 10. Many lambs and calves are born at all times of the year, resulting in a very uneven crop of increase which is more difficult to market.

Many ewes and cows calve too young, resulting in some death loss, some stunted ewes and cows, and some stunted lambs and calves. Such animals are difficult to sell and are inferior breeding stock.

D. DOCKING AND CASTRATING.

The same errors in docking and castrating are found in this Unit that have been found in all other parts of the Reservation. Wether lambs are often undocked and ewe lambs are often docked

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too long. The proper docking of all sheep should result in increased sales, increased prices, increased lamb crop, and increased value of wool and pelts.

Buck lambs and bull calves should be castrated younger than is the case in many instances. The proper castrating of bucks and bulls should result in better prices and an increased demand for Navajo wethers and steers.

E. SHEARING:

Practically all shearing is done by hand. Probably all of the larger owners and some of the small ones would use machine shearers if they were made available.

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. Some of the small operators will partly shear some sheep in mid-winter so as to trade the wool for groceries and clothing. Such a practice is very detrimental to the sheep and the owner gets but little for the wool. Much of the "winter clip" wool is used to make blankets and is not sold in the virgin state.

In many instances the shedding of wool takes place in the spring. This is probably caused by too early lambing or lack of sufficient water, either of which produces a fevered condition in the animal and causes it to shed some wool.

The best shearing dates are probably from May 25 to June 10.

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F. HERDING:

The same herding errors are made on this Unit as are made on the rest of the Navajo Reservation. Dry ewes, wet ewes, lambing ewes and wethers are seldom herded separately. All livestock are driven too fast and handled too roughly. Sheep are herded too closely, corralled too long in the same place and trailed over the same ground day after day. These practices should be discontinued.

G. SALTING:

On the basis of the 1957 dipping records, an average of approximately 147 tons of salt would be required annually. A survey of the traders records shows that a total of 9,788 pounds or 4.7 tons of salt was sold to Indians in this Unit. Although the abundance of salt-bearing forage and the salt content of the stock water may materially reduce the salt requirement of grazing animals, a larger quantity of salt is required on this Unit than was sold last year.

H. SUPPLEMENTAL FEEDING:

Very little supplemental feeding of livestock is practiced on this Unit. However, some hay and grain are fed to horses and a small amount of canned and dried milk is fed to lambs during the winter and early spring. A survey of the traders' records shows that approximately 226 tons of hay, 23 tons of

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oats and 18 tons of corn were purchased by the Indians in this Unit in 1937. Probably most of this feed was fed to horses but some was undoubtedly fed to sheep and cattle during last winter's snow storms.

The supply of water and suitable land is so small that the possibility of raising hay or other crops for supplemental feed is negligible. Therefore, the range must be managed in such a way that little supplemental feeding will be necessary. However, the supplemental feeding of bucks and bulls should be practiced. Such feeds as cottonseed cake, grain or alfalfa hay are preferable.

V. RANGE MANAGEMENT OBJECTIVES

A. Increase the income from the natural resources (range) and at the same time conserve and increase the productivity of the range for future use.

1. Adjustment of the livestock numbers to the carrying capacity of the range.
2. Secure livestock distribution which will result in the most efficient use of the land and vegetation.
3. Allowance of a sufficient number of cattle and horses to meet the needs of the people.
4. Controlled breeding of all classes of livestock and better care of sires.
5. Education and demonstration of range management and animal husbandry practices which will tend to increase the efficiency of livestock production and utilization of the natural resources.

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VI. PLANS AND RECOMMENDATIONS

A. GENERAL PLANS AND RECOMMENDATIONS FOR THE UNIT:

The following plans and recommendations are based primarily upon the needs of the land. The needs of the people have been considered to be an added income from the range resources. The following recommendations are the result of a study of the basic data and conditions in the field at the time the surveys were made.*

1. Grazing Dates:

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

2. Class of Livestock:

There shall be 1,390 horses and 1,000 cattle allowed to graze on this Unit. The number of horses was determined by allowing an average of six horses per consumption group. The number of cattle allowed is based upon the number of cattle counted on the 1937 cattle and horse roundup and deducting the estimated number that should be culled. It is estimated that five hundred cattle should be culled.

In adjusting the number of horses, the amount of farmland controlled, the number of livestock (cattle and sheep) owned,

*The cooperation of all other Branches represented on Study Group "C" in the collection of this data and the formulation of these recommendations is greatly appreciated.

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*The cooperation of all other Branches represented on Study Group "C" in the collection of this data and the formulation of these recommendations is greatly appreciated.

