HOPI AGRICULTURAL NOTES

Gordon B. Page

U. S. Department of Agriculture

Soil Conservation Service

May 4, 1940

TABLE OF CONTENTS

ILLUSTRATIONS

L O C A T I O N

Location: The Hopi Unit[1] is situated in northeastern Arizona between 110 00' and 111 00' west longitude and 35 30' and 36 00' north latitude and comprises approximately 780 square miles of dissected mesa land.[2]

H. E. Gregory[3] has described three of the geographic provinces which form parts of the unit, namely, Black Mesa, Tusayan Washes, and the Hopi Buttes. The southern boundary of the Black Mesa is involved, as the long sinuous fingers of the mesa form the northern boundary of the Hopi unit and afford fine high locations for the seven villages of First, Second, and Third Mesas ~~above~~ which overlook the low south dipping country of the Tusayan Washes. The Hopi Buttes province forms the southwestern boundary of the area.

---

1. The term "unit" has been adopted by the Department of Agriculture. Since 1934, the former administrative units represented by six agencies have been subdivided by the Indian Service into eighteen Land Management Units; seventeen of these being Navajo and number six, the unit under discussion, being the eighteenth. The Hopi Unit, however, is entirely self-contained and administered by a Hopi Reservation Superintendent. As graphical units, the Hopi Unit is a representation of the part of the older Hopi Reservation which is actually used by the Hopi. The same area corresponds to the unit which J. W. Hoover refers to as "Tusayan".

2. The original Hopi Reservation of Executive Order of December 16, 1882 was much larger, but the Hopis now occupy the area described above. This former reservation was bounded by the 110 00' and 111 00' west longitude, but extended from latitude 35 30' to 36 00'. The Navajo Reservation thus completely encircles the Hopi Reservation.

3. Gregory, H. E.: United States Geological Survey, Water Supply Paper, # 380, Washington, D.C., 1916, pp. 22-42.

Keams Canyon, the administrative center of the unit, is approximately eighty miles north and east of Holbrook, Arizona, a small town on the Santa Fe Railroad and U. S. Highway 66.

The Hopis live in seven villages, situated on the southern extension of Black Mesa, called, in reference to their location from the Indian Agency at Keams Canyon, the First, Second, and Third Mesas.

Surrounding the Hopis on all sides are the much more numerous Navajo, unrelated to the Hopi and entirely different in custom and mode of life. In the past, the stock raising Navajo has been very troublesome to the Hopi, infringing, as the Navajo tribe moved westward, upon their waters and range and stealing products of their fields.

From Hopi tradition and archaeological evidence we may conjecture that groups of the ancient Hopi first entered the region seeking water and areas favorable for maize cultivation. Possibly the first settlements were along the washes. With the later pressure of wild nomadic tribes, the Navajo, the Utes, and the Apaches, these towns were moved up to low spurs jutting below the mesas.[1] Here they were still near the fields but had the military advantage of elevation. From Spanish accounts of the 16th century we may determine that this type of site was still used.[2] However, after the Pueblo revolt in 1680, reprisals were feared,[3] and all of the

---

3. Bancroft, H. H.: History of the Pacific States of North America, Vol. 12, Arizona and New Mexico 1530-1888, San Francisco, 1888, pp.349.

1. Awatovi.
2. Winship - The Journey of Coronado

lower sites were abandoned and the move made to their present locations, high on the mesa top. Here on bare, wind-swept rock surfaces the new homes were built, and here they have stayed for almost 260 years, resisting ~~all~~ many attempts by Spanish, and later American authorities, to move them down to the flats below.

PHYSICAL FACTORS

Geology: The Hopi region is one of folding and warping of the earth's crust with ~~very little~~ limited faulting. During the Tertiary period the underlying sandstone and limestone strata were elevated and the epigene seas retreated. Fissures caused by the weakening of the crust allowed lava to extrude and flow over the sedimentary beds.

Increasing folding and faulting took place. The land was warped and lifted to elevations comparable to the present elevations.

In late Tertiary time erosion become dominant and reduced parts of the area to a peneplain. The gradient of the streams was later increased by a regional uplift, which enabled the streams to cut through the Mesozoic and Cenezoic strata. Other uplifts took place and the cutting power of the streams increased, enabling them to cut the canyons which form a striking feature of the landscape.[1]

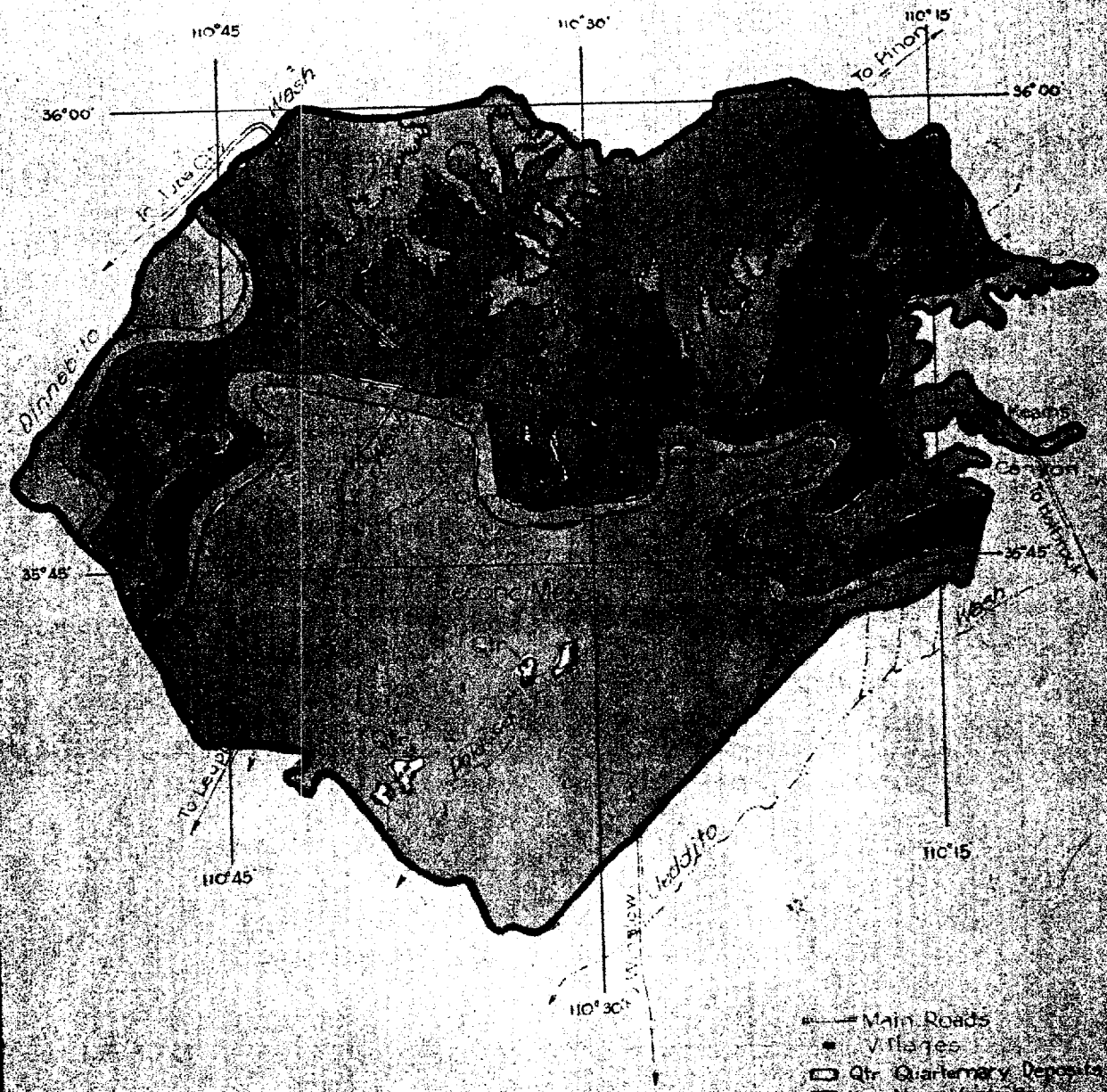
In the Hopi Unit the Jurassic period is represented by the Morrison formation, the Cretaceous by the Dakota sandstone and the Mancos shale. The Mancos is prevailingly argillaceous, but contains many beds of sandstone and numerous thin seams of coal. The Mesa Verde formation of the Cretaceous is present as the cap which covers all three mesas. It consists of sandstones, shales, and coal, which the Hopis utilize, to some extent, for heating purposes.

Quarternary gravels are found in the southern part

---

1. Gregory, H.E.: The Navajo Country.

PLATE I



GEOLOGY

BASE MAP • HOPI UNIT

PLATE I

of the unit.

Products of post-Tertiary erosion are represented by accumulation of alluvium and by large areas of dunes, which the aerial mosaic maps show oriented in a northeast, southwest direction, along the axis; and as barchanes at right angles to the prevailing wind from the southwest.

The dunes climb the mesas of the Hopi Unit and in many cases have threatened patches of farmland. The farmer utilizes the sand, if it is not spread thicker than ~~a foot~~ twelve or eighteen inches, as a mulch for corn, or for beans and melons.

Climate: General characteristics of the climate are very hot summers and cold winters. The elevation (over 5500 feet) and rare atmosphere intensify the daily extremes.

The diversity of topography, flat lands of the washes to high caps of the mesas, varies the local climate.

Sudden thunderstorms are common during the rainy season from late July to early August. The run off is so rapid, during these heavy showers that the ordinarily porous sandstone cannot absorb the flow and the arroyos are flooded, the run off rising above the banks and spreading onto the flats on either side of the upper reaches of the three major washes.

Snow does not usually stay on the ground for long periods, however, it has remained for days and weeks during some winters. At the elevation 6,000 feet on Black Mesa behind the

Hopi villages, snow may remain on the ground for long periods during the winter months.

The climate of the Hopi Country is dry. The rainfall varies from about 10 inches in the lower portions of the region to about 13 inches in the higher portions. The mean annual temperature is around 50 degrees.[1]

1. The seasonal variations in climate are very marked. Each of the four seasons has a distinct type of weather. Through all the seasons, however, three characteristics remain the same. The first of these is the small amount of cloudiness and abundance of clear weather, a feature characteristic of the whole southwest. Second, the humidity is very low, so that the sun's rays are very powerful and one may be comfortable in the sun even in winter. The third element which varies little from month to month is the daily march of temperature. The temperature varies on the average from night to day about 30 degrees, and although this daily temperature change may be as much as 60 degrees and occasionally as low as 10 degrees, the temperature varies usually with such regularity that one can predict on a clear day in the morning just what the temperature will be at each hour of the day. The annunal march of temperature follows closely the altitude of the sun, the temperature being the highest in July and lowest in January. The regularity of the temperature and the dominance of solar climate is shown clearly in figure where the average maximum and minimum temperatures have been plotted for Keams Canyon.

Precipitation has markedly a seasonal distribution. The wet seasons are winter and summer, and the dry seasons, fall and spring. In the winter precipitation falls mostly as snow. The maximum snowfall occurs in February and from then until May the precipitation gradually decreases. In May and June the humidity is very low, and rain rarely falls. These two months are characterized by strong winds, causing sandstorms and duststorms which make this season the most unpleasant of the year. This dry windy season is also a factor in making agriculture precarious, for the plants are often killed by the sand cutting the young tender shoots. Protection is necessary, for some of the crops.

The summer rainy season usually begins suddenly about the middle of July. About 3 or 4 inches of rain falls on the average during July and August. This falls usually not in general storms in which the sky is completely overcast as in Eastern United States, but as scattered thunder-showers, some of great violence. For periods of several days or even weeks, in the summer, the weather may be entirely clear, but then will begin a rainy period of several days duration. During this rainy period, the nights are usually clear and cool. Clouds form in the middle of the morning and grow in size moving slowly up over the region usually from the southwest. In the afternoon large thunderheads grow, scattered over the region. Rain falls from these as they move across the country drenching everything in their path (see figure). Sometimes when the air is less humid, the clouds are so high that if rain falls it may dry up before reaching the ground. Rarely "general rains occur" when for pericds of several days the whole region may be clouded over; the temperature both at night and during the day is cool and rain falls intermittnetly in light showers or drizzles. Mss. by John Hack, Harvard University.

JEDDITO 1932 - 1936

Climatalogical Data

	Temp. Av.	Precip. Av.	Snowfall Av.	Rainy Days Av.
Jan.	28.8	.78	4.00	4
Feb.	35.4	.96	4.46	7
March	41.6	.52	3.44	4
April	49.7	.65	1.56	3
May	57.6	.65	.28	4
June	67.7	.09		2
July	74.5	1.49		8
Aug.	71.9	2.48		10
Sept.	64.8	1.01		5
Oct.	53.6	.88		4
Nov.	41.6	.51	1.90	4
Dec.	30.3	.76	1.70	4
				59 per yr.

Growing Season April - Sept.

Average Temp. 51.4°

Average Precip. 10.78"

Average Snowfall 17.34"

Water Supply[1]: The springs which supply the water for gardens, reservoirs, and domestic purposes are found in a restricted zone which forms the contact between the Mancos shale and the sandstones of the Mesa Verde formation (note Geology map). The sandstones of the Mesa Verde formation of Black Mesa which dips gently southward, acts as an enormous catchment basin. The sandstone being permeable and the Mancos shale beneath being impermeable, the water is conducted toward the southern rim of the mesa. Here the water emerges in the form of springs.

The Indians have constructed stone reservoirs to hold this water until needed. The flow sufficies for domestic purposes and for the gardens.

The greatest need for water, aside from water needed for human consumption, is that of a sufficient amount for stock and crops. Indian Service engineers have attempted to pump water out of the washes adjacent to the villages, by means of windmills and storage tanks, but the need has not been satisfied yet.

An artesian well has been drilled at Taylor's ranch in the Wepo Wash, about three miles east of the First Mesa, but this serves only local use.

---

1. Compare: Gregory, H. E.: The Oasis of Tuba, Arizona, Annals of American Association of Geographers, Vol. 5, 1915, pp. 107-119.
Cotton, E.: Tuba City and the Charlie Day Spring, Northern Arizona Notes, Vol. 3, No. 11.

Water for stock purposes has been developed in the past three years by building "Charcos" or water holes. A small dam of earth is thrown across a drainage and when rain falls, the runoff is caught and held until stock, evaporation, or soil absorption uses up the supply.

Water for farming purposes, aside from garden supply, is utilized by clearing ground for fields on a silt fan at the point where the sheet flood may be spread to cover a maximum acreage but not uproot the corn plants.

Various attempts have been made to pump the flow out of the washes in the lower part of the unit, by means of pumps, but the deepness of the arroyos has hindered the attempts.

Waters

First Mesa

"Coyote" spring at the foot of the Tewa Trail.

"Coyote" spring on the north side of the mesa.

Wepo spring at Taylor's ranch.

Second Mesa

Spring at Toreva (a school just below mesa rim).

Shongapovi uses a spring on the southwest side (La Nava) of the mesa and another called "Masepa" on the east side of Second Mesa.

Third Mesa

New and Old Oraibi use a well at the foot of the mesa. (La Nangnva)

---

1. Compare Hoover, J. W.: The Hopi Indian Country.

Hotevilla and Bacavi use springs at or very near the two villages.

since historical times

Vegetation: The vegetation of the Hopi region seems to have always been of a barren character--Sitgreaves[1] notes the area, near the Tusayan country as barren and wasted; and Whipple[2] classified the same area as rock, sand, and sagebrush. Garces in 1776 noted that " . . . in the cañadas at this place there are many peach trees, the ground is sterile but well cultivated about the trees."[3] Dr. E.S.G. Ten Broek in a letter dated March 31, 1852, Walpi (First Mesa) notes, " . . . the valley is most miserably poor, but there are thousands of acres in it".[4] Lieutenant Ives reported in a letter of May 11, 1858, from Mishongovi (Second Mesa)[5] that grazing areas were very scarce although there appeared to be good grass in the Wepo Wash.

Farther south, however, along the margins of the Little Colorado, possibly near the present site of Winslow early explorers must have been struck by the plentiful grass and native flax which covered fields along the river's margins as the early name for the river was that of Rio de Lino, (River of Flax).

Within the area under discussion may be found three zones[6]

---

1. Report of Expedition Down the Zuni and Colorado Rivers, 33rd Congress, 1st session, Executive Document, 1854.
2. United States Pacific Railroad Explorations, Vol. 3, Part 2, 1854.
3. Coues, E.: Fray Garces.
4. Ten Broek, E.S.G. Quoted in 11th Census Bulletin.
5. Lieutenant Ives, Quoted in 11th Census Bulletin.
6. Gregory, H. E.: The Navajo Country, pp. 72-73.

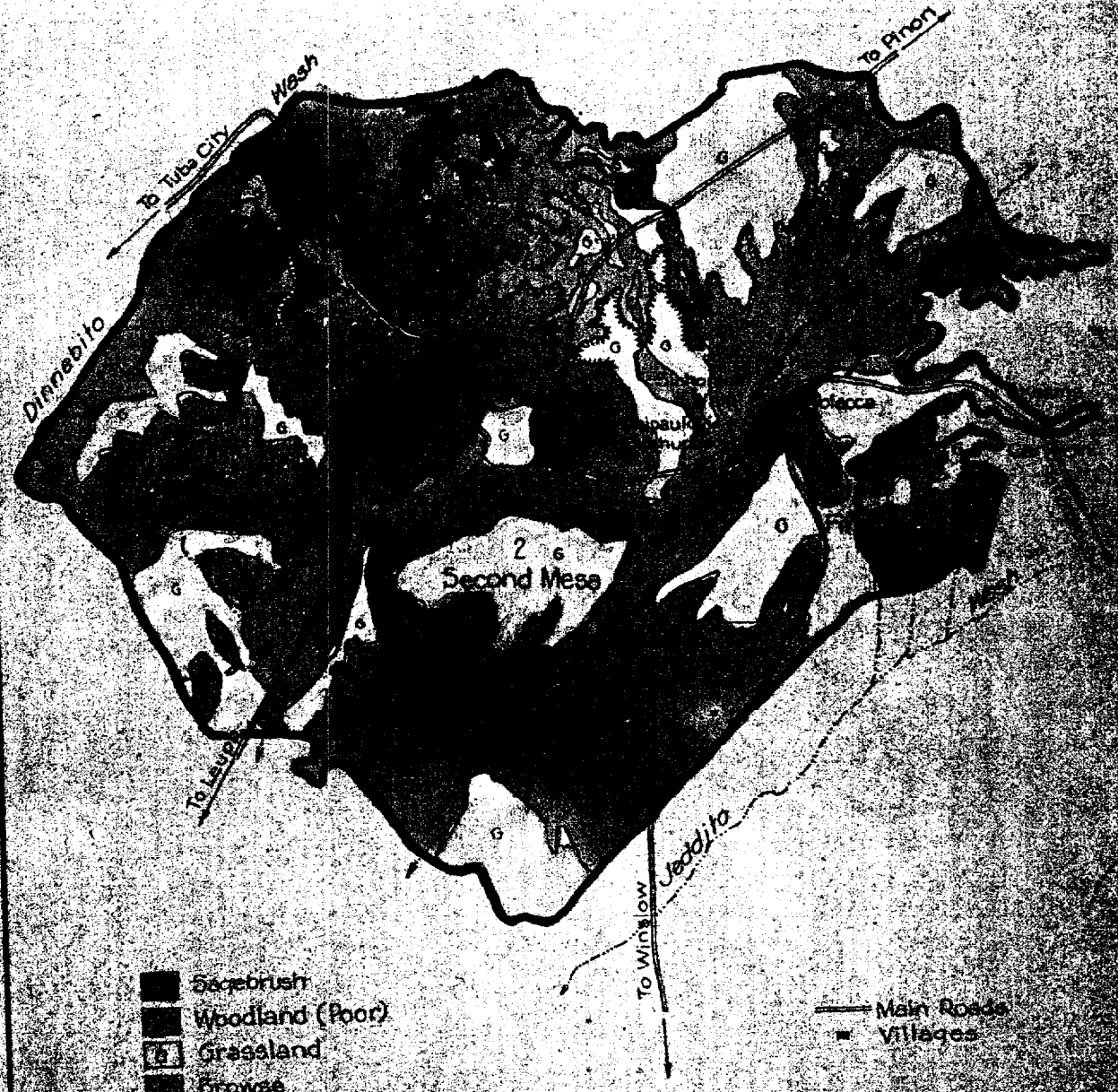
of vegetation.

1. Zone of cottonwood, cactus, and yucca; altitude 3,500 to 5,000 feet (type area, Little Colorado Valley). In this zone vegetation is scanty and inconspicuous over large areas. "Flat leaved" and "Globular" cacti are abundant, yucca is common, grass is scanty and usually in detached clumps. Sage and greasewood are of small size; scrub juniper and pinon are rare. During the rainy season, annuals such as Mariposa lily and yellow sun flowers appear. Wild flax is common. This zone is the range used for winter range by Hopi cattle.

2. Zone of sagebrush (Artemisia) and greasewood (Sarcobatus); altitude 5,000 to 6,000 feet. The locations of the Hopi villages, altitude 5,800 feet fall in this zone. Sage in this zone attain heights of four and five feet and may be close packed, to the exclusion of trees, on mesa tops that have not been utilized by stock. Besides the ever present sage and greasewood, grass is fairly abundant. Patches of pinon and juniper of scrub size are irregularly scattered about, usually along rock ridges. The constant cuttings by Hopi and Navajo in search for fuel have thinned out or, in some cases, wiped out former pinon and juniper stands.

3. Zone of pinon (Pinus edulis) and juniper (juniperus monosperma); altitude 6,000 to 7,000 feet. The pinon usually

Plate III



FORAGE TYPES

BASE MAP • HOPI UNIT

grows at higher altitudes than the juniper. The south edge of Black Mesa and the region immediately behind the Hopi villages is characterized by this growth. Sage brush, and, to a less extent, greasewood, occupy the open spaces between the pinon and juniper trees. Often, parks of sage are found, surrounded by groves of pinon. Grass in tufts and scattered mats grow everywhere.

Fauna: "The larger indigenous animals most frequently seen in the Hopi country are the coyote, the rabbit, the prairie dog, the trade rat, the field mouse, and snakes of several species, including abundant rattlers, and a large variety of lizard.[1] The Spanish Padres, Sitgreaves[2] (1854), and Leathermann[3] (1858) found antelope in the areas away from the villages. The principal birds are the eagle, the hawk, the night hawk, the raven, the wild turkey, the crow, the pinon jay, the cat bird, and the rock wren.

---

1. Gregory, H. E.: The Navajo Country, pp. 72-73.
2. Report of an Expedition down the Zuni and Colorado Rivers, 1854.
3. Leathermann, Jonathan: Sketch of the Navajo Tribe of Indians, Smithsonian Institute, Tenth Annual Report, Washington, D.C., 1855.

POPULATION

As it has been stated in other sections of the paper, the Hopis are concentrated in a relatively small portion of their use area.

Over a period of 400 years recorders have reported estimates of the number of Hopis living in the villages of the three mesas. Earlier reports were no doubt grossly exaggerated. However, from 1865 to the present the population figures have been fairly constant.

Donaldson records 1,996 Hopis in 1893, there are now approximately 3,000, or an increase in number of some 1,200 people. There are reasons for believing that the Hopi population is increasing steadily. The 1936 survey disclosed that 47% of the total population was under 20 years of age. There were 391 women between the ages of 20 and 45 years and 380 children under 5 years of age. Using a unit figure, the above statistics give us 972 children per 1,000 women. This is comparable to the ratio among the United States farm Negro, which is 987, and much higher than the United States General Native White figure of 503 children per 1,000 women.[1]

The problems of administration will be further complicated by this surge in population. Hospitals, clinics, schools and easier means of transportation are factors which will insure this increase.

The Hopis have absorbed groups of peoples who have come to them at various times to escape drought or the results of the Pueblo Revolt in 1680. These groups, however, were usually of pueblo stock. There has not been much inter-marriage with the Navajo. There have been some 20 marriages in the past 20 years between Hopi and Navajo with 50% of these have been between Navajos and the Tewas of First Mesa.

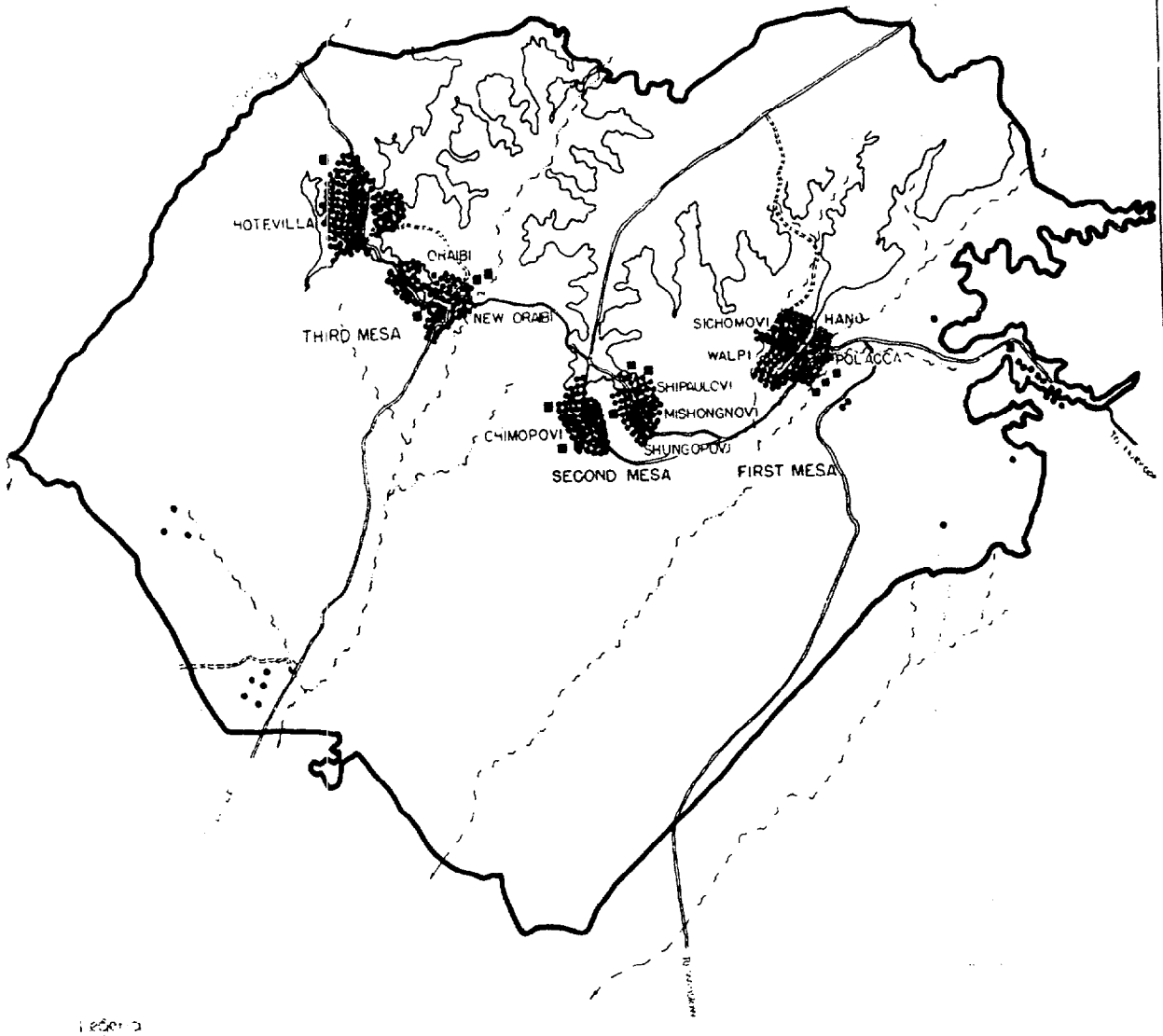
One white man has married a member of the tribe and lives near

---

1. Population Statistics, 1937 National Resources Committee.

POPULATION DISTRIBUTION

HOPI UNIT



LAND MANAGEMENT UNIT 6
NAVAJO DISTRICT

DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SECTION OF CONSERVATION ECONOMICS
SOURCE: HUMAN DEPENDENCY SURVEY - 1937
SCALE IN MILES

USPRI002405

Polacca. There have probably been some marriages between Hopis and ~~Hopis~~ Whites at various times, away from the Reservation, but records of such unions have not been available.

TABLE 1

POPULATION TABLE

Sub Unit	No. of Con. Groups	Population	Ave. Con. Group
First Mesa	141	814	5.8
Second Mesa	121	735	6.1
Third Mesa	211	1,070	5.1
Total Hopis	473	2,619	5.5
Total Navajos	20	160	8.0
TOTAL	493	2,779	5.6

It will be noted that there are 160 Navajos living within the Unit. None of these live in the villages but 16 live around the periphery of the village use areas. Some of the members of these groups have affiliations with the villages through marriage, by acting as herders for Hopis or by old established rights of occupation.

1. A consumption group consists of a family sharing the produce of fields and flocks and limited cash income.

POPULATION AND SERVICES

COMPARISON OF POPULATION OF THE THREE MESAS 1583-1936

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FIRST MESA	1583	1745	1775	1776	1780	1846	1852	1853	1860	1861	1865	1876	1893	1898	1936
Mano				660				600			250			159	
Sichomovi				90				120			100			103	
Walpi				1,200				900			300			232	
Polacca															814
SECOND MESA															
Musangnuvi				300				900			250			244	
Supaulovi				84				900			200			126	
Toreva															
Sonahpovi															
Chimopovi				360				900			600			225	735
THIRD MESA															
Oraibi				4,000				2,400			800			900	[illegible]
Bacabi															1,074
Hotevilla															
TOTAL	50,000	10,846	7,497	6,694	798*	2,450	8,000	6,720	7,000	3,500	2,500	2,700	1,996	1,989	2,779

Population estimate sources:

1. Espejo
2. Franciscaus
3. de Anza
4. Escalante
5. de Anza
6. Governor Bent's Report of Nov. 10, 1846
7. T. Ten Brack ?
8. Whipple Report (Mr. Leroux)
9. Abbe Domenech
10. I. Ward (Stock Report)
11. I. Ward
12. Powell Report
13. 11th U.S. Census-Extra Bulletin-Donaldson, T.
14. F. W. Fewkes
15. Soil Conservation Service Dependency Survey Census

* A three year drought caused many deaths and desertions.

** A small pox epidemic is reported to have reduced the population to some 2,000 between 1853-1854 indicating that this figure (7000) is based on hearsay. See abstract of Lt. Thipple's Report in 11th Census-Extra Bulletin.

POPULATION CENTERS

In 1938 there was approximately 2,779[1] people distributed throughout the unit. Of this number, however, approximately 2,600 ~~are~~ were concentrated in the following sub-units.

A. Keams Canyon
   a. Boarding School
   b. Hospital
   c. Telephone Exchange
   d. Roads and ECW Warehouses
   e. Trading Post

B. First Mesa
   a. Hano [2]
   b. Sichomovi
   c. Walpi
   d. Polacca
      a. Day School
      b. Trading Post
      c. I.S. Garage and Irrigation Warehouse

C. Second Mesa
   a. ~~Musengnuvi~~ (Musangnovi)
   b. ~~Supaulovi~~ (Shipaulovi)
   c. Toreava
      a. Day School
   d. Mission
   e. Sonahpavi
   f. ~~Chigmopovi~~ (Chomopovy)
      a. Day School

D. Third Mesa
   a. Oraibi (Ki'-gots-movi)
      a. Day School
      b. High School
      c. Resident Doctor
      d. Trading Posts
   b. Old Oraibi
   c. Bacavi
   d. Hotevilla
      a. School

Of these population concentrations, the largest are: First Mesa on the Polacca and Wepo Washes, and Third Mesa on the Oraibi and Dinnehbito Washes.

---

1. Statistical Summary - Human Dependency Survey - Navajo & Hopi Reservatio Soil Conservation Service (unpub. report) Department of Agriculture, Gallup, New Mexico, 1938.
2. The spelling of the town names is that approved by the President of the Hopi Council.

Keams Canyon and the population concentration there should be considered apart from the others because of its geographical location on the edge of the unit and the administrative functions performed there. Of all the concentrations it alone is composed of a majority of White and Indian officials.

ROADS AND TELEPHONES

The primary Holbrook-Keams Canyon Highway enters Unit 6 at Keams Canyon, crosses in a east-west line to Oraibi, contacting all concentrations directly or by short secondary feeders, turns south at Oraibi and leaves the Unit at Shonto Springs, continuing on to Highway 66 via Leupp. The primary road from Gallup enters the Unit at Keams Canyon.

A secondary road connects Oraibi and Tuba City, to the northwest. A primary road connects the Keams-Oraibi Highway with Pinon to the northeast. There is also a secondary road from Polacca - Winslow.

Due to the number of schools the Unit is well supplied with telephones. The main telephone line from Holbrook follows the general alignment of the Holbrook-Keams Highway to Keams where the exchange is located. From Keams a branch line extends to Third Mesa connecting most of the towns. A branch also extends to Pinon. The continuation of the line to Tuba City from Oraibi is now complete.

TRADING POSTS - SCHOOLS - HOSPITALS

There are four trading posts in the Unit. Halderman at Keams, Tom Pavatea at Polacca and Lorenzo Hubbell and the James Bros. at Oraibi.

In addition to these posts there are seven stores, with limited stocks in the various towns. These small stores are run by Hopis and are often habitation - shops.

There is a boarding school at Keams Canyon and day schools at Polacca, Toreva, Chimopovi, Oraibi and Hotevilla respectively. In addition, at Oraibi, there is a new high school, opened in the fall semester of 1937.

All of the above schools are maintained for Hopi children exclusively except Keams boarding school which has approximately 150 Navajo pupils and 60 Hopi pupils.

A hospital is maintained at Keams Canyon and a Resident Doctor with a Dispensary at Oraibi, thus putting medical attention within 12 miles of the large population concentration at First Mesa and 35 miles of the Third Mesa, where, however, a physician is located. Small dispensaries are located at the various schools.

Pages 19 to 28 published in PLATEAU, March 1940.

LAND USE PATTERNS

There are various conflicting claims made by the Hopi relative to land which they use.

The Hopis, first of all, claim the North American continent from ocean to ocean. This claim is always presented as being a basic consideration in boundary discussions. The second claim is more conservative and approximates the area formerly occupied by the ancestors of the clans which now make up the loosely organized "Hopi Tribe". This is an area bounded roughly by the Colorado - San Juan Rivers to the north, the present Arizona - New Mexico State line on the east, the Zuni and the Mogollon Rim to the south and the Flagstaff Peaks to the west. This is an area of shrines, sacred natural features, eagle trapping locations and regions where salt is obtainable. It is necessary to realize, concerning this second claim, that actual use is not the important thing. What is important is that this area be recognized as a sacred area. Use is made of it by priests who visit the shrines to perform certain rites, to trap eagles and to gather various herbs and minerals necessary to their rites. The Hopi does not think of this region as an area to be used for agricultural use or for exploitation of the natural resources.

Within the two previously mentioned areas there are two more, the first, cattle range and the second, agricultural lands.

In major land disputes with Navajos the Hopis usually begin all discussions with a presentation of the religious claims and then present the practical claims based on livestock or farming use.

The area ranged by cattle is fairly recent, since the beginning of the 19th century. Cattle were owned in earlier times but cattle herding as

Ouch insert Van Valkenburgh

an important factor in the culture, had not been developed.

Four operators with large herds emerged in the late 1800's. These men established ranges and herding camps as far away from the villages as Shonto Springs, Tolani Lakes, Ganado and the Hopi Buttes. These localities are now deep within the regions presently used by Navajos.

The Hopis feel that the cattle ranges gave them prior rights to the area now settled thickly by the Navajo.

Due to the character of the Hopi method of herding cattle, some doubt may be cast on this claim. Few operators, even today, make any attempt to herd or account for the cattle they own. The cattle drift and often drift into a Navajo corn field or on Navajo sheep ranges.

The fourth and last use area represents the basic "home land" of the Hopi. This is the region represented on the accompanying maps. Here the Hopi has his home, his fields and his flocks.

Sheep are herded and corralled within a radius of ten or fifteen miles of each village and for that reason do not usually overlap Navajo sheep ranges.

Agricultural lands are in essentially the same locality as they were when the first migrating clans found them and cleared and planted for the first crop.

The first clan, traditionally the Bear clan, settled near the spurs of First and Second Mesas and used the lands in the washes which drain Black Mesa. Other clans continued to enter the area and with the consent of the Bear clan, settled nearby.

As the towns grew in size, other villages were established as suburbs on adjacent spurs of the mesa.

The system of allotment of lands was simple. The Bear clan continued to grant allotments until the Sun clan, presumably the last clan to enter the area, occupied the blocks on the edge of the clan allotments as they are recognized today.

Within the clan, authority to grant use of land remained with the "clan mother" who allotted planting areas and settled disputes.

Land disputes between clans was presumably settled by the Kibmangwis who were usually members of, or affiliated with the Bear clan.

Livestock range was not a factor until the entrance of the Europeans and then, not important until the Reservation Period.

The clan block system was the predominant pattern until late in the 1800's.

The pattern of land use has changed considerably since 1900 A.D. A comparison of the maps labeled "Land Use Pattern Before 1900" and "Land Use Pattern, 1939" show a marked shrinkage in the areas formerly classed as "clan land".

Before the revolt and disruption of Old Oraibi in 1906 there were still traces of clan land holdings in the Oraibi Wash.

Stephen [1] who lived some years among the Hopis during the late 1880's reported, concerning Oraibi, "of the land properties there are still traces that it once was divided on a communal basis for use of families composing the clans and not as individual holdings".

Conrad Quoshema [2] of Oraibi ~~says~~ states that Lomayayouma, his grandfather, told him of clan lands extending from what is now Well H-60 along both sides of the Oraibi Wash southward for five miles. Lomayayouma also stated that the Bear Clan, of which he was a member, controlled the best blocks of land situated on the wash near the present site of New Oraibi.

A tendency toward expansion of existing farm land at Oraibi was apparent before the "revolt". [3] Some individuals began to encroach on the clan blocks and overlapping and confusion ensued. The sanctions applied to land rights lost their significance. The revolt precipitated the tendency toward a break up of clan lands. Over a period of a few years the clans lost their rights. Individuals using the land continued

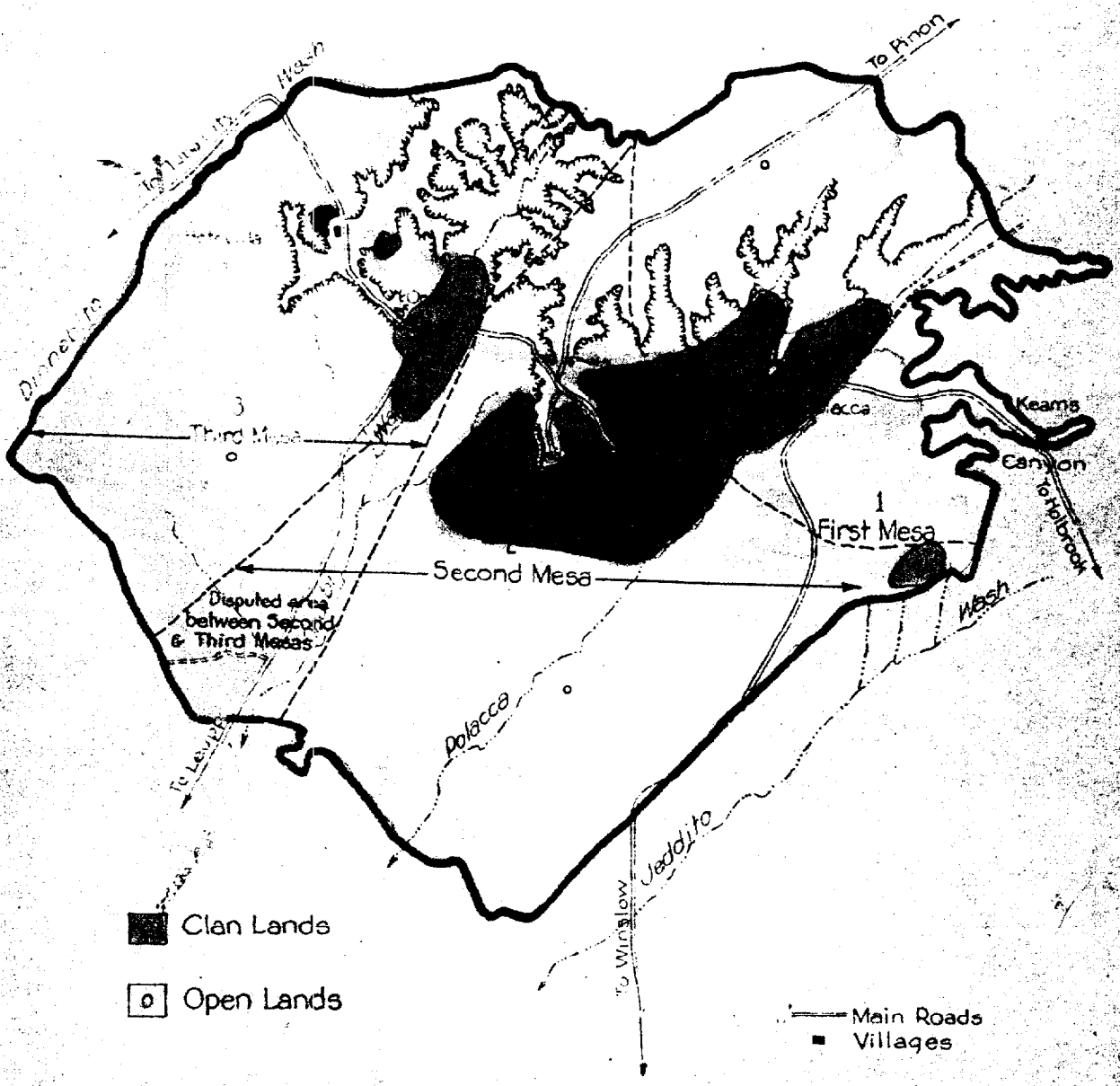
---

1. Stephen, A.M. "Hopi Journal" (Edit. by E. C. Parsons), Columbia University Contributions to Anthropology, Vol. 23, 1936, p. 17.