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the amount of income other than that from agricultural products or livestock, and the possession of automobiles must be given consideration. After allowing for 1,330 horses and 1,000 cattle, 40,189 grown sheep can be run on the Unit.

8. Bucks, Bulls and Stallions:

Three bucks per hundred ewes = 1,200 bucks and four bulls per hundred 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 the bucks on the Unit. At least one other pasture should be constructed to care for the bulls.

Ten stallions should be allowed. These stallions should be owned and controlled by the Government and bred only to selected mares. Approximately 350 mares will be required to make the necessary replacements in the 1330 horses. With two good jacks, there is a possibility of producing some mules to advantage.

4. Breeding:

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

5. Shearing:

Shearing dates should be from June 10 to June 20. Four shearing plants should be constructed.

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6. Range Improvements:

The maintenance work and new developments recommended should be executed as prescribed in the Range Improvement Survey section of this report. (See Page 150). Additional range improvements and maintenance work will be necessary from time to time and the observations of the Unit Managers, stockmen, and range riders should determine, to a large extent, the class, location, and need for these developments.

One maintenance crew should be stationed on this Unit to take care of all range improvements.

The two buck pastures should be constructed as recommended (See page 158).

7. Livestock Adjustments:

The order of livestock adjustments should be (1) Horses, (2) cattle, (3) goats and (4) sheep. The adjustment in the numbers of horses and cattle should be made immediately. This adjustment should start in Sub-unit No. 2 and proceed to Sub-units Nos. 1, 3 and 4 in the order listed.

The adjustment should be approximately as follows:

Horses	Head	Sheep Units
Cattle	*	* *
Goats	*	* *
Sheep	*	* *
Total - -		

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All animals to be removed should be culled and the least desirable and least productive animals sold first. If this procedure is followed there should be very little, if any, reduction in livestock income; in fact, the increased fleshing that should result should increase the income.

8. Livestock Numbers:

The records of livestock numbers must be kept more accurately in the future than they have in the past. A cattle and horse roundup is needed every second or third year to determine their numbers. More accurate records must be obtained at the dipping vats on the numbers and classes of sheep and goats and on the range used by the various operators.

9. Livestock Movements and Distribution:

As few livestock shifts* as possible are to be made and still secure the proper livestock distribution and management of the range.

All excessive concentrations at permanent water must be eliminated as nearly and quickly as possible. All range around temporary water supplies must be used when water is available and the feed near permanent water conserved for use when temporary water does not exist.

*Livestock shifts are here used to mean the moving of livestock for great distances - over ten miles - or from one part of the Unit to another.

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Livestock concentrations must be eliminated on 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-choo Trading Posts.
4. Jeddito Trading Post and Skunk Springs.
5. Dilkon Dipping Vat.
6. Saybito Well on Cottonwood (Pueblo Colorado) Wash.

Livestock must not be permitted to concentrate around farming areas. This is especially true along the Jeddito and Bida-ho-choo Valleys.

Three range riders are needed on this Unit and one should be stationed at each of the following places: Jeddito Trading Post, Comah Springs, and Indian Wells.

10. Education and Demonstration.

The proper range management and animal husbandry practices should be demonstrated at all times. The back pastures should serve to demonstrate the proper care and management of range resources. Constant individual and group advise should be given the Indians in all parts of the Unit.

One of the first livestock practices that should be inaugurated is the "bedding out" system of herding. Along with this the Indian should be taught to herd his sheep from in front instead of from behind.

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B. SUB-UNITS:

Land Management Unit No. 7 has been divided into four sub-units. These sub-units were determined by a study of the Range Survey Schedules, livestock movements and topography. In so far as possible, these lines were set to include similar conditions of trade, livestock movements, vegetative conditions, and land status.

Table No. VII, page 40, gives the surface acres, percent of area, carrying capacity, percent of carrying capacity and surface acres per sheep unit yearlong, for each of the sub-units.

Table No. V, page 36, gives the commercial income for Unit No. 7 but it is impossible to break these figures down by sub-units at this time. Table No. VI, page 36, gives the population, number of consumption groups and the average size of consumption groups by sub-units.

1. Sub-unit No. 1:

Sub-unit No. 1 is in the northern portion of Unit No. 7 and includes the majority of the woodland and big sage found on the Unit. This sub-unit is higher in elevation, has colder winters, and probably gets more precipitation than any other part of the Unit.

his broken, tree-covered area is preferred by the Indians as winter range. Although the snow often gets quite deep, seldom does it cover the entire area. The south slopes are

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usually covered for only short periods and the shelter of the trees, the protection afforded by the numerous canyons and the abundance of browse make this part of Unit No. 7 valuable as a winter range.