2. Conrad Quoshema, Dec. 20, 1939.

3. Lomayouma

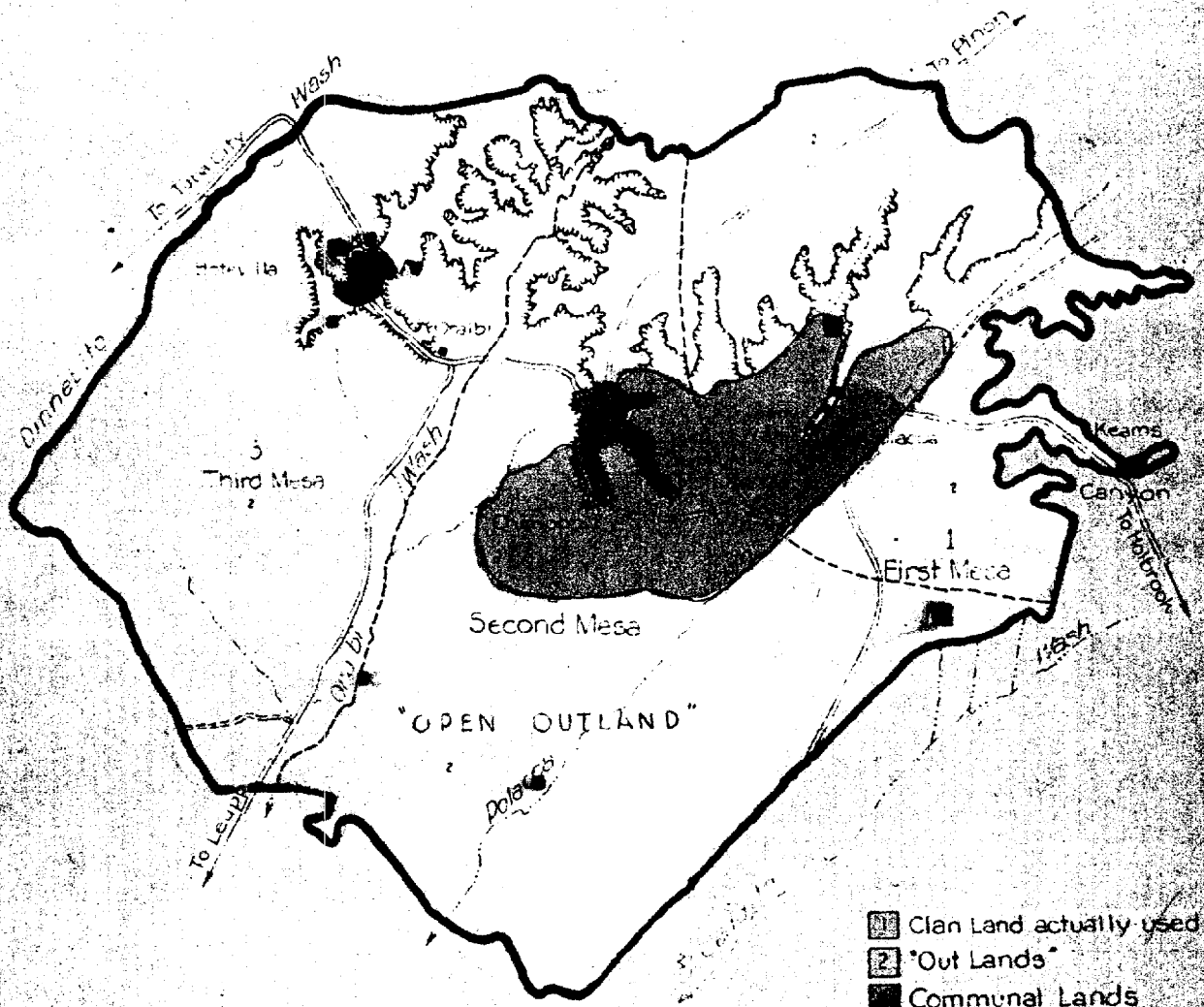
PLATE VII



LAND USE PATTERN
BEFORE 1900 A.D.
BASE MAP ◦ HOPI UNIT

Scale in Miles
0 5

PLATE VII



LAND USE PATTERN
1939
BASE MAP ◦ HOPI UNIT

to do so but on an individual use basis. New lands were cleared and prepared for farming by individuals who either desired more land than the clan blocks provided or wished to use lands away from the former agricultural areas.

With the breaking away of groups from Old Oraibi, new lands were opened up. The gardens at Hotevilla and Bacabi, formerly used by the people of Old Oraibi were taken over by the groups from that village, who settled near the gardens and utilized the water from the springs for domestic purposes.

The families who settled New Oraibi took over much of the old clan blocks as did Bacabi, but on an individualistic basis.

The clan block system continued ~~to hold~~ at First and Second Mesas. This condition was probably due to a more stable village government and the presence of strong leaders at the time of the Oraibi "revolt". Too, the deep-seated conservatism of the villages of First and Second Mesas may have been of a more passive nature than Old Oraibi and the necessary adjustments were made in the relations between the villages and the government without the breakdown of religious and civil authority.

Individuals living in the villages of Chomopovy, Shipaulovi, Musangnovi, Walpi, Sichomovi, and Hano were free to open and use new lands, with the provision that it was not clan land, and that their nearest neighbors approved. Beyond these two limitations an individual was free to use land provided he kept within the area used by his village.

The Hopi Unit has been divided into three sub-units, the sub-units being defined by the traditional village boundaries existing before the Reservation period.

There exists today a well defined boundary between First and Second Mesa. The boundary is based on traditional claims, seemingly based on

land claimed by the house chiefs of the first groups to settle in the area.

The boundary between Second and Third Mesa is disputed, but for practical purposes of land administration a compromise has been acknowledged. The Oraibi Wash serves as a boundary and splits the area claimed by each Mesa group.

Of the three sub-units, it may be seen that in the third, centering around Oraibi, there have occurred the greatest changes in land patterns, the central and eastern units remaining stable in land policy.

While the Oraibi "revolt" was gathering momentum in the middle 1800's a new force was beginning to make itself felt on Hopi land use. This force was exerted by Navajos, who in increasing numbers were settling on the periphery of the region occupied by the Hopi.

After the release from Fort Sumner, the Navajos were forced, by new treaty obligations and increased pressure by white immigrants from the Rio Grande valley, to abandon to a large degree their old territory in the Mt. Taylor - Chaco Canyon region. This tended to push many members of the tribe westward even beyond the west boundary of the 1878 treaty reservation established by Executive Order. Droughts also attracted some groups to the Hopi country to trade for corn and melons. These groups settled in the Jeddito Valley and on Black Mesa where water was available.

Ute and Navajo raids for agricultural produce and slaves were not uncommon before 1879. In this year an Agency was established at Keams Canyon and some measure of protection was given to the Hopi. Trading posts were founded at Keams Canyon, Polacca and Oraibi after this date and the good obtainable at these posts influenced Navajo families to settle around the Hopis.

The juxta-position of the two groups generated some friction over outlying agricultural lands.

The individual holdings of the Hopis mentioned earlier were, in some cases, along the Jeddito Wash and south of Oraibi near Padilla Mesa. These areas were settled by Navajos and permanent camps built.

The Hopis and Tewas of the villages on First Mesa were directly involved in this settling of lands in the southeastern portion of the Hopi use area. Inter-marriages between these two groups and Navajos occurred in this area creating a colony in Talahogan Canyon, which is unique in the Hopi Unit today. This farming colony is made up of descendents of these inter-marriages, who use the springs in the canyon to water the terraced gardens built below the canyon rim and are constantly expanding the areas planted to corn.

Other Navajo families have settled south of Talahogan Canyon in order to be near the flocks which they herd for Hopis of the First Mesa villages. Small areas of agricultural land are used by these groups to furnish subsistence and in this manner new lands are being developed for dry farming along the Jeddito Wash.

So far the discussion of the land use pattern has been chiefly agricultural, that is the use of land for raising crops not for ranging stock. To the Hopi the use of fields for raising corn and other crops has more than an economic significance. The raising of corn has become an integral part of his inner life, his spiritual life. An infinite number of ceremonials and acts are bound up with his concepts of agriculture.

This is not true of a new stratum of land use which, introduced by Europeans, has now become an important factor in the Hopi economy. This strata is the pattern imposed on the basic agricultural clan - individual

land holding concept by the introduction of livestock in the form of sheep, goats, cattle, horses and burros.

The Hopis readily realized the value of livestock but the manner of production did not become a part of his religious life. Systems of herding, establishment of range lands, the trade of livestock products all became fixed in the general pattern, but the use of livestock was not accepted as a part of the Hopi concept of the inner life.

This is a separation of economic factors which must be considered in administration.

In the application of revised land use ways a searching survey is necessary where the proposed uses of clan blocks is concerned in order that ritualistic planting ceremonies and religious holdings be preserved intact. The same plans applied to livestock movements will not have as great an affect on the inner core of the Hopi's way of living and therefore a more realistic approach to range problems may be used.

THE HOPI BOUNDARY

For many years, officials concerned with the administration of Hopis and Navajos have advocated the establishment of some sort of a boundary.

After the abandonment of the missions by the Spanish and in the period of raids by the Navajo and the Utes, the Hopis moved their villages from the low benches above the farm lands to the higher parts of the mesas above their villages. Here new towns, designed for defense were built.

The Hopi seeking peace was by fear confined to a comparatively small area.

TECHNOLOGY OF RANGE USE

Herding of Sheep and Goats: Transhumance,[1] where care of the sheep is delegated to shepherds and the rest of the group remains sedentary, is a term which may define the use of the Hopi area by livestock, particularly sheep and goats.

The Hopi, as may be gathered from material in the Historical Sketch is firmly attached to his village on the mesa top. During the summer months, all able-bodied men are employed in the fields, planting, tending, and harvesting. The women are busy in the households. Thus the shepherd's task ~~is~~ often delegated to very young boys and girls and to very old men. The sheep and goats are ~~usually~~ often banded together in village flocks or in herds made up of sheep owned by several related household groups.

---

1. "Pastoral life presents itself under three principal forms--nomadism, transhumance, the pastoral life of the mountain. . .It is founded on the exploitation of livestock; it involves periodic movements of the stock as they exhaust the resources of their encampment". This is the definition of pastoral life, given by Philippe Arbos.

Of the three terms mentioned by Mr. Arbos, the only one which might be applied to the Hopi livestock complex is that of transhumance, and this is not, I believe, an entirely accurate description. Perhaps a better word would be the 18th century Spanish sheep herding term of "estantes", meaning stationary flocks. The opposite term "transhumantes" was used to designate migratory flocks which moved long distances for summer feed.

The distinction between these two expressions is probably of minor importance, but they are cited as the best descriptive terms that may be applied to the herding of Hopi sheep.

Arbos, Philippe: The Geography of Pastoral Life, The Geographical Review, Vol. 13, No. 4, October, 1923, pp. 559 published by The American Geographical Society, New York.

Burns, Robert H., and Moody, E. L.: The Trek of the Golden Fleece, The Journal of Heredity, Vol. 26, No. 11, Nov., 1935, pp. 437.

Mr. Hoover has listed eight movements of the Hopi's closest neighbor, the Navajo, who uses the same range. They are:[1]

1. Moves between summer and winter pasture.
2. Seasonal moves controlled by temperature conditions.
3. Temporary moves for summer farming.
4. Winter moves for feed.
5. Moves after showers for pasture in the drier parts.
6. Moves in search of water for domestic purposes.
7. Autumn moves for pinon nuts and for peaches.
8. Moves for social reasons.

---

1. Hoover, J. W.: Navajo Nomadism, Geographical Review, Vol. 21, July, 1931, pp. 432.

Of these eight possible reasons for moves by the Navajo, four are for shifts that will enable their stock to feed or obtain water to a greater advantage than the primary location.

On the contrary, the Hopi, by reason of one fixed residence, is forced to hold his flocks close to his mesa home. A few of the more "progressive" farmers have established a six months' home near their fields and have sheep and goat corrals at these locations to care for their flocks. The majority, however, range their stock south from the mesa rim, keeping to the level or slightly rolling range near the washes. The range of each flock is strictly limited by the location of the corral and by the water necessary to the stock. The water is limited to springs near the villages, to wells and windmills in the washes and "charcos" or stock tanks. These locations, therefore, limit the areas that may be utilized for continuous use, and here the corrals are built. Grass, away from the areas mentioned, may be utilized, if the rainfall is above normal or if tanks built in recent years fill with sufficient water to supply the flocks. The result of the limiting factors is that the sheep herders keep within 10 or 12 miles of the villages. The Navajos who herd just along the borders of the Hopi area have established range rights through use and have closed in around the Hopi, making future expansion of range for Hopi stock almost an impossibility.

It seems quite likely that the decreased stands of grass, pinon and juniper on the mesa tops near the villages may be attributed to this practise of holding the flocks close to the villages. Antelope Mesa, in the southern portion of the unit has, by it's location, been used comparitively little for grazing, and as a result, supports a fair growth of the above stands.

The areas of severely overgrazed land may be observed from the Range Map. These areas are along the washes and around the bases of the three mesas. The more inaccessible mesa crowns are not so badly overgrazed and are so typed by the range examiners of the Soil Conservation Service of the Department of Agriculture.

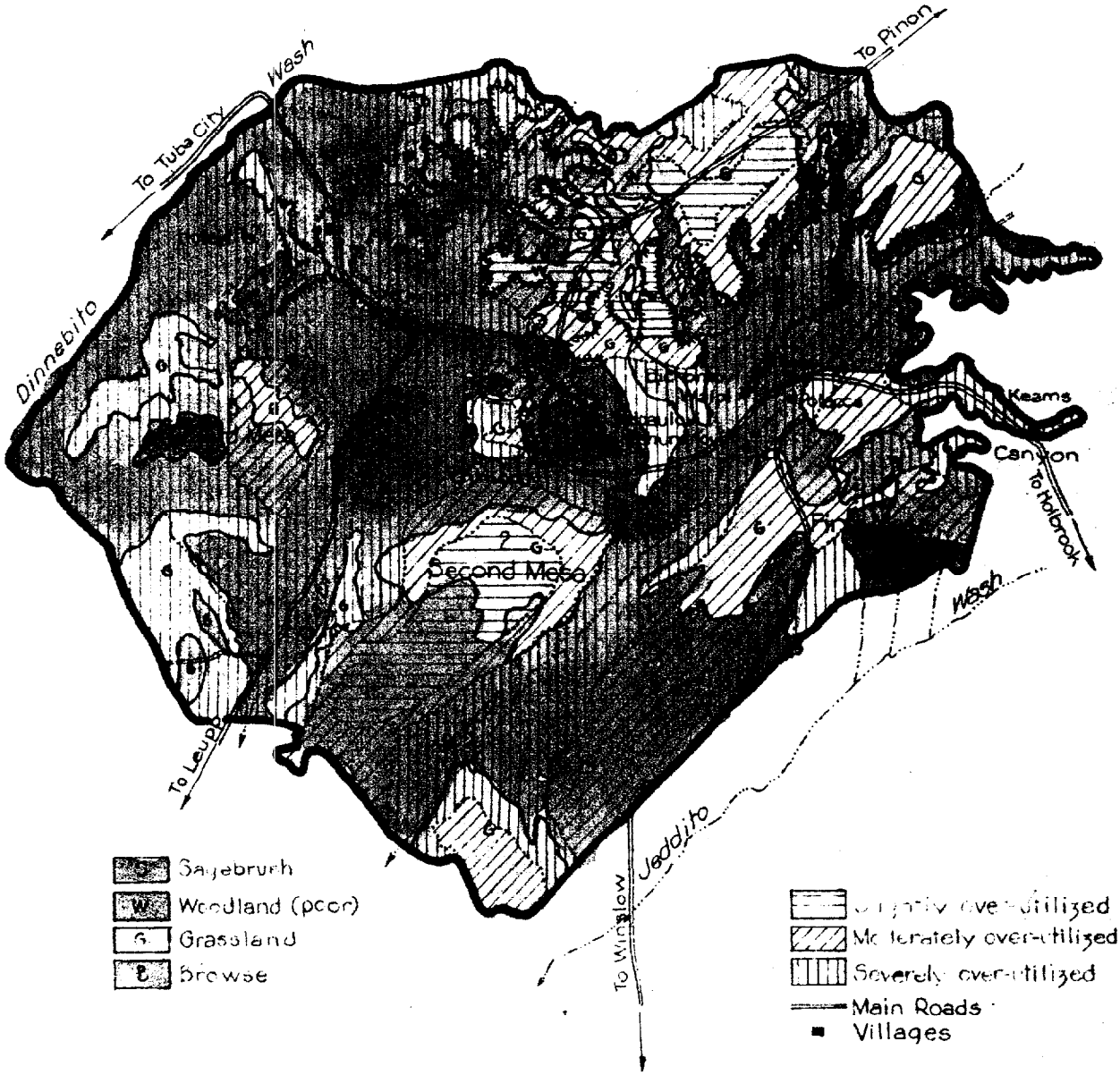
STOCK POPULATION OF THE UNIT[1]

	Cattle	Horses, Mules, Burros	Sheep and Goats
First Mesa	1,582	422	5,022
Second Mesa	425	65	5,712
Third Mesa	690	264	7,078
Total	2,697	751	17,812

The chart indicates the distribution of all classes of livestock over the Hopi unit. The greatest load on the range would seem to be borne by the Third Mesa area and a glance at a Range Map bears out the surmise, as almost the entire portion is typed as

1. Memorandum to J. G. Keller, January, 1939.

PLATE IX



RELATION OF RANGE UTILIZATION TO FORAGE TYPES

BASE MAP ◆ HOPI UNIT

Scale in Miles

severely overgrazed.

Sheep Breeds: The present sheep may be part Kentucky Cotswold[1] stock, if one may hold to the thesis that some of the Hopi sheep of today are descendents of sheep originally obtained from the Navajo. After the return of the Navajo from Fort Sumner it was necessary for the authorities to issue sheep to the returning Indians. Between the years 1868-1869, 30,000 sheep of the Kentucky Cotswold stock were so issued to the Navajos.[2]

Some of these were probably traded to the Hopi to help rebuild the herds depleted during the famines. Sheep obtained from the Spaniards was probably part Churro and part Churro (See appendix C).

Today Rambouillet rams are being introduced;[3] good meat producers and suited to the range, they give a shear of quality wool.

Stock Production: In humid sections of the eastern portion of the United States, where there has been increased production of erosion-resistant and semi-erosion resistant forage crops, very little reduction in stock has been necessary. Such increased production is largely the result of better crop rotations including more legumes and additions of lime, manure and commercial fertilizers, water conservation practises and reduced losses of surface soil

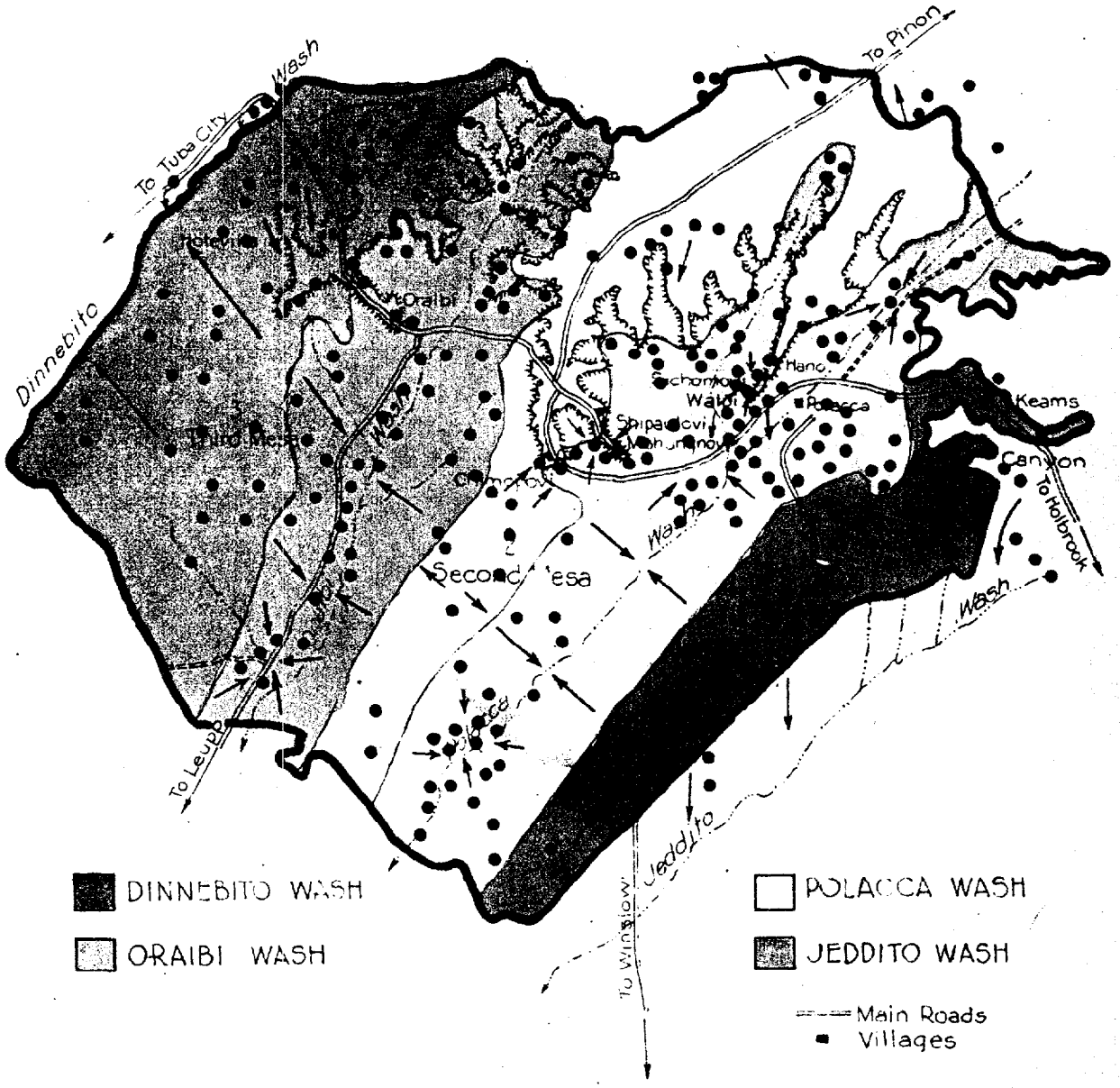
---

1. Amsden, Charles A., Navajo Weaving. The Press of the Southwest Museum, 1934, pp. 113.

2. Amsden, C. A. Ibid. pp. 198.

3. Amsden, C. A. Ibid.

PLATE X



DISTRIBUTION OF SHEEP CORRALS

MOVEMENTS OF FLOCKS TO WASHES FOR WATER

BASE MAP ◇ HOPI UNIT

Scale in Miles

0 5 10

In the Hopi country planned adjustment of the stock to the carrying capacity of the range seems necessary. Here, sufficient possibilities do not exist for increasing the grazing area or increasing, to any large amount, the production of supplemental feed. Therefore a reduction in numbers seems necessary that the stand and vigor of grasses desired as feed may be allowed to come back.

Herding Groups: The ownership of stock and the establishment of range is on an individual basis. This is contrary to the ownership of clan lands, the use of the clan fields being determined by the matrilineal system prevailing among the Hopi.

Herding groups may be composed of one operator or, as in many cases, five to ten operators. The larger groups are usually composed of men who are related to each other as members of an extended family.

The groups, aside from the individual herder, are in the majority of cases formed in two ways.

A man who owns sheep and not wishing to spend all of his time herding will approach relatives or, occasionally, friends who also own sheep and propose that they pool the bands and each man spend one or more days a week herding, thus allowing the others to work elsewhere. No payment, other than release from constant herding, is awarded to any member of the group. Herding days are shared equally regardless of the size of band owned or the importance of the owner.

The other method of forming a combined band is undertaken as follows: A man, owning and operating a large band of sheep, may wish to start his young nephews in the sheep business. A nucleus, sufficient for his needs, will be kept as the former operator's share and the balance of the original band split into equal portions. New operators are thus created by assigning

each boy to a part of the band. Each new owner takes turns herding the combined band, the uncle sharing herding days with the nephews. During severe winter weather, lambing season, or other occasions when an experienced hand is needed, it is customary for the older operator to take over all herding duties in order to insure proper care of the band.

Cattle groups are not organized as are the sheep herders. This is due to the Hopi practice of not herding cattle, although a few men who can afford to do so hire Navajos to herd their cattle and sheep. Most of the cattle are allowed to drift north of the Unit in the summer months and south of the Unit in the winter months. This practice leads to disputes with Navajos who hold ranges upon which these cattle drift. The sheep bands being held to corrals and established ranges adjacent to permanent water rarely trespass on Navajo ranges. A period of drought, causing many waters to dry up, tends to force both Hopi and Navajo sheep men to change ranges thereby causing overlapping and the inevitable disputes over already insufficient water and grass.

Within the Unit the herders of each mesa tend to recognize the boundaries established in the past to keep each village unit, now called a "mesa", apart from the others. These boundaries, formerly made to define the fields cultivated by members of the clans making up the various villages, now serve as interior range boundaries. The boundary between Second and Third Mesa is not as clearly defined

nor is it as mutually satisfactory, as the boundary between First and Second Mesas. As is to be expected, there is a good deal more overlapping of range use and therefore more friction between operators of Second and Third Mesas.

The establishment of the original claims to range rights was a simple process of "first come first served". As long as the stock were not allowed to enter the cultivated areas they were free to graze near the villages. The Hopi, being a villager, naturally preferred to stay in the village and take his part in the ceremonies. For this reason the first corrals were built on the benches immediately below the villages. The sheep were herded out, in the early morning, to graze and returned to the village at night to be watered and penned. As the herds built up, operators increased and the good range decreased. Newer operators were forced to build corrals farther out on the "out ranges" and arrange to ride out to them to herd or build small shelters where the herder might stay during his turn at herding.

This condition prevails today, some corrals being located 12 miles away from the village, the herder driving out in a pickup, to take his turn tending the flock.

The majority of the sheep men still prefer to stay in the village rather than live away. The Navajos surrounding the Hopi use area have taken advantage of this tendency on the part of the Hopi and have established range rights solidly around the Hopi Unit.

Return to Lot 2 P

To obtain more range a few Hopis have tried to buy out Navajos living close to the villages but the mass opinion of the Navajos is naturally against this practice.

Other Hopis, notably those from the village of Hano, have established satisfactory herding relationships with neighboring Navajos. This relationship is based on a need on the part of the Hopi employer for a herder to relieve him of all herding duties, and a willingness on the part of the Navajo, hired as a herder, to assume the duties.

This practice of hiring herders is not to be confused with the system of herding practiced in northern New Mexico and known as the "Partido System". The "Partido" imposes an obligation on the part of the herder to return a fixed number of sheep to the employer in exchange for the use of grazing land controlled by the employer. The system also is fixed and bound by a contract between the two parties.

The arrangement between the Hopi and Navajo is not set forth in a formal contract, nor are there stipulations about the number of stock to be returned. Unless the season is abnormally dry or cold the Hopi employer expects to have returned to him the increase of the flock which is measured by the Navajo herder's competence and skill in herding.

The range used is usually the area which the Hopi established in the period when his lack of wealth did not allow him to assume the role of employer.

From data obtained from the histories of sample groups, we may determine that a standard rate of pay of $15.00 a month (cash or equivalent in trade) is the usual amount paid to the herder. This amount is usually paid in the form of food. Occasionally lambs or articles of clothing have been given in payment for herding services.

The Navajos herding First Mesa stock have built their hogans on Hopi ranges, but this is a matter of convenience, and done so in order that the herders may be near the flocks or herds they are hired to care for. This arrangement is tacitly agreed to on the part of the Hopi employer and the herder, but is not looked on favorably by Hopis of other villages who do not get along as well with the Navajos as the Tewas of Hano[1].

It is interesting to note that of the total of 19 stockmen employing Navajo herders, 14 men, or 75 per cent, are from First Mesa. Of these 14 men, seven are from the Tewa town of Hano. One man from Sichomovi, Charlie Naha, is a Tewa married into a Sichomovi group.

In an analysis of Hopi-Navajo herding relationships, several factors enter into an explanation of the preponderance of First Mesa employers over the employers of the other two mesas.

---

(1) The people of Hano are reported to have originally come from the pueblo of Jemez about 250 years ago to aid the villagers of Walpi in their warfare against the Utes. They are also reported to have brought cattle and sheep with them on the long trek. In return for their services as warriors they were given lands in the Polacca Wash north of Tom Pavateas store, and in the Nepo Wash north of the "Wala" or gap, to be used for farming. . . . . Informants - Bennet Cooka, Travis Mahle, Douglas Douma.

It is quite possible that the people of First Mesa have, as a group, had closer relations with the Navajo than any of the other Hopi people. Of the twenty Navajos who are reported to have married into Hopi groups within the past 15 or 20 years, 10 have married into First Mesa groups, the majority of the unions being with Hano people.

The inhabitants of Hano were descended from people who migrated from Jemez, a village known to have had early contact with the Navajo. Many of the Hano men speak Navajo and have strong trade ties with Navajo groups living outside of the Hopi area. The school at Keams Canyon, 12 miles from First Mesa helped form Navajo-Hopi contacts as early as 1875 when boys of both tribes, now elderly men and heads of herding groups, were boarded and taught in the Government school.

With this background it is perhaps natural for the men of First Mesa, who can afford to hire Navajos, to do so.

Tom Pavatea and Naha, ~~both Tewas~~ of First Mesa, were two of the largest stockmen operating sheep and cattle and establishing cattle ranges on the outlying First Mesa lands.

A short history of Tom Pavatea follows:

Tom Pavatea was induced to enter one of the lower grades of the first school in Keams Canyon, then situated at the head of the canyon, sometime in the 1880's. Apparently the school and Tom did not get along very well as Tom admits that after repeated "French Leaves" it was agreed to by the school authorities and the

home group that Tom might be better off at something else.

About the time that young Tom was busy thinking of ways to get out of attending school a trading post was being organized by Tom Keams. The post at that time was also located at the head of the canyon, close to the school.

Tom Pavatea hung around the post and was finally put to work as a cow puncher to ride herd on the sheep and cattle which Keams was buying from the Navajos. For the first three weeks Tom was paid in board and room. The probationary period proving that young Tom was able to punch cows in a satisfactory manner, the pay was raised to board and $15.00 per month. Attention to business and an eye for cattle soon raised his pay to $30.00 per month.

An uncle of Tom's, meanwhile, had lost what few sheep he owned and desired to rebuild his herd. He advised young Tom to buy saddles, bridles, and other trade articles (probably at a discount through his employer, Mr. Keams) and trade these to the Navajos who lived between Keams Canyon and Low Mountain for sheep. At that time sheep were worth $1.00 to $1.25 a ~~piece~~ head. A herding group made up of the uncle and two brothers and a cousin took turns herding the sheep for which Pavatea was trading. For their herding periods, which were taken in turn, they were given lambs.

In 1894 Tom, having learned the basic principles of trading, opened a small post at Polacca. This building still exists just

the foremanship of Cap-pinto until the sale of most of the cattle before 1918.

Tom operated ~~at the present time~~ in 1939 70 cattle and 234 sheep on a range north of the head of Keams Canyon and still employs Cap-pinto as herdsman.

The range, used by the Pavatea cattle prior to 1918, is now used by Kootka (kikmongwi of Walpi, and a close friend of Tom), Lomayisva, and Bennett Cooka (whose father was employed for many years by Tom) and Wahpee.

These men were allowed to graze their cattle and increase the size of their herds as the Pavatea herd decreased in size, Tom acting in an advisory capacity and granting range use on his formerly more extended range.

Bennet Cooka was allowed the use of the old headquarters building and loaned money by Tom in order to buy cattle. This new herd was begun in 1932 after Bennet lost his job as track forman on the Santa Fe Railroad due to retrenchment. Bennet has a compact herd and through his new job as a government range rider is in a position to buy more stock.

The other large Polacca stock outfit was built up in the 1880's by Naha I, who ranged stock from Polacca to Low Mountain.(1) The Nahas and Tom Pavatea were members of the same clan by birth. The Naha outfit split, part going to Albert Naha and part to George Lomayesva, upon the old man's death. These two ranged stock from Red Lake on the south to Low Mountain on the north, and from the Hopi Buttes on the west to Cow Springs in the northeast.

Albert left his cattle and sheep to Vinton Naha, King Naha, Neal Naha, Archie Naha, and Emery Naha. Emery, however, sold his share. Vinton and Bennet Cooka are trustees for stock left to Albert's daughters.

George Lomayesva still runs some sheep and cattle, but has in turn started his sons, Fred and Jonkey, and a nephew, Lawrence Lomayaya, in the cattle and sheep business.

At Oraibi, "Rogers' Father", or Duwamueyma, ~~range the largest~~ bought a range stock outfit, made up mostly of cattle, in the 1870's. Other Oraibians had cattle, but the herds were small, five to fifteen head each. Duwamueyma left his stock to Roger, who with Ross Nacaya, who bought in, now runs the largest outfit made up of cattle of the Third Mesa group. Their range extends down the north bank of the Oraibi Wash as far as Blue Lakes; however, their stock drifts on south as far as the Sand Springs Trading post.(2)

(1) Bennet Cooka and Conrad Quoshena

(2) Bennet Cooka

Stockmen of Third Mesa report that very few cattle were owned by Hopis of Oraibi prior to 1902. In that year four men from Oraibi, Duwanueyma, Seeyouma, Sakewa, and Masitima made a trip to the village of Jemez in New Mexico and traded about $400 worth of goods and turquoise for cattle.(1)

Duwanueyma apparently was the largest cattle operator in the late 1890's and 1900's, as he is reported to have operated about 13 cattle at the time of the trip to Jemez.

Table I attempts to trace the split up and expansion of the herds established by the four men. In all cases, the sons acquired a few head of cattle by being given calves for payment of herding services. The sons took over the herds as the original operators grew too old for active herding or died.

The period between 1910 and the present has been marked at First and Third Mesas by the organizing of new herding groups among the Oraibi men.

The leaders of the eight groups herding some 1,000 cattle report that the cattle making up their herds were derived from stock bought from one of the original four herds mentioned before, or from Navajos ranging cattle out from Leupp, Tuba City, and Low Mountain.

The cattlemen of Oraibi, previously mentioned, and eleven groups from First Mesa own and operate most of the cattle in the Hopi Unit. Second Mesa remains, essentially, a sheep herding unit. Here four men operate a total of 387 cattle.

---

(1) Conrad Buoshena

TABLE 3

Hopi Stockmen Hiring Navajo Herders

Name	Village	Mesa	Type of Stock Herded	
			Sheep	Cattle
Vinton Naha	Mano	First	x	x
Percy Tecling	Mano	First	x	
Taylor Tabo	Mano	First	x	x
Kala	Mano	First	x	
Albert Yava	Mano	First	x	
Starlie Polacca	Mano	First	x	x
Nelson Coying	Mano	First	x	
Tom Navatea	Polacca	First	x	x
Dutta	Polacca	First	x	
Byron Adams	Polacca	First	x	
Naho	Walpi	First	x	x
Charlie Naha	Sichumovi	First		x
Mahee	Sichumovi	First	x	x
Lomayesva	Sichumovi	First	x	
Ned Lomayestewa	Sungopavi	Second	x	
Archie Quamala	Sungopavi	Second	x	
Judge Talashwihuma	Mishongnovi	Second	x	
Earl Albert	Hotevilla	Third		x
Benj. Whytewa	Hotevilla	Third		x

SUMMARY:

First Mesa - 14 Operators (7 sheepmen, 7 cattlemen, 6 sheep-cattlemen)

Second Mesa - 3 Operators (3 sheepmen, 0 cattlemen)

Third Mesa - 2 Operators (0 sheepmen, 2 cattlemen)

TABLE 4

Outline of Four Oraibi Cattle Herding Groups

1902-1939

Duwamueyma	Seeyouma	Sakuva	Nasitima
Herd left to: Roger Quachhytewa, Duwamueyma's son. 250 cattle in 1939.	In 1928 the original herd was given to three sons to divide. Ralph Hotewa S.E. Scott Alfred Polmyesva When the brothers were in their "teens" the cattle were corraled near the village and ranged out to feed each day. At the present time, the herd having been split into three parts, each man has established his own grazing grounds for his herd. Some of the stock, in the present herds is derived from calves given to the boys by their father in payment for herding the original herd.	Waldo, Sakuva's son inherited the herd in 1908. The herd was sold to Naha I, of First Mesa, in the same year. The herd, now numbering 204 cattle, is owned and operated by Vinton Naha, a son of Naha I.	Nasitima herded his cattle until 1922. His two sons, Victor Cutah and Bert Williams then took over the herd. Victor bought out his brother and now ranges his cattle on the home range first established by his father.

Note: This chart is not intended to imply that there were no other herding groups at Oraibi, or that the groups given above were the earliest cattle herding groups. The material is presented in the belief that it does show the inheritance pattern of four groups.

HOPI AGRICULTURE

Introduction:

Food determines, to a great extent, the culture of a people; therefore, a brief consideration of the foods of the Hopi people and the means they have of producing foods, by agricultural means, is necessary. To some extent, the kinds of foods people can obtain determine whether they will be nomadic or sedentary, build scattered temporary habitations or permanent well built towns.

In the Hopi area, the sedentary communal life is a direct result of one staple, maize or corn. Around maize a whole culture has been built. The site of a town was determined by the ability of the physical landscape to support the raising of corn in a quantity to supply its people's needs. If for any reason the climatic cycle changed, causing drought, the people moved to an area better suited to their agricultural habit; this may possibly be an explanation of the migrations and abandonment of towns on the periphery of the Hopi Unit. The fluctuations in rainfall may have caused a retreat of the water table and this, coupled with over grazing after the beginning of the 19th Century may have resulted in a change in natural erosion control. After a time, the heavy rains ceased to be absorbed by the scantily covered earth and gullies were formed; thereafter, the water, so necessary for cultivation, continued to cut deeper into the ground until the arroyo was carrying the water twenty feet or more below the former farming level.

Corn found throughout the Pueblo III Period was of four colors, yellow, red blue and white. Today, in the Hopi villages, the blue corn still gives its color to the translucent "Piki" bread, a wafer sheet bread of tissue fineness.

The women of the ancient times must have spent a great deal of their time grinding the corn, on the smooth "metates", into meal. Other ways were found to prepare the kernels - some were parched, and corn which did not find its way to the metates might be prepared, by soaking in lye water obtained from wood ashes, into a hominy.

Although corn was of paramount importance, other plants and fruits were utilized and are still used - notably, orchard fruits, introduced by the Spanish, melons, squash, beans, and pinon nuts as well as wild berries, seeds, and grasses. Up to the time of introduction of modern agricultural tools by the Government, very few Hopi farmers had access to modern methods and the same methods that the ancients used were followed without much change. Indeed, the "dibble stick", or digging stick, mentioned above, is still the principal planting tool, although steel hoes have replaced stone and wooden hoes. Very little change has taken place in their religious concepts based, as they are, on their agricultural life and the fertility of the soil.

The Effect of Climate, Soils and Topography Upon Agriculture

The climatic factors which play such an important part in the production of crops in the Hopi country are three in number. First, the occurrence of frost in the fall and spring, second, the occurrence of moisture and third, the effect of the violent wind storms which occur in the spring.

The average length of the growing season is about 133 days with a short frost free period from June to September. Because of the short season the moisture conditions in effect at the time of planting and early growth are decisive factors.

Fluctuations in climatic factors, especially precipitation have a direct effect on the economy of the Hopi. A drop of two or three inches in the total yearly precipitation will lower production in agricultural products 15-30%. A recent example may illustrate this point. The average annual precipitation is about 12 inches, however, during the drought year of August, 1938-July, 1939, the average precipitation was only 7.75 inches. As a result there occurred a 60% drop in agricultural production.[1]

The months of April and May usually have less than 1" of precipitation. As these months are planting months, and the moisture content of the soil is vital to plant growth a deficiency of moisture at this time, especially if the winter months preceding have been dry, will work havoc with the crops. August

---

1. Estimate of Resident Agronomist, December 1939.

is the maximum rainfall month, the precipitation averaging 2.5 inches.

In September the rainy season ends, not suddenly, but by a gradual lengthening of the intervals between storms. Fall weather is very comfortable being cool at night and affording plenty of sunshine for the drying of crops such as peaches and melon strips which are later stored for winter use.

The prevailing winds from the southwest have a drying effect on the soil and unfortunately come during the early planting season. The dry winds usually blow during the months of April and May.

Fortunately for the Hopi farmer, nature and centuries of domestication have developed a corn plant called Zea Mays which has adapted ~~itself~~ to the dry climate. By observation and experience a method of planting has been evolved which affords the maximum benefits of the climate to the plant.

The seeds are planted about ten inches to a foot deep or to a depth at which moisture is held in the sandy soil. This deep planting allows the plant to gain moisture during the dry spring, tapping the moisture left in the ground by the snow melt, and protects it from the very late frosts and early sandstorms.

The Hopi farmer spaces the corn plantings and staggers the rows according to his estimate of the moisture conditions of the previous months and the amount of drying up of that moisture that may have taken place.

After planting, the farmer must depend on the flash rain storms which usually begin in the month of July and extend through August.

Soils: The soils of the Unit are derived from the sandstone and shale formations which underlie the surface.