Generally speaking, the vegetation is in a moderately vigorous condition except near Jeddito Trading Post on the Jeddito Wash. This area is a "critical area" and is badly in need of immediate protection from over-grazing. Livestock water is moderately abundant, there being several permanent developed springs, two deep wells with windmills, several temporary surface tanks, and several permanent or semi-permanent undeveloped springs.

Generally speaking, the livestock found in this sub-unit are not of such improved type and quality as they are on other parts of the Unit. The reason for this condition is probably because of the lack of contact of these people with the white stock raisers.

There is some "crossing-over" into Units Nos. 4 and 17 by people and livestock in this sub-unit (See Map No. 4). A number of people move into Unit No. 4 in the spring to farm in the Tse Chissy Valley. They move back into Unit No. 7 in the fall after harvest time. A few families move into Unit No. 17 to farm in the Steamboat Valley, moving back to Balakai Mesa in Unit No. 7 in the fall. In addition to moving for the purpose of farming, the availability of fuel on Balakai Mesa

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is the cause of some of these shifts. Practically all of the sheep in this sub-unit dip at Teddite.

Some of the trade from this sub-unit goes into Unit No. 6 at Keams Canyon and into Unit No. 17 at Steamboat. Also, some trade goes out to White Cone in sub-unit No. 2. Probably very little of the trade from this sub-unit goes off the Reservation because of the distance to the towns along Highway 66. Quite often, the Indians in this sub-unit trade wood to the Hopis for meat or agricultural products. The magnitude of this trade is not known. Most of the wood that goes out of Unit No. 7 is taken out of this sub-unit into Unit No. 6 and a smaller amount going into Unit No. 17 south of Steamboat.

A number of farms are scattered over sub-unit No. 1 but there is practically no possibility of developing an appreciable amount of new agricultural land.

In light of the foregoing data, we may state that the chief value of the land in sub-unit No. 1 is for watershed, grazing, and woodland production.

2. Sub-unit No. 2:

Sub-unit No. 2 is in the central part of Unit No. 7 (See Map No. 5).

This sub-unit lies south of the Mesa Verde capped mesas in sub-unit No. 1. The vegetation consists principally of Galleta, Blue grama, Saccaton, Chamise, Snakeweed and Yellow bush. The range is adapted to yearlong grazing.

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A small amount of woodland is found in the southern and southwestern portions on the volcanic buttes. Except for two critical areas, the vegetation is in fair condition. The smaller but most badly depleted critical area is at Cowah Springs. Here the vegetation has been depleted to such an extent, due to the heavy livestock concentration, that wind erosion is very severe on the light textured soil. Livestock must be excluded from this area if it is to be stabilized. The second critical area is White Cone Flat. Continued overgrazing has resulted in the depletion of vegetation to such an extent that wind, sheet, and gully erosion is becoming very severe.

Thousands of head of livestock graze in this valley during the summer and some stay here yearlong. Not only is much valuable rangeland being threatened but also valuable agricultural land. The whole Jeddito Valley is being threatened by severe erosion and is similar to White Cone Flat. Grazing must be controlled in these valleys immediately. The principal reasons for the excessive livestock concentrations in these valleys are (1) abundance of water, (2) abundance of farmland and (3) the open topography of the range.

Practically all of the farmland is located in White Cone Flat and along Jeddito Wash. One large potential agricultural project is located on the Jeddito Wash in the southwestern portion of this sub-unit where there is a possibility of diverting

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water onto some valuable agricultural land. Practically all of the Hopis farming in Unit No. 7 are located along the Jeddito Wash in this sub-unit.

Some "crossing-over" into and from Unit No. 17 occurs in the eastern portion of this sub-unit near White Cone (See Map No. 4). The sheep in this sub-unit dip at Comah, Jeddito, and Indian Wells. Practically all of the Hopi livestock grazing in Unit No. 7 graze in the northwest corner of this sub-unit.

Practically all of these people trade at White Cone, Ha-ha-tee and Teestoh. Some, however, trade at Indian Wells, Sunrise, Dilkon, Jeddito and Keams Canyon.

3. Sub-unit No. 3:

Sub-unit No. 3 is located in the southwestern portion of Unit No. 7 (See Map No. 5).