The Mesa Verde, Dakota and Morrison sandstones contribute the bulk of the sandy soils. Lenses of shale in the Morrison and Mesa Verde furnish some of the clays which are to be found in the alluvial soils. The Mancos formation has a great deal of clay and gypsum in it's make up and supplies the balance of the clay to be found in the valley fills.

Sandy loams are the prevailing soils types. The best soils have sufficient capacity for moisture penetration thus allowing very little run off. The water holding capacity is high and alkali content low. These soils are found in the valley flats and have about 3% slope. Soils of coarser texture and higher clay content are to be found in the valley bottoms. These soils are susceptible to wind erosion to a higher degree than the above.

As the clay content increases the value of the soil for agricultural purposes decreases as more water must be used on the clay areas due to the decreased absorption and greater evaporation characterstics, and the crop yields are low.

The Hopi farmer prefers a condition where ten or twelve inches of light sandy material overlie a heavy sub-soil and located so that the flood water will spread evenly over the entire area.

When the light soil or mulch becomes too deep due to wind

valley centers and nearer the mesa scarps. These fields are not as desirable as the older fields in the valley flat due to more shallow soils and to the fact that sand dunes tend to pile up near the mesa's rims and through wind action eventually cover fields on the leeward side of the dunes.

Sand dunes are common in the Hopi region. They are to be found on the tops and against the sides of the mesas and are especially common in the valleys. An examination of the aerial mosaics covering the area discloses a regular pattern of dunes. Their general strike does not vary much from N 45° E and their orientation parallels the direction of the prevailing winds which blow from the southwest quarter.

The dunes have been skillfully utilized by the Hopis and planted to orchard, melon and squash crops, where there exists sufficient under-dune circulation of moisture and the dunes are so oriented as to be exposed to plenty of sunlight.

Structures that may be built for direct flood use are often logs thrown at right angles to the direction of stream flow. Brush may be piled on the upwash side of these barriers. These small dams break the force of the flood and may direct a portion of the water to areas not usually receiving it under normal flood conditions. A certain amount of silt is spread over a field by this means. The silt will afford soil for a good crop, all other factors equal, in the next season if the silt sheet is not too deep or badly channeled.

For the best agricultural use the flood water should contain a minimum amount of silt and colloidal matter.

It is difficult to attain this condition on Maori fields because to achieve a silt free supply of water it is necessary to let the rush of the flood go by before clear water appears. Due to the Maori practise of using all of the flood water obtainable a more or less silt free condition cannot be obtained. In fact to do so the farmer would have to have a system of diversion ditches and gates to control the flow of the flood waters.

It is true that the Maori does attempt some diversion by using small earth dams but has not as yet attempted to store water to be used on valley fields. Storage of water is confined to the garden tanks.

Direct flood use is more or less of a gamble. More fields than the operator expects to mature must be planted. If the floods are not too erosive, and spread the water evenly on his

fields, he may expect a fair crop. However, if the fields are trenched by the force of the flow, some replanting must be done if the season is not too far along. In good years all the fields planted may mature for harvest and a bumper crop may result. The valley lands may be flooded three or four times during the rainy season of late June through August. At this time the more level fields will be flooded to a depth of four or five inches. The water standing until the surplus has disappeared through absorption and evaporation.

The scarp lands have more slope than the valley lands and for this reason the run off is greater and absorption less. Because of the slope erosion is more prevalent and more care in constructing small diversion structures is necessary.

The importance of flood water irrigation may be determined by the acreage under cultivation which depends on this type of irrigation. Of the 6,084 acres under cultivation in 1936, 4,460 acres were dependent on flood water irrigation. The balance of the total acreage was divided into 1,613 acres planted to crops dependent on local rains (dry farms) and 14 acres planted to garden crops and irrigated by water held in storage tanks.

The dry farms are situated on the mesa tops and in the "Outland", the balance of them being situated in the latter area.

The gardens, although their acreage is small play an important part in the Hopi economy. They are discussed in greater detail in the section entitled Gardens.

Away from villages and located on the valley floors are to be found extensive cornfields. The Hopi farmer utilizes any flat or gently sloping area which can be flooded easily, for his field. A thin sand mulch is desirable as a moisture conserving blanket. Because the westerly winds cause the sand to shift, a Hopi farmer will each year plant a row or two more on the leeward side of the field and perhaps abandon a row or two on the windward side of the field. This condition is particularly noticeable on the field south of the Totevilla-Tuba City highway bridge crossing the Dinnebito Wash.

Corn is planted by digging a trough like hole in the sandy loam. A "dibble stick", a piece of wood two or three feet long and an inch and one-half in diameter with one end flattened is used for this action. The farmer, kneeling, swings the stick over his head, in an arc, the flattened end penetrating some ten inches. This stick is rocked back and forth to loosen the dirt and withdrawn. The seeds are deposited and a sweeping movement of the hand fills the hole. The hills are made about four or five paces apart and between last year's rows. A low earthen mound may be raised around each hill to retain flood water. Weeds are hoed and attention is paid to each hill, during the growing season, to keep the green cut-worms from injuring the plant.

Corn is the most important crop raised by the Hopi, constituting 70 per cent of the value of all the crops raised.

Corn fields lie below the gardens. Conservation structures employed here are limited to the building of spreader dikes, diversion ditches and occasionally some gully plugging.

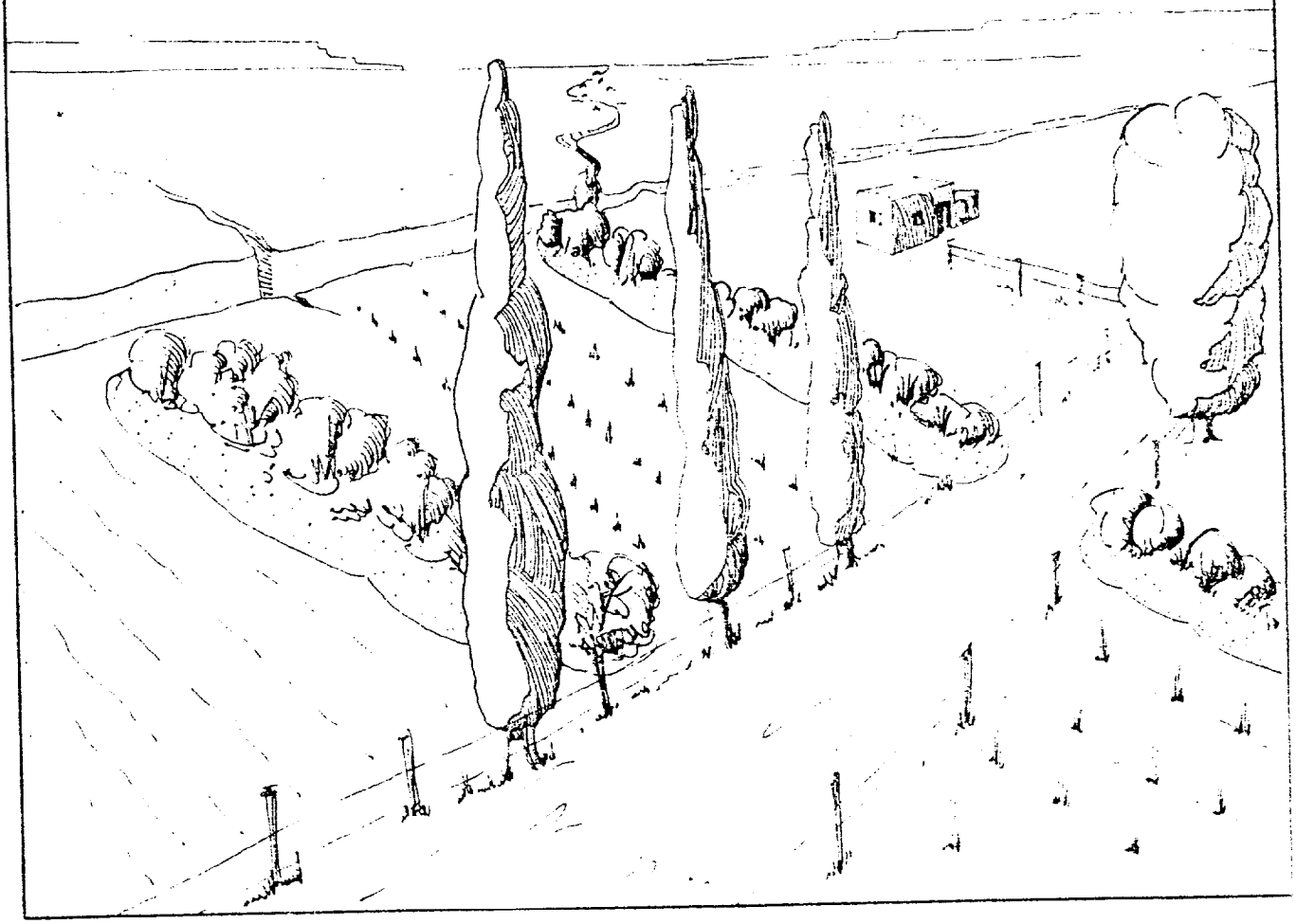
Windbreaks

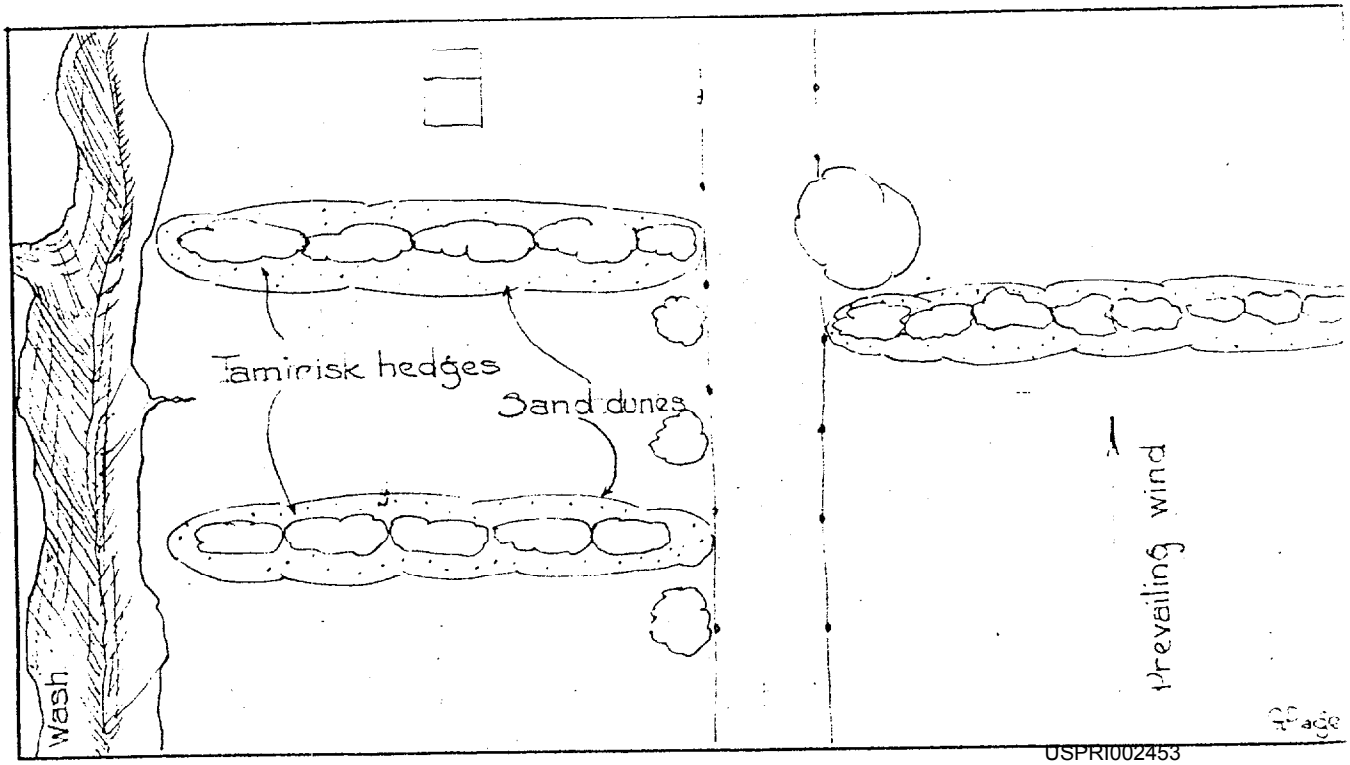
The prevailing winds, which blow from the west and southwest, have a cutting effect on the young corn plants which, during the spring, are beginning to appear above the surface of the ground. The Hopis use several means to protect the plants. A few farmers at First Mesa have obtained poplar cuttings and planted these along the windward side of the field. Greasewood, rabbit brush, snakewood, or sage brush branches are thrust into the ground, forming a continuous hedge extending across the field, and sheltering the corn or bean plants (See plate). The brush may be so woven or piled as to form low brush fences, or individual shelters may be formed behind each plant by thrusting twigs into the earth to form a crescent shaped wind barrier. Stones may be piled behind each plant to achieve the same effect. Tin cans with the ends punched out may be placed over the plant to protect it from the wind. These also serve to keep cut-worms away from the plant. The practice of planting many seeds in one hill is actually a form of windbreak protection. Obviously, if fifteen corn kernels are planted in one "dibble" hole the outer shoots, when the plants begin to appear, will shelter the inner plants. Thus the outer plants are sacrificed to the sand-laden wind in order to protect the inter plants. Good examples of windbreaks may be observed on Second Mesa and on Third Mesa just out-

USE OF TAMARISK AS A WINDBREAK

Plate XIII

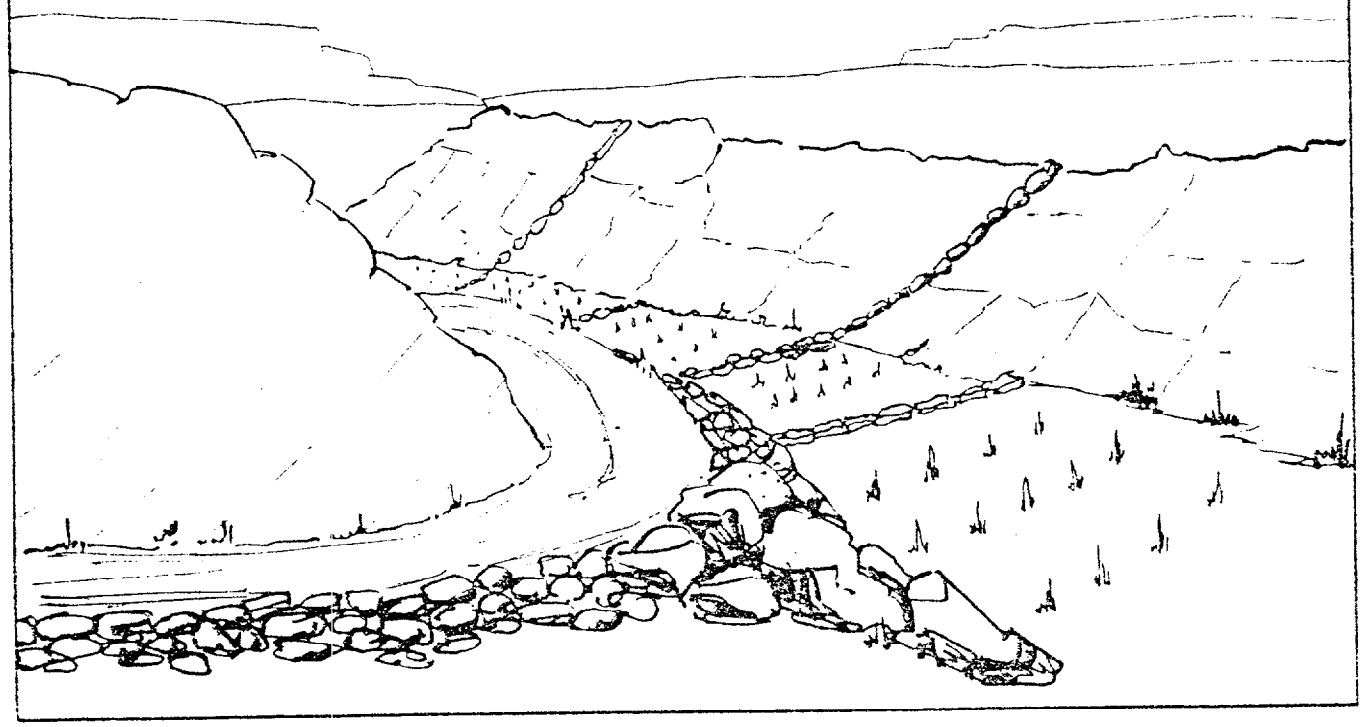
Taylor Ranch

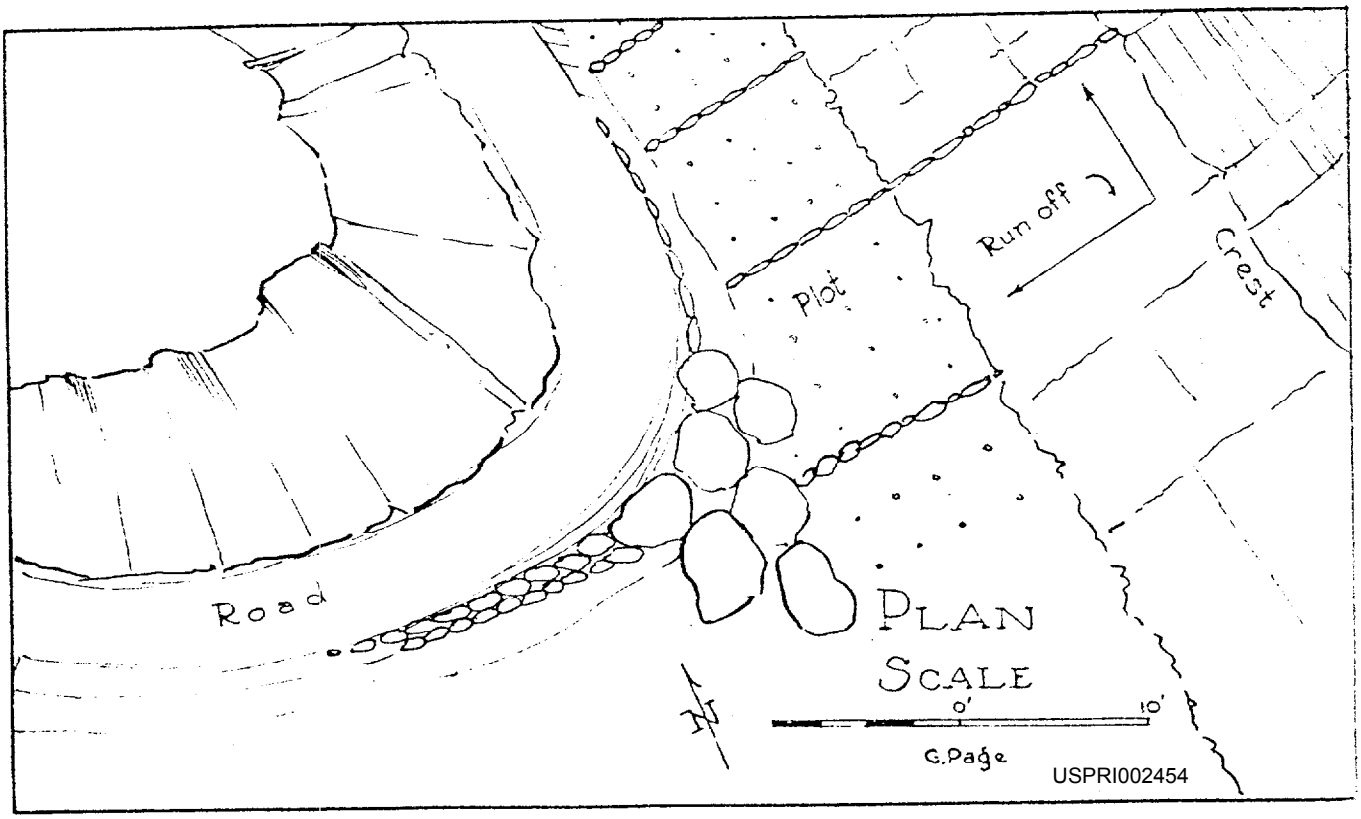




CHECK DAMS
MUSANGNOVI
HOPI RESERVATION

PLATE XIII





A MODERN TERRACED GARDEN

of the

HOPI INDIANS

Vertical risers in the form of stone laid in a wall without mortar retain the earth which is piled behind the wall. The walls vary in height from two and one-half feet to five feet. The widths of the terraces vary from five to ten feet. Each terrace is divided into plots about five feet long and five to ten feet in width, the width of the terrace being the determining factor in each case. The length of each terrace is determined by the amount of cultivable land. The average length is about 150 feet.

Each plot is separated from the others by a low mound of earth. These mounds serve to hold and direct the water which is conducted to the plot by channels, from the master ditch. The channels are dug at the foot of each wall and serve all plots on the same terrace.

The Hopi gardens of the present depend on a constant supply of water held in storage and originating in springs which are to be found below the mesa rim, near the towns. A bung in the storage pool is removed and water needed for plants allowed to trickle down small ditches, which follow the grade of the slope. The flow falls from level to level and finally irrigates the peach trees planted on the lowest terraces. (See plate of Hopi Terraced Gardens.) The care of the gardens usually falls to the women. The men work in the cornfields.[1]

1. Mr. A.E. Jenks describes a similar type of terraced garden, the "sementeras" of the Phillippine Igorot. The construction of the walls is similar to that of the terraces of Red House and the Hopi gardens. Climatic conditions, being entirely different, due to increased rainfall, enable the Igorot to build miles of these garden terrace walls as he is not forced to localize the garden around a particular spring as the Hopi is forced to do. Jenks, A.E.: "Terrace Agriculture in the Phillippines", Source Book in Anthropology, Kroeber, A.L. and Waterman, T.T.: Harcourt Brace and Co., New York, 1931.

The use of the gardens at First Mesa and Talahogan is controlled by the clan. Bear clan at First Mesa and Badger clan at Talahogan. "Control" is used in the sense that the clans named above were the first groups to use the springs and the area around the springs at the time of original settlement. By this act the groups achieved squatters right which were sanctioned by other groups entering the area later and the use rights thus consolidated.

Today, a member of another clan may regularly obtain water or use land and water together in the garden area only through permission of the clan "mother".

Women usually work in the gardens although old men have been observed, planting, repairing walls and directing the water into the various channels.

The other small gardens at Hotevilla and Bacabi are used by members of the villages and are not controlled by clan. This also applies to the gardens which have been developed by individuals away from the villages.

Safflower, Turban squash and wheat were introduced by the Mormons.[1] Wheat was introduced by Mormons and planted at Moencopi, a Hopi village outside the area under consideration.

In pre-historic times, corn, lima beans, kidney beans, sunflower, squash, aztec bean, tepary bean and cotton were probably the garden crop. Now, crops of chili, onions, sweet

---

1. Whiting A. F. Ibid.

corn, beans, and cress are raised in the plots. Peach trees are planted in areas not susceptible to terracing, or they may occupy the lowest terrace. Peach trees are also planted on the sand dunes which pile up against the mesa slopes near the gardens. Moisture from seepage along the mesa wall may supply a portion of the moisture held in the dune. At any rate, peach trees, melons, and squash seem to thrive on the dune slopes.

GARDENS

Garden	Acreage	Number of Operators
Talahogan	4½ acres	5 Hopis, 4 Navajos
First Mesa	4 "	20 "
Bacabi	¼ "	20 "
Moteville	5 "	57 "
Lollama	1/10 "	3 "
Burro	1/10 "	4 "
Approximately	14 acres	113 Operators

Garden Crops[1]		In or adjacent to Garden
Coxcomb	Pea	Peach
Peanut	Radish	Pear
Beet	Safflower	Apple
Cauliflower	*Onion	Almond
Cabbage	*Chile	Apricot
Turnip	*Watermelon	Cherry
Coriander	Cress	Grapes
Cucumber	*Sweet Corn	
Carrot	Potato	
Lettuce		
Tomato		

* Bulk of Garden Produce.

1. Whiting, A. F. "Ethnobotany of the Hopi", Museum of N. Arizona Bull V # 15, June 1939, pp. 12-13.

Planting

There are two corn plantings, one takes place late in April and is designed to furnish corn for ceremonial purposes, specifically the departure of the Katchinas in July.[1] The main or second planting takes place later to avoid the early frosts and ~~avoid~~ the spring sand storms.

The early corn is planted in warm, sheltered locations and reaches maturity about July 25th.

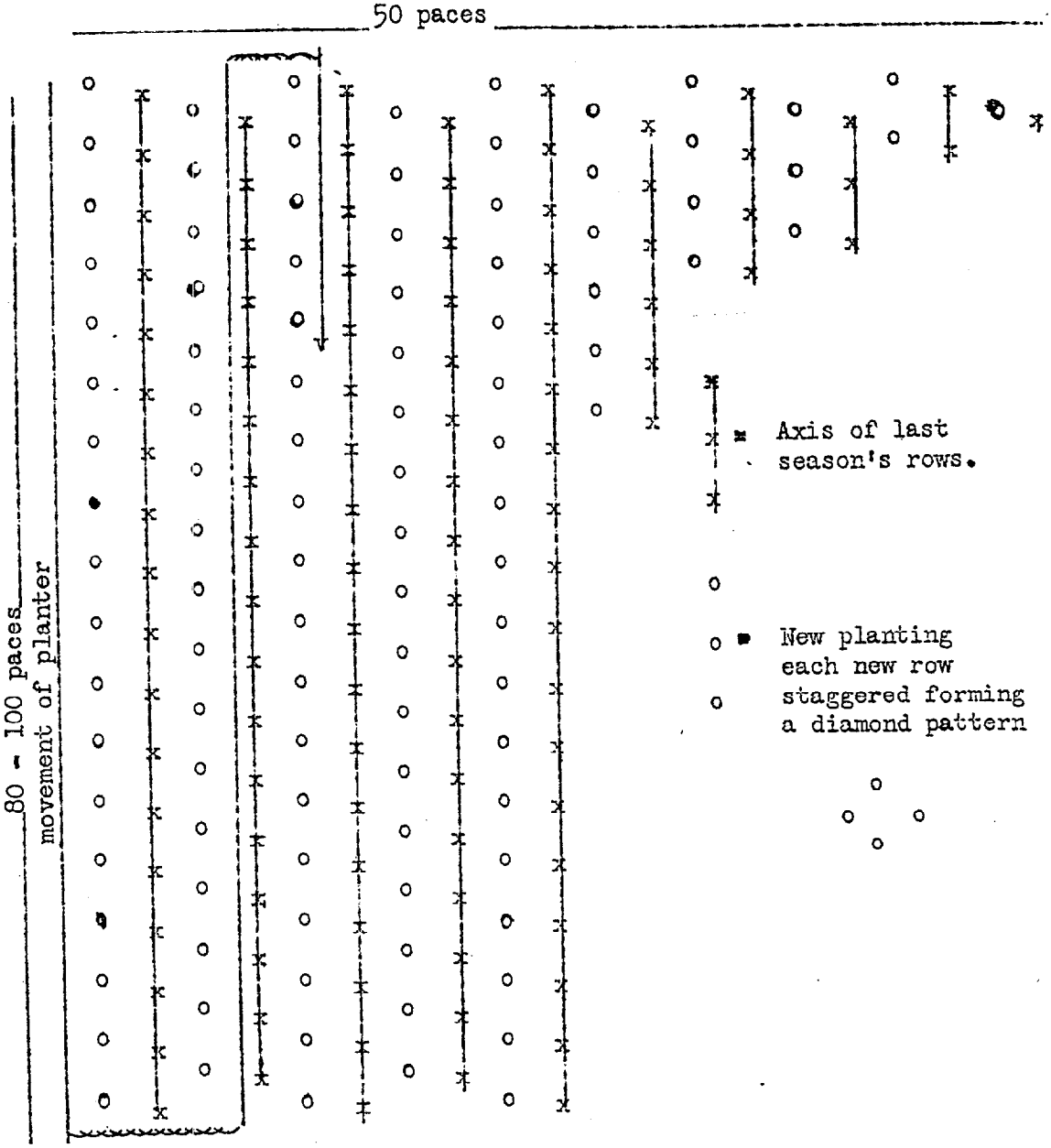
The second planting has been described earlier but may be elaborated on here.

A typical corn plot varies in acreage but is usually about 50 paces wide and 70 to 100 paces long. The planter places the first hole between the rows of last year's stalks, then moves 3 to 5 paces down the new row and makes a second planting. This is repeated until the end of the plot has been reached. The planter then moves over to the next row, skipping the old row and moves back toward the starting point.

---

1. Forde, C. Daryll - Hopi Agriculture and Land Ownership.

TYPICAL PLANTING



A man may plant alone or he may exchange his services with other men, that is, a man will assist others in their planting in exchange for their help on his field. There is, in the majority of groups planting, a kinship tie either through the maternal clan or through friendships with members of the same religious clan. Too, groups may be organized within villages to plant fields for priests of the religious clans in exchange for their services during the year in the various societies.

Helpers, if not members of the operator's household group are paid with presents of food, reciprocal services or a promise of a share in the crops.

Beans, squashes, and melons are also planted in alternate rows and are usually planted in plots devoted to each crop and are rarely planted in with the corn. If the sprouts are not noted after the usual period of sprouting, the rows will be replanted to the same crop.

Beans are planted in "flats" or boxes in January and kept in the warm kivas. Watered carefully, and kept below the shaft of sunlight which comes through the kiva entrance, they may attain a height of 10 or 12 inches before being picked. In twenty one days they will be picked for use in fertility ceremonies.

Planting Dates:- Second Mess [1]

CROP	PLANTED		TIME TO RIPEN
Early corn	April 6-15	Ceremonial Use	70-75 days
Yellow corn	April 6-15		80-90 days
White, Blue, Red	April 6-15		120 days
Dark red	April 6-15		105 days
Lima beans	May 1		115 days
Beans	May 25		110 days
Melons	May 15		75 days
Pumpkins	May 15		75 days
Muskmelons	May 15		60-70 days

1. Informant: Cecil Calvert, Toreva, August, 1937.

Importation of Seed

Whiting made a sample study of sources of seeds used by the Hopis and determined that about 1/3 of the crops raised are from seeds or slips obtained off of the reservation.[1]

---

1. Sources:
   a. Barter among Hopis
   b. Seeds from eaten fruit (neighbors or other)
   c. Seeds purchased in the form of fruit to be eaten and seeds saved; from trading posts or stores. 16% of all seed planted comes from this source.
   d. Seed or stock bought off of reservation - 16% (of this 7% equals nursery stock, peaches, apples and nursery onion sets)

   Thus about 1/3 of the crops raised are (seeds or slips) obtained off of reservation.

   80% of beans are raised from local seed.
   50% of all crops planted are obtained by inheritance from older women of the household or from husbands or son's-in-law in family.

Of the 16 households sampled:

Distribution of Principal Crops

corn - 26%
beans - 20% melons - 22% fruit trees - 25% vegetables - 9%

Whiting, A. F. "Hopi Importation of Seed" - Museum of N. Arizona Notes Vol. 10, #5, pp. 15, Nov., 1937.

Harvesting and Storage of Crops

The early sweet corn, which has been planted early in warm sheltered spots or in the irrigated gardens, is cut green in July and roasted in pit ovens (See Plate) in the fields. The early roasted corn is usually eaten at the time but some may be stored for winter use.[1]

In September the main harvest begins. Parties work in the fields from early morning to sunset harvesting the corn which is then placed in "pickups", wagons or in bags thrown over a burro's back and carried to the villages.

The stalks are left for the foraging cattle and horses but loads of stalks and leaves may be carried to the villages to be used for winter feed for domestic livestock kept in the village.

The corn is stored in windowless, dry rooms in or under the living quarters, a custom which has not changed in a thousand years.

The corn is usually stacked by segregating it by colors, red, white, blue or parti-colored and by harvest years as an effort is made to keep at least two year's harvest in the storage rooms.

Seed corn may be stacked in a separate room.

Pumpkin and sweet squash are cut spirally into long strips and hung over wires or poles and allowed to dry in the sun.

---

1. Forde, C. Daryll: Hopi Agriculture and Land Ownership.

When dry they are stored away.

Peaches are cut into halves and placed on the bare rock surfaces in front of the storage houses which are to be seen along the edges of the mesas, back of the towns, and above the orchards. A watcher sits in front of the house, watching the sky and in the event of rain, carrying the partially dried peaches inside until the shower passes.

After the peaches are throughly sun dried they are stored away in bins for winter use or for barter with Navajos.

The peach grown by the Hopi ~~is~~ usually/either a freestone variety or a cling. It is small but very sweet and is highly prized by the Navajos.

Very few of the trees in the orchards have been pruned. My informant told me that the older people believed that harm would come to the tree's spirit if the tree was cut.

The branches, as a result of lack of care, grow low on the ground and the trees appear scrawny. Lower branches and the trunks are often wrapped in cloth to prevent burros and goats from nibbling at the outer bark.

Cotton

In modern times the ~~tendency for Hopis to not raise cotton has been marked~~ Hopis have stopped raising cotton as a crop. Cotton batting is purchased from traders instead, with consequent loss of interest in cotton as a garden crop.

The Hopis apparently abandoned raising cotton later than the villagers of the Rio Grande as mention is made by Harrington that cotton embroidered goods were imported from Hopis by the people of the Upper Rio Grande Pueblos. [White cotton blankets with red and black woolen borders were woven at Nambe within living memory. Only fifty years ago, the last man to weave ceremonial blankets died.] delete

Casteneda and Espejo mention "towels" and mantels, embroidered and having tassels as being worn by the Moquis (Hopi).

Fewkes found cotton in the ruin of Awotobi, a former Hopi town abandoned in 1760. Other fragments of cloth were found in an earlier ruin of the Hopis "Kawauakuh" near Keams Canyon, Arizona.

Ives, an army officer on survey duty, while in Oraibi in May, 1878, mentioned that the men wore trousers of cotton which they grew locally and spun in their homes.

A little cotton is reputed to be raised in the Hopi gardens for purely ceremonial use, i.e. pahos and strings used in ceremonies. All pahos are tied together with such strings and all prayer offerings and cotton strings placed in the trails leading to the villages, when ceremonials are in progress, must be made of

cotton. Whether enough cotton is raised to meet this demand is doubtful.

Haenkopi raised cotton as abundant springs and ease of irrigation made such a crop easy to raise. A long arm of the Upper Sonoran life zone reaches this far north and allows cotton to grow.

Jeffers, an Indian Superintendent stationed at Tuba City, two miles from Haenkapi reported that considerable cotton was grown at Haenkopi in the early 1880's, but that its importance was decreasing rapidly.

Voth reported cotton being raised at Old Oraibi as a garden crop without irrigation but an agricultural survey in 1936 failed to reveal such a garden crop, at least of such size as to warrant mention by the Indians acting as guides.

Lorenzo Hubbell, trader at Oraibi, says that ease of trading for cotton batting at the trading posts has probably caused abandonment of the crop.

The Havasupai traded with the Hopis for cotton up to late times. The cotton, as raised by the Hopi, was a distinct species with the outstanding characteristics of being very sturdy and having a short early growing period, 84 days from ripening to weaving.

With the aid of early accounts we may then draw the con-

clusion that cotton was raised in the Southwest among the Hopis, the Rio Grande villages, and the Pimas. Other tribes not located in locations favorable to cotton cultivation, traded other goods in exchange for cotton or cotton products. A continuous cultivated crop prior to 1540 (Pedro de Tabor's account) and up to the early 1880's.

Notes on Uncultivated Native Plants Used as Source of Food by the Hopi.[1]

Acanthochiton wrightii Torr. -cooked as greens, known as an ancient Hopi food gathered and strung into long bunches, has been used in famines.

Agave parryi Engelm.- Hopis traded with the Apaches for this plant.

Yucca bacchata; datil; soapweed.

Yucca glauca; amole, soapweed.

Allium recurvatum; grows on high ground, a field onion, eaten raw with wafer bread used by Hopi and Tewa of Hano.

Allium deserticolum: wind onion, found at lower altitudes than above, small and almost tasteless.

Amaranthus retroflexus L. Amaranth: pigweed, alegria, quelite. Boiled and fried.

Amaranthus blitoides: a variety of above and used in same way.

Amaranthus torreyi: leaves boiled and eaten with meat.

Chenopodium album, lambsquarter cooked with meat and boiled with fat.

Amelanchier pallida:

Asclepias speciosa Torr.: milkweed, boiled with meat.

Astragalus diphysus: ?

Astragalus pictus filifolius: roots scraped and eaten as sweets.

Atriplex canescens: (Pursh) Nutt. Shad scale, salt bush, food for livestock, ash are stirred with corn dough to make wafer bread to turn the purplish gray color of the corn meal, ground from blue grains, to a greenish blue color.

Atriplex confertifolia (Torr.) S. Wats: saltbush. The water in which the scented leaves of this plant have been boiled is used to mix the corn meal for a baked meal pudding.

Atriplex philonitra: saltbush, shita, salty leaves are boiled and eaten with fat. This is the earliest of the six typical Hopi spring food plants.

Calochortus aureus: S. Wats. Mariposa lily, gathered early in spring, peel and eat them raw.

Carthamus tinctorius L. Saffron. The flowers of this plant, said to have been obtained from the Mormons about sixty five years ago, are used to give a yellow color to paper bread.

---

1. Castetter, Edward F.: Notes on Uncultivated Native Plants Used as Sources of Food. Bulletin in Ethnobotany, Univ. of New Mexico, Albuquerque, 19

Chenopodium cornutum as well as seeds of Amaranthus blitoides are eaten as food those of the former species are ground and mixed with corn meal to make small dumplings which are wrapped in corn husks and tied with a thread of yucca.
Stanleya albescens, S. pinnata and S. integrifolia are similarily boiled and eaten, also boiled or roasted between hot flat stones are the leaves of Sisymbrium canescens and the sage Artemisia dracunculoides, these are eaten after dipping in salt water (4 and 9).

Epilobium coloratum Muhl: used in making bread. (9)

Equisetum laeigatum: smooth scouring rush. dired and ground to make mush for food a ceremonial bread.

Eriocoma cuspidata Nutt. Indian millet, sand bunchgress.
seeds used in ancient times, called "lehu" one of the clans assoc. with the flute clan.

Sporobolus cryptandrus: drop seed grass, ground and mixed with corn for food.

Panicum capillare: panic grass, ground and mixed with corn for food.

Eriogonum corymbosum Benth: leaves are boiled and with some of the water in which they are boiled they are rubbed on the mealing stone with cornmeal, then baked into a type of bread. (4)
Hymenopappus filifolius. used as above.

Helianthus annus L; sunflower, anil, Bourke (1) refers to the Hocuis as having cultivated the sunflower, the seeds of which were mixed with corn and ground into a meal which was then made into cakes.

Sphaeralcea angustifolia, globe mallow, the mucilaginous stems and Eriogonum corymbosum are chewed as chewing gum. (9)

Juniperus scopulorum: Rocky Mt. Juniper, at Hano the resinous secretion is chewed as a delicacy. (12)

Lycium pallidum Miers, tomatillo, ripe or cooked berries eaten as food also the berries are mixed with "potato clay" and used with paper bread. (9, 12)

Lygodesmia grandiflora (Nutt) Torr, and Gray. Leaves boiled with meat to make a stew. (4, 9)

Mentha canadenis L. Minteanten as a relish. (9,4)

Mentzelia albicaulis Dougl. seeds parched and ground into a fine sweet meal and eaten in pinches. (4,9)

Monarda menthaefolia Graham, horsemint, oregano, the plant is cooked and eaten by itself at Hano (12). The Hopis boil the plants of the Monarda citriodora with rabbit meat (4,9).

Opuntia arborescans Engelm, cane cactus, candelabrum cactus, chollas, velas coyote (coyote candles) in the spring and early summer the succulent stem is boiled and eaten. (4,9) also P.A a species of O, is gathered by the women of Hano, tongs made of cleft sticks are used and the spines rubbed off with a stone. The fruit is boiled for a time after which it is eaten with sweetened corn meal porridge. (12) Casteneda (2) refers to the Indians of Arizona making a preserve from the tunas of a species of Opuntia, by preserving them in a large amount of their own juice.

Panicum obtusum H.B.K. panic grass, seeds are ground with corn and eaten as food. (8,9)

Pectis angustifolia: seasoning, boiled with corn for flavoring (8,9)

Phoradendron juniperinum, Engelm, juniper mistletoe, a substitute for coffee (8,9).

Physalis neo-mexicana Rydb. ground cherry, ground tomato, tomate, tomate del campo, berries eaten.

Pinus edulis Engelm. pinon, nut pine

Pinus scopulorum Engelm, Lemmon, rock pine, Western yellow pine, inner bark chewed (13) (15).

Poliomintha incana (Torr) A. Gray, plant dipped in salt water and eaten (4).

Portulaca oleracea L. common purslane, verdolaga, fleshy leaves and stems are boiled and eaten (12,3).

Portulaca retusa, plants are boiled with meat (4,9).

Rhus trilobata Nutt. skunk brush, three leaved sumac, lemita, the fruit is eaten fresh or after being ground. (4,8)

Ribes inebrians Lindl. currant, manzanita, fruit eaten (4,9).

Rotatom jam esii, boiled and eaten with a tale of greasy taste, known as potato clay, also the Tewas eat the tubers (4,9,12).

Solidago missourensis, Nutt. goldenrod, round leaves eaten with salt. (8,9)

Spiesia lambertii (pursh) Huntze. Hano eat these roots as food. (9)

Tradescantia virginiana, round leaves cooked as greens. (9)

Yucca baccbata, soap weed, datil, fruit eaten, (4,9).

APPENDIX A

Historical References
to Livestock and Agriculture
in the Hopi Unit
1540 - 1936

Historical sketch: After occupation of central Mexico by the Spanish in 1514, various exploring parties were sent north to explore and report on the northern regions.