The lowest elevation is in the southwestern part of this sub-unit where Coyote Wash leaves the Unit.

Quite a large area of barren "badlands" exists along the southern boundary in the Painted Desert. Over the rest of the area, there are numerous volcanic buttes, the most of which are good grazing lands.

The principal vegetative species are: Galleta, Blue grama, Sacaton, 3-awn, Spiny Muhley, Chamise, Shadscale and Mormon tea. All of the range is adapted to yearlong grazing.

There is a scarcity of woodland and fuel, the only woodland

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being on the volcanic buttes. Those 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's Chair Buttes.

Livestock water is not abundant. Several areas are served only by surface tanks, many of which are of little value. Water is very difficult to obtain because of its depth. Summer rainfall was very scarce in this area, resulting in the growth of a very small amount of feed.

The majority of the livestock are of very good type and quality, showing the influence of some very good sires.

Practically all of the sheep in this sub-unit are dipped at Comah Springs and Dillon. Now and then a band may be dipped at Indian Wells.

"Crossing-over" into other sub-units or other Units is not common. However, one family does move into Unit No. 5 (See map No. 4).

At the present time, approximately one-half of this land is privately owned and is not under the jurisdiction of the Government. Therefore, trespass is committed by both Indians and whites and will continue to be committed until these lands have been purchased or otherwise re-conveyed to the Government.

Two very prominent "critical areas" exist; one at Milton, where continued over-grazing has resulted in severe wind and

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water erosion. Livestock concentrations should be eliminated on this area as soon as possible. The other is at Seba-dalki Day School where wind erosion is endangering the school and valuable range land. Livestock concentrations must be avoided.

Farmland is scattered in small areas over the sub-unit and there appears to be little possibility of materially increasing the acreage of agricultural land.

The above data indicate that the value of the land in sub-unit No. 3 is primipally for watershed and grazing. Therefore, grazing should be so regulated as to properly conserve and improve the range.

4. Sub-unit No. 4:

Sub-unit No. 4 occupies the southeastern portion of Unit No. 7 (See Map No. 3).

The barren Painted Desert formation (Chinle shale) covers an extensive area in the southwestern part of this sub-unit. Several volcanic buttes are located over the rest of the area and, for the most part, are covered with sufficient vegetation to be classed as good grazing lands.

The major vegetative species are: Galleta, Blue grama, Saccaton, Three-awn, Chamise, Mormon tea, shadscale and salt bush. The whole area is well adapted to yearlong grazing.

The only woodland is on the volcanic buttes. The condition of these stands is poor and little fuel wood is available.

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As a result, such browse plants as Chamise and rabbit brush, are used for fuel. Apparently, no coal is available on this sub-unit. Therefore, these Indians are in need of a fuel supply. The closest supply is on Balakai Mesa.

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 of and maintenance on the present supplies as recommended on Page 150 there should be sufficient water, providing the temporary supplies are made use of when they are available.

The livestock in this sub-unit are of fair type and quality, being very similar to those in sub-unit No. 8.

There is some "crossing-over" into Unit No. 17 along Cottonwood (Pueblo Colorado) Wash and east of Indian Wells. Also, there is some "crossing-over" between this sub-unit and sub-unit No. 2. These livestock movements are of little consequence, however, since they do not involve administrative problems. Almost all of the sheep in this sub-unit dip at Indian Wells. Most of the trade goes to Indian Wells and Bida-ho-chee Trading Posts. A small amount goes into Unit No. 17 to Greasewood and Sunrise. Once in awhile some trade goes to Dilkon, Castle Butte and White Cone. A small amount also goes to Holbrook and other places along Highway 66.

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There are quite a number of scattered farms in this sub-unit but the largest concentrated farming area is at Indian Wells. From the Agronomy and Engineering reports we learn that there may be a possibility of increasing this acreage of farmland.

Two "critical areas" exist in this sub-unit, namely: At Indian Wells and Bida-ho-chee including the valley between the two trading posts, and along Cottonwood (Pueblo Colorado) Wash. These two areas have been overgrazed to such an extent that wind, sheet, and gully erosion is destroying them. Livestock should not be allowed to concentrate in these areas and some mechanical erosion control work will be needed.

A quantity of the land in this sub-unit is privately owned (See Map No. 2).

The status of these lands results in the same difficulties as pertain to like lands in sub-unit No. 3.

The chief values of these lands are for watershed and grazing, and inasmuch as the present methods and intensities of grazing are highly destructive to the range, watershed and farms, grazing must be properly controlled.

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