Excitement, generated by stories told by Alvar Nunez Cabeza de Vaca, prompted the authorities to send a representative of the church, Marcos de Niza, a Franciscan friar; three other priests; a negro, Estevan; and a small body of soldiers to the north. Fray Marcos reached Zuni by way of Sonora and western Arizona. The tales of this ~~city~~ pueblo seemed to have become magnified into a legend of a glittering city filled with riches.

In 1540 the expedition of Francisco Vasquez de Coronado set forth to conquer this rich region for the Spanish crown. When the main party reached Zuni two expeditions were sent out as "feelers" into the Navajo and Hopi country. One of these, the party under Friar Juan de Padilla and Don Pedro de Tovar discovered the province of Tusayan.[1]

The province consisted of seven villages, situated on three mesas. The report of Tovar's expedition is the first account of contact with the Hopi Indians by the civilized world.

Presents of tanned skins, pinon nuts, native fowl, turquoise, corn, and cotton cloth were given the explorers.

---

1. Winship, G. P.: The Journey of Coronado 1540-1542, 14th Annual Report of the B.A.E., 1869, Washington, D.C., Government Printing Office.

The information obtained by this party was used to aid a second expedition under Don Garcia Lopez de Cardenas in penetrating to the Colorado River north and west of the Hopi Country.

Attempts to missionize the Hopi were not successful until 1629 when Francisco Parras and Andres Gutierrez and Cristobal de la Concepcion established a mission at Awatobi,[1] now a ruin nine miles south of Keams Canyon. Parras was poisoned June 28, 1633, and no record was ever made of the fate of the other two friars.

In the year 1650, Jose de Espeleta became missionary at San Francisco (or San Miguel) de Oraibi. In 1674 Jose Trujillo assumed charge of San Bartalome de Shumopovi (with visita of Musangnovi). In the same year Jose de Figueroa and Augustin de Santa Maria re-established the mission at Awatobi and Walpi (a visita of Oraibi).

All of these men of the church were slain by their followers or other Hopis on August 10, 1680, the fateful day of the general uprising of Pueblo Indians of New Mexico and Arizona against the Spanish regime.

The impress of these missions on the Hopi may not have had any great religious significance, but the entrance of new agricultural and livestock elements entering as mission supplies did have a profound influence.

It seems obvious that cattle which usually accompanied

---

1. Coues, Elliot: On the Trail of a Spanish Pioneer--Fray Garces Diary 1775-76, Vol. 2, Introduction; Harper, New York, 1900.

the expeditions would be brought to the Hopi missions as well as sheep and fruit trees and new seeds to bolster the native agricultural economy of beans, maize and squash. Blackmar notes that "Onate petitioned to take 7000 cattle and horses on his expedition of January, 1598."[1]

In July or August of 1629, a party of three priests and 10 soldiers left Santa Fe for Tusayan with peach seeds, melons, wheat, apricots and garden vegetables, a herd of sheep, a drove of cattle and some horses.

After the revolt of 1680, no attempt was made to reestablish contact with Hopis until the reoccupation of New Mexico in 1692 by Diego de Vargas who visited Awatobi. Eight years after this event a padre, Juan Garaicoechea visited Awatobi in 1700 by invitation of the Oraibi chief. A mission was not established, but the act of friendliness on the part of the inhabitants of Awatobi cost most of them their lives.. Hopis of other villages burned and killed and totally destroyed Awatobi in 1701.[2]

Remnants of the Badger clan from Awatobi now exist at Mishongovi and Shipaulovi and their head, Luke, still has a voice in division of land at Talahogan garden, a walled garden on the north side of Antelope mesa about two miles west of

---

1. Compare: Blackmar, Frank: Spanish Institutions of the Southwest, pp. 223; Baltimore, John Hopkins Press, 1891.

2. Harvard University, under direction of Mr. J. O. Brew has prepared for study, possible grains which might have been incorporated in adobe blocks. Wheat straws and peach stones were found. Bones of two domestic sheep were found in a kiva near the mission quarter, indicating that sheep were kept at the mission.

Awatobi.[1]

Sometime between 1680 and 1692 a group of Tewas from Payupke (now known as Sandia) on the Rio Grande settled among the Hopi until the consequences of the revolt were over, but returned to Sandia in 1742.[2]

In the ten years between 1700 and 1710 another group of Tewas from the Rio Grande settled on First Mesa between the "notch" and Sichomovi, ostensibly as a buffer group between the Hopis and the Utes and Navajos who were constantly raiding for corn and women.[3] Their descendents still live in the original quarters, the town of Hano. The Tewas had a reputation as warriors and were induced to move their families to First Mesa. As a reward the Hopis gave them grants of land in the Nepo and Polacca washes for farming purposes.[4] These Tewas brought their own cattle with them.[5]

Escalante noted that they " . . . raised fruit, various kinds of garden vegetables, corn, beans, chili, and cotton, apt at weaving and spinning. . . . They also raised cattle and

---

1. Page, G. B.: Unpublished Mss.

2. Coues, E.: pp. 395.

3. Tewa informant--B. Cooka.

4. Page, G. B.: Report of Study Group C, Department of Agriculture, Soil Conservation Service, Gallup, N. Mex., 1936.

5. Hodge, F. W.: Handbook of American Indians North of Mexico, Vol. 2, pp. 687; Washington, D.C., 1907-1910.

sheep and made vaious kinds of useful implements. In these, as well as fabrics, they had commercial relations with neighboring tribes, especially the Yumas and Mohaves of the Colorado River."[1]

Frey Garces saw implements of Moqui make among the Colorado River Indians on his journey from Mohave to Moqui.

Espejo's entrada to Tusayan brought horses as noted " . . . and the people do not leave the villages except to go to their farms, especially at this time, when they heard that Cibola had been captured by very fierce people who traveled on animals which ate people . . . "[2], evidently the Hopis had forgotten the horses of the Coronado party.

After de Vargas' resumption of Spanish rule, an expedition was sent to Moqui to pecify them. The Moqui, influenced against the Spanish by the Apache de Navajo, drove in their cattle and prepared for war.[3]

Jesuits attempted to ~~usurp~~ occupy the Hopi Franciscan mission

---

1. Escalante, Silvestre Velez de; Diary of a Journey to Moqui in June 1775, Mss. in Archivo General de Indies Seville--Maas Vicyces de Misioneras Francisco printed form.

2. Winship: Journey of Coronado, 1540-42, pp. 33.

3. Archives of New Mexico. In Documentary History-Series, iii, pp. 134-40, 168-71.

field in 1742[1] when Father Ignacio Keler, under orders of the Spanish King set out from southern Arizona. However, Apaches attacked the group, stealing their horses and ending the expedition.

Escalante[2] writing of First Mesa notes the lack of water, a spring for domestic purposes, and one for cattle at the west side of the mesa at the foot of a little hill. "There are three small springs on the plains to the northwest of the pueblo, a mile away. All springs are so situated that mounted warriors can defend them easily. Second Mesa . . . has three horse entrances." Oraibi had springs and six large cisterns, dry when Escalante saw them.

" . . . All the pueblos abound in sheep whose wool is usually black. They also have cattle and of these, many more are in Oraibi. In this pueblo there are good horses. They plant corn, kidney beans, chili, and cotton. . . . they weave from wool to sell and to dress themselves. The fruit here are melons, watermelons, and peaches. They have the pinon, but very distant."[3]

". . . To the north from Moqui, a day of travel, they told me that there is a medium river with good plains." (Probably

---

1. Sedelmayr, Jacabo: Relacion Documentary Historia of New Mexico, Series iii, pp. 853-54.
   Note: Bancroft gives this date as 1743 in Arizona and New Mexico.

2. Escalante: Diary of Entrada to Moqui, June 22-July 5, 1775, with Letter to Minister Provincial, Fray Ysidro Murillo, April 30, 1776.

3. Escalante, ibid.

Yutas,[1] and on the south by the Apaches and Gilenos, and on the southwest by others that they here call Mascaleros and in Moqui, Tochies and Tosabues. In this direction and in the west, cattle and mustang horses are bred, by which the people of Oraibi especially profit. . . . Wood and good water appear to be scarce."

Escalante recommended that a presidio be organized at Oraibi and force used to make the Hopis move off the mesa top to their former villages on the foothills.[2]

A route to Sonora from the Moqui country is traced, " . . . By traveling four days to the south of Zuni is a small river named San Francisco. It is composed of two small streams of which one runs from northeast to southwest; the other north to south . . . the bed of the latter may be used to cross the range of the Gila with ease . . . in this canon, the river follows in a southerly direction, and at the end takes that from west to east. At a little distance begins a small valley which with its moisture makes it very pleasant and fertile. Here various settlements of Apaches, who cultivate it, and with the benefits of irrigation, gather much yellow maize. Six leagues from this valley is the River Gila. From here it is sixteen leagues to the place that

---

1. Fray Garces noted that the enemies of the Hopi were "Yabipais, Tejua, Yutas, Yumos, Chemaguabes, Jamajabs, Pimas, Gilenos, Coconoricopas"; Coues, E.: Fray Garces, pp. 451.

2. Escalante: 1775, ibid.

Sitgreaves Expedition in 1851-1852.[1]

Lieutenant Ives visited the Hopi villages while running a survey party in 1857-1858 and made careful observations.[2]

Geologic knowledge of the Hopi area was added by the Wheeler Survey.[3]

Little of interest to geographers was written about the area until "The Navajo Country", the work of H. E. Gregory appeared in 1916.[4] A more extensive description, "Geology of the Navajo Country", was published in the same year. This paper by Gregory covered more area than the first paper.

Mr. A. M. Stephen[5] resided among the Hopi for many years but notes very little material which would be of interest to those interested in Hopi agricultural practices. However, full notes of religious rites connected with agriculture are included in Mr. Stephen's diary.

Of recent years, the most comprehensive accounts of

---

1. Report of an Expedition down the Zuni and Colorado Rivers; 32nd Congress, 2nd session, Executive Document, 59, 1854.

2. Ives, J. C.: Report upon the Colorado River of the West; 35th Congress, 1st session, Executive Document, 1858.

3. Wheeler, G. M.: United States Geographical and Geological Exploration West 100th Meridian, Report, Vol. 3, Geology, 1873.

4. Gregory, H. E.: The Navajo Country.

5. Stephen, A. M., and Parsons,: Hopi Journal University of Columbia Press.

Hopi agriculture have been written by C. Daryll Forde,[1] and J. W. Hoover.[2] Alfred Whiting[3] writing in the series of Museum Notes published by the Museum of Northern Arizona presents material on seed and general ethnobotany.

---

1. Forde, C. D.: Hopi Agriculture.

2. Hoover, J. W.: The Hopi Indian Country.

3. Whiting, Alfred: Hopi Indian Agricultural Background, Parts I and II, Museum of Northern Arizona Notes, Vol. 8, No. 10, pp. 51, 1936.

   Vol. 10, No. 5, 1937, pp. 15

   Crops Introduced into Hopi Economy by Spanish, Vol. 8, No. 10, April, 1936.

The Hopi Sheep: It seems quite logical to suppose that the first sheep introduced into the unit were brought by the Spanish and introduced via the missions.

However, the breed of sheep so introduced is not quite clear. The Merinos of that period were protected by the Spanish Crown, and it does not seem likely that such a valuable breed would be sent. The prime need of the soldier was for a meat animal, and this would have been satisfied by the Churro, a breed larger and heavier than the Merino.

A description of the early types of sheep brought to the California missions states that they were, in part, descendents of degenerated Merinos and in part descendents of the unimproved Churro long wool breed of Spain and in part crosses of these two types.[1]

The sheep reported in early accounts seem to have had black wool. Hernando de Alorcon, exploring the Colorado River at the time that Tovar was visiting the Grand Canyon region, was told by river Indians that the explorers at Cibola (Coronado's party) had "little black beastes with wooll and hornes".[2]

Fray Garces observed a sheep fold at Oraibi (corral de ganado menor) with a flock, " . . . The ewes are larger than

---

1. Burns, Robert H., and Moody, E. L.: The Trek of the Golden Fleece, The Journal of Heredity, Vol. 26, No. 12, Dec., 1935, pp. 517.

2. Winship, G. P.: (quoting Hakluyt) Coronado, pp. 405.

early 19th century, and from those obtained from Mexicans and Mormons along the Santa Fe railroad to the south.

Bibliography

1. Amsden, Charles, A.: Navajo Weaving, Southwest Museum Press, Los Angeles, California, 1934.

2. Arbos, Philippe: The Geography of Pastoral Life, The Geographical Review, Vol. 13, No. 4, Oct., 1923.

3. Archives of New Mexico, Documentary History Series iii.

4. Bancroft, H. H.: History of the Pacific States of North America, Vol. 12, Arizona and New Mexico, 1530-1888, San Francisco, 1888.

5. Blackmar, Frank: Spanish Institutions of the Southwest, Baltimore, John Hopkins Press, 1891.

6. Bryan, Kirk: The Classification of Springs, The Journal of Geology, Vol. 27, No., 7, 1919.

7. ---------- Flood Water Farming, The Geographical Review, Vol. 19, No. 3, 1929.

8. Burns, Robert H. and Moody, E. L.: The Trek of the Golden Fleece, The Journal of Heredity, Vol. 26, No. 12, Nov. and No. 12, Dec., 1935.

9. Castetter, Edward, F.: Uncultivated Native Plants Used as Sources of Food, University of New Mexico Biological Series, Albuquerque, New Mexico, 1936.

10. Coues, Elliot: On the Trail of a Spanish Pioneer - Fray Garces Diary, 1775-1776, Vol. 2, Harper, New York, 1900.

11. Cotton, E: Tuba City and the Charlie Day Spring, Museum of Northern Arizona Notes, Vol. 3, No. 11.

12. Domenech, Abbe En: Deserts of North America, 2 Vols., London, Longman, Green and Longman, 1860.

13. Donaldson, Thomas: Extra Bulletin, The Hopi Indians, 11th United States Census, Gov. Printing Office, Washington, D. C. 1893.

14. Forde, C. Daryll: Hopi Agriculture and Land Ownership, Journal Royal Anthropological Institute, London, Vol. 61, 1931.

15. Gregory, H. E.: The Oasis of Tuba City, Arizona, Annals of Amer. Assoc. of Geographers, Vol. 5, 1915.

16. _____: The Navajo Country, U. S. Geological Survey Water Supply Paper, No. 380, Washington, D. C., 1916.

17. Hodge, F. W.: Handbook of American Indians North of Mexico, Vol. 2, Washington, D. C., 1907-1910.

18. Hoover, J. W.: The Hopi Indian Country, Tusayan, Geographical Review, Vol. 20, July, 1930.

19. Hoover, J. W.: Navajo Nomadism, Geographical Review, Vol. 21, July, 1931.

20. Ives, J. C.: Report Upon the Colorado River of the West, 35th Congress, 1st Session, Executive Document, 1858.

21. Leathermann, Jonathan: Sketch of The Navajo Tribe of Indians, Smithsonian Institute, Tenth Annual Report, Washington, D. C., 1855.

22. Page, Gordon B: Report of Study Group "C", Dept. of Agriculture, Soil Conservation Service, Economic Section, Gallup, New Mexico, 1936. Unpublished Mss.

23. Page, Gordon B: Unpublished Mss. of Hopi Notes.

24. Report of an Expedition Down the Zuni and Colorado Rivers, 32nd Congress, 1st Session, Executive Document, 1858.

25. Report of Study Group "C", Dept of Agriculture, Soil Conservation Service, Gallup, New Mexico, 1936-1937.

26. Sedelmayr, Jacobo: Relacion Doc. Historia, Series iii, of New Mexico, Santa Fe, New Mexico.

27. Stephen, . M. and Parsons : Hopi Journal, New York, Columbia University Press.

28. United States Pacific Railroad Explorations, Vol. 3, Part 2, Washington D. C., 1854.

29. Weinburg, F. T.: Translations of, Escalante, Silvestre Velez de, Informe y Diario de la Entrada que en Junio de 1775, Hizo a la Provincia de Moqui. Thesis, University of California Library, Berkeley, 1922.

30. Wheeler, G. M.: United States Geographical and Geological Survey, Exploration, West of 100th Meridian, Report, Vol. 3, Geology, Wash., D. C., 1873.

31 Winship, G. P.: The Journey of Coronado 1540-1542, 14th Annual Report, Bureau of American Ethnology, Wash. D. C., Gov't Printing Office, 1869.

32. Whiting, Alfred: Hopi Indian Agricultural Background, Part I, Museum of Northern Arizona Notes, Vol. 8, No. 10, 1936.

Sources of material on Hopi Use of Uncultivated Native plants used as Food.

1. Bourke, J.G.- The Folk Foods of the Rio Grande Valley and of Northern Mexico. Jour. Amer. Folk Lore, 8:41-71. 1895.

2. Castereda, Pedro de. The narrative of the expedition of Coronado. Spanish explorations in the Southwest and southern United States 1528-1543 ed. F.W. Hodge, New York., 1907.

3. Cremony, J.C. Life among the Apaches., San Francisco 1868.

4. Merker, J.W. A Contrib. to Ethnobotany. Amer. Anthro. o.s. 9:14-21 1896.

5. Franciscan Fathers, The - An Ethnologic dictionary of the Navajo Language, St. Michaels, Ariz. 1910.

6. Maynard, Teleny. The Food Plants of the North Amer. Indians. Bull. Torr. Bot. Club. 22:98-109, 1895.

7. Hodge, F.W. Handbook of Amer. Indians north of Mexico. Bull. B.A.E. 30: 2 vol. Wash. D.C. 1907, 1910.

8. Hough, W. The Hopi in relation to their plant environment, A.A. S.S. 10:33-44., 1897.

9. ..... Environmental interrelations in Ariz. A.A. o.s. 11:133-155 1898.

10. Palmer, Edward - Food products of the North American Indians. Ent. U.S. Dept. of Agric. 1870.

11. ..... - Plants used by the Indians of the U.S. - Amer. Nat. 12: 593-606, 676-655, 1878.

12. Robbins-Harrington et al. Ethnobotany of the Tewa Indians, B.A.E. Bull 55, Wash. 1916.

13. Standley, P.C. Some useful plants of New Mexico. Ann. Report, Smithsonian Inst. 1911, pp. 447-463 Wash. 1912.

14. Stevenson, M.C. Ethnobotany of the Zuni Indians, 30th Ann. Report B.A.E. Wash. 1915.

15. Wooton, E.O. and P.C. Standley Flora of New Mexico, Contrib. from the U.S. Nat. Herb. 19, Smith Inst. Wash 1915.

OUTLINE

I. GENERAL HOPI ECONOMY

A. Place of Livestock

II. LIVESTOCK RANGE USE

A. Overall Figures

1. Number of livestock

2. Clan affiliation of stock operators

3. Distribution of livestock

4. Non-owners

5. Carrying capacity

6. Overstocking

III. COMMERCIAL AND NON-COMMERCIAL ASPECTS OF THE LIVESTOCK INDUSTRY

A. Products

1. Where and how sold

2. When and by whom consumed

3. Relative contribution of livestock to total living

IV. TECHNOLOGY OF RANGE USE

A. Range Rights

B. Corral Use

C. Water Use

D. Herding Practises

E. Navajo Herders

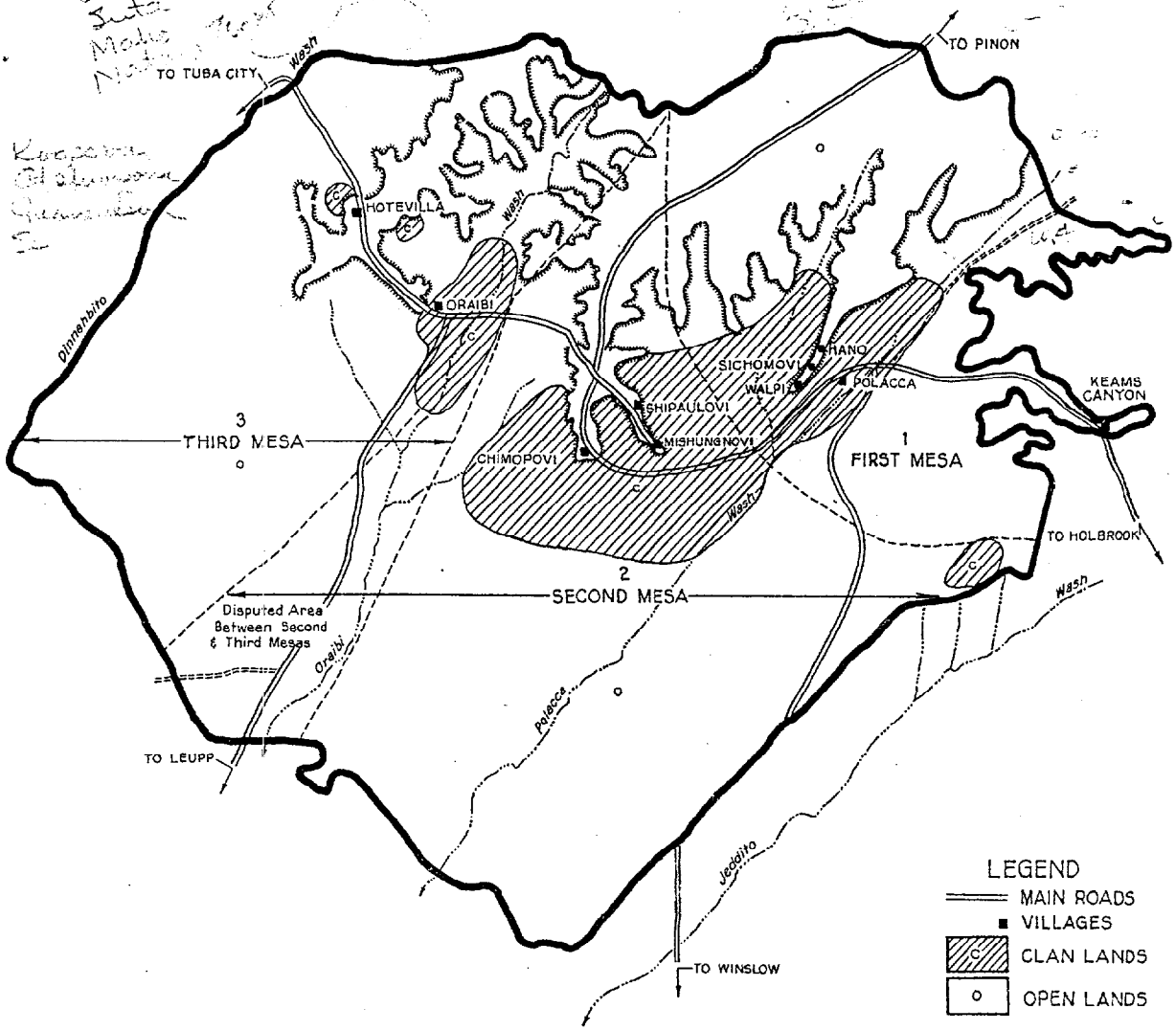
OUTLINE FOR HOPI ECONOMY

THE NATURAL LANDSCAPE

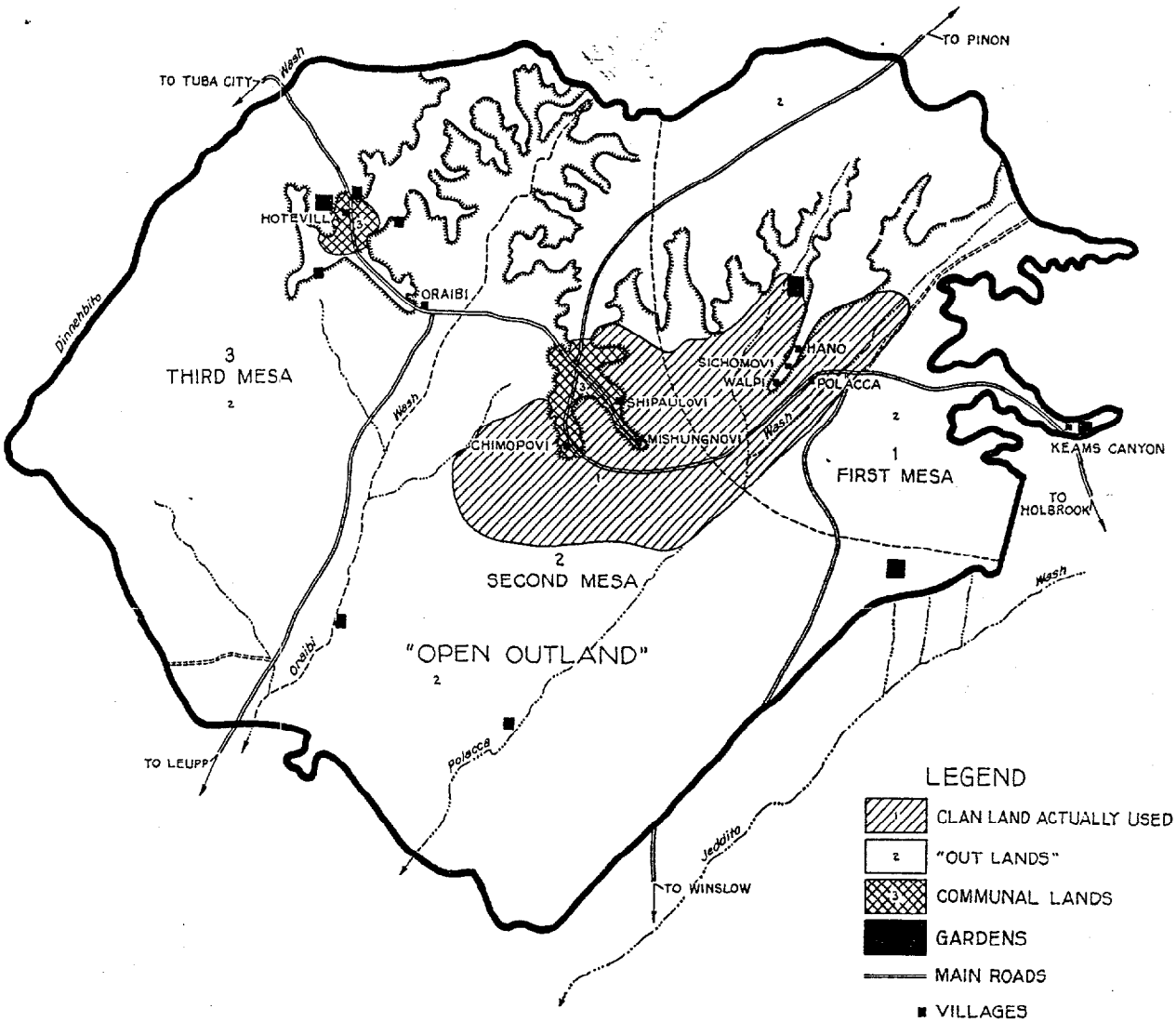
FACTORS			FORMS	
Geognostic			Climate	
Climatic	→	TIME →	Land	
Vegetational			Surface	
			Soil	
			Drainage	NATURAL LANDSCAPE
			Mineral Resource	
			Sea & Coast	
			Vegetation	

THE CULTURAL LANDSCAPE

FACTOR		MEDIUM		FORMS	
CULTURE	+ TIME +	NATURAL LANDSCAPE	→	Population	
				Density	
				Mobility	
				Housing	CULTURAL LANDSCAPE
				Plan	
				Structure	
				Production	
				Communication	



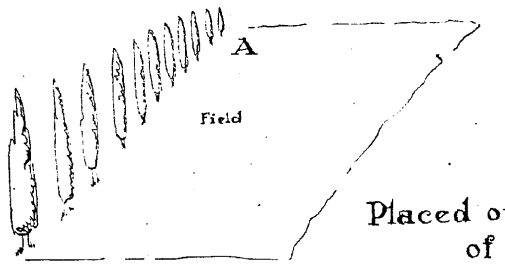
LAND USE PATTERN BEFORE 1900 A.D. BASE MAP-HOPI UNIT



LAND USE PATTERN
1939
BASE MAP HOPI UNIT

USPRI002491

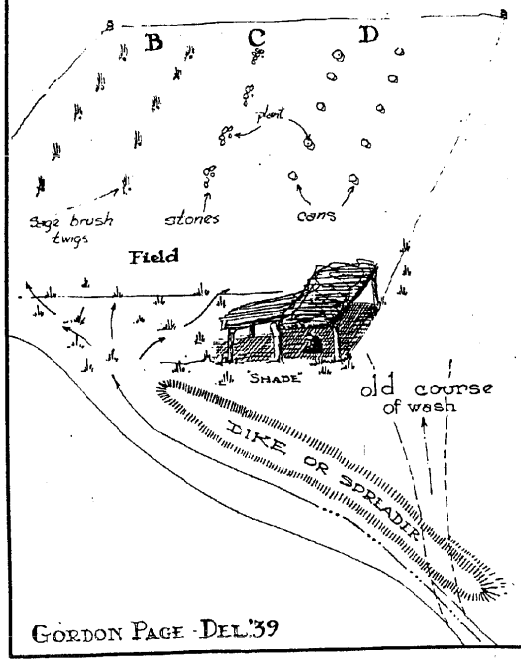
METHODS OF PROTECTING CROPS

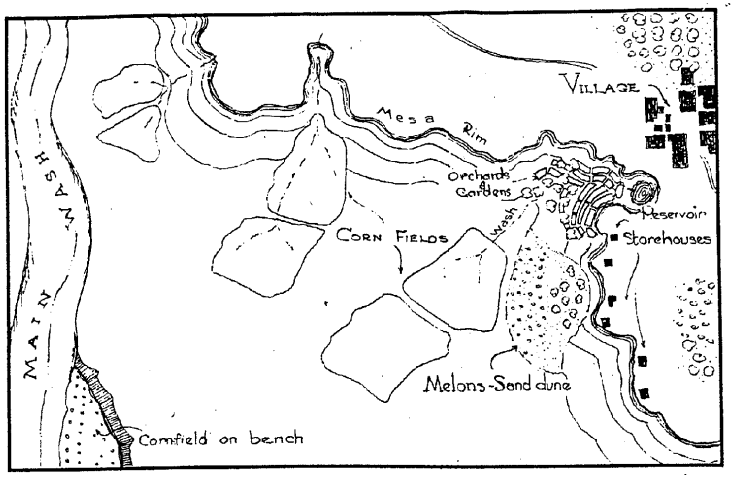


A trees
B shrubs-twigs
C stones
D tin cans

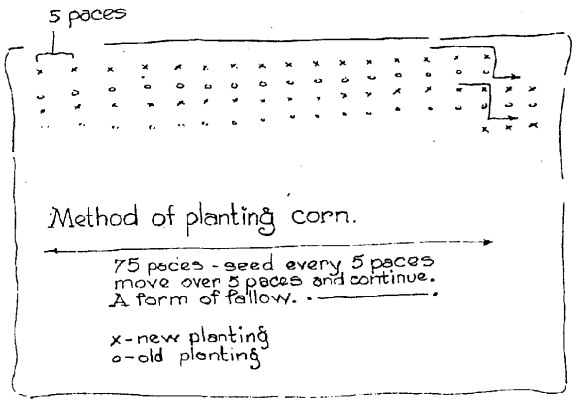
Placed on windward side of plants

Prevailing winds





RELATION OF A HOPI VILLAGE TO GARDENS AND CORN FIELDS

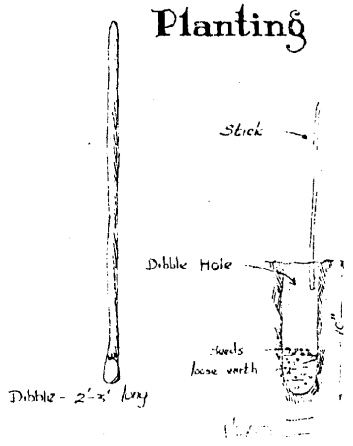


Method of planting corn.

75 paces - seed every 5 paces
move over 5 paces and continue.
A form of fallow.

x - new planting
o - old planting

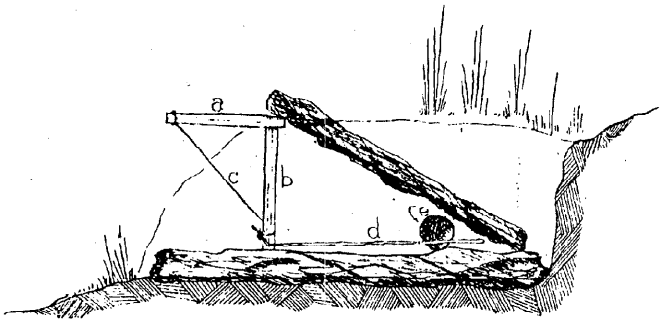
Planting



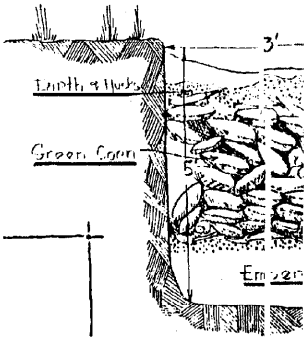
GORDON PAGE - DEC. '39

HOPI AGRICULT PRACTI

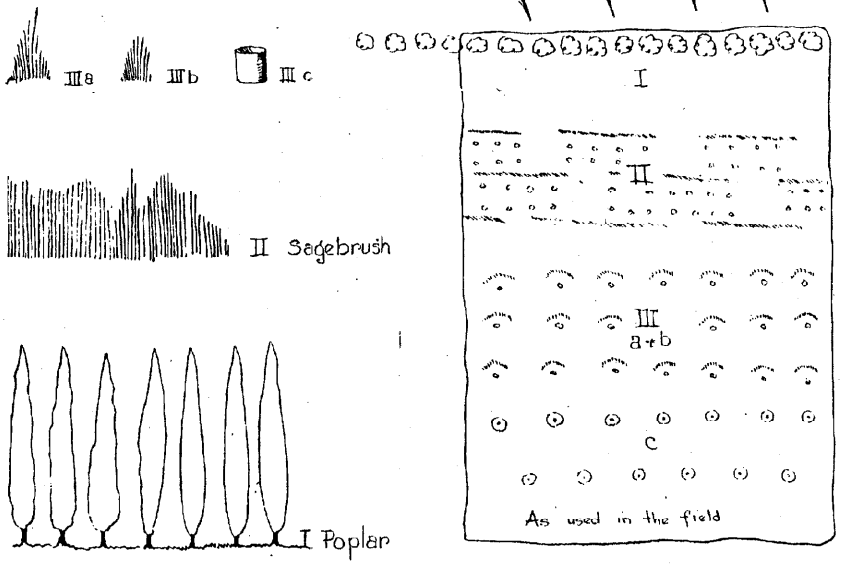
HOPI RAT TRAP



a. Trigger Bar
b. Fulcrum
c. String
d. Release Wand
e. Rat Hole



HOPI WIND BREAKS

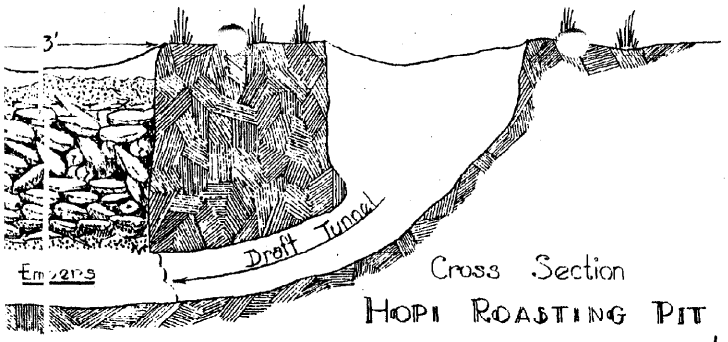


Rows
every
allov
lie fallo

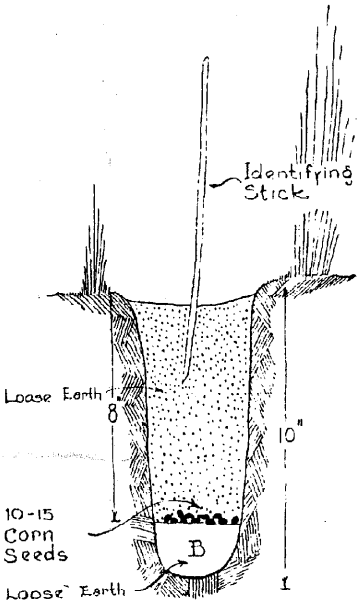
Low Mour
plots, in c
by two

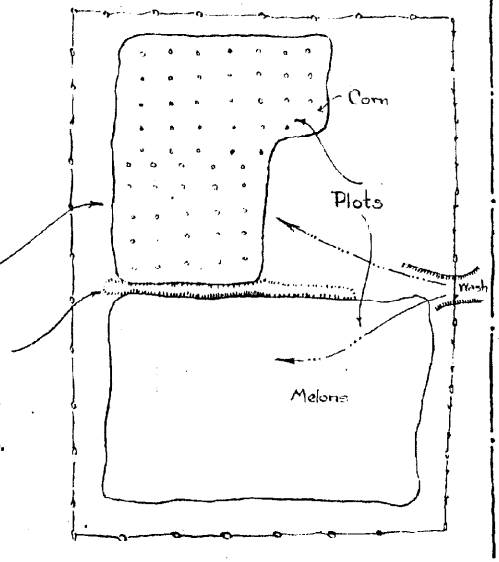
TYPICA

HOPI
ULTURAL
CTICES



Cross Section
HOPI ROASTING PIT

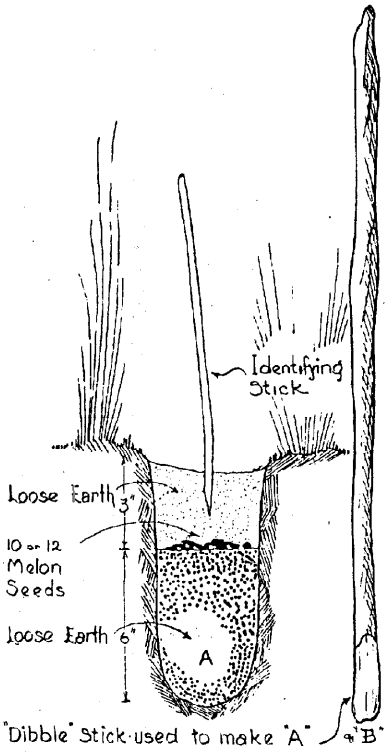


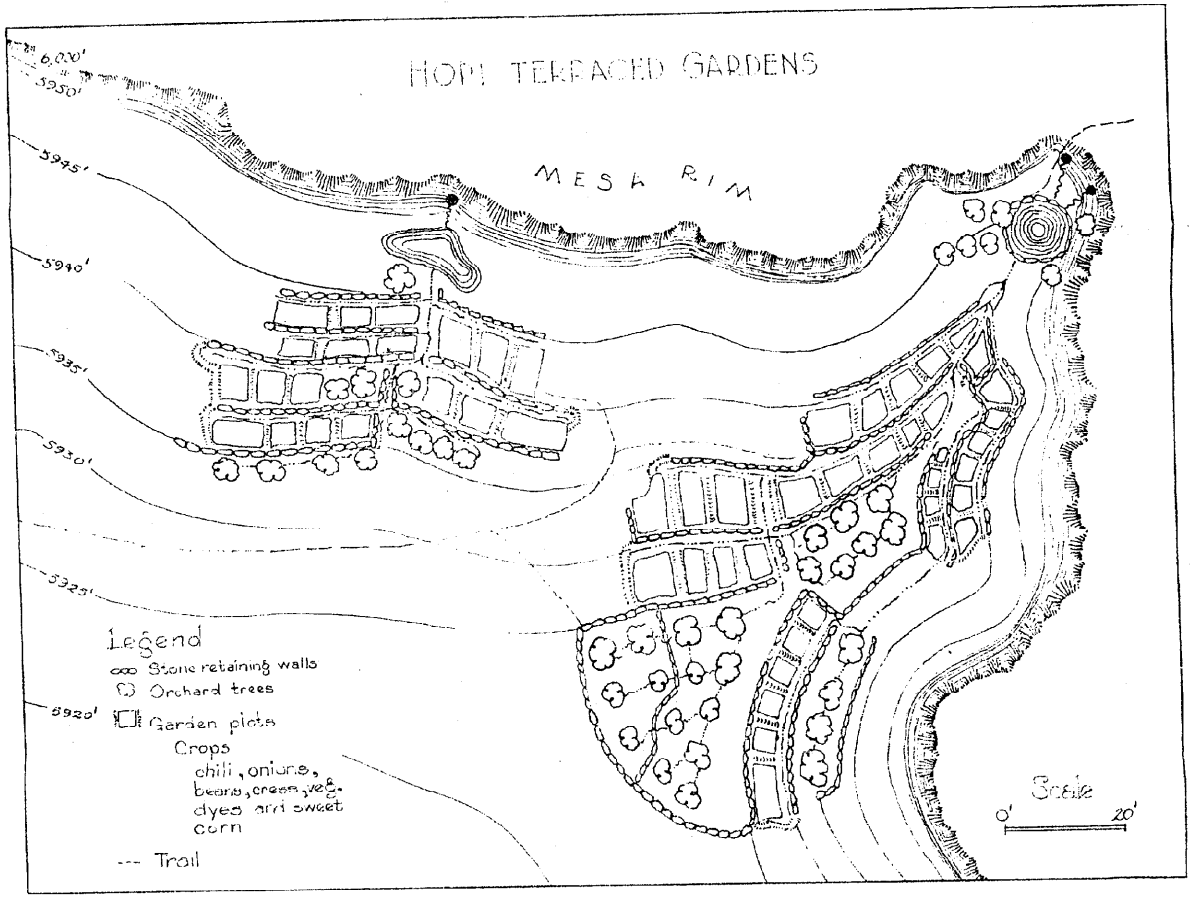


ows staggered
ery season to
llow one row to
fallow.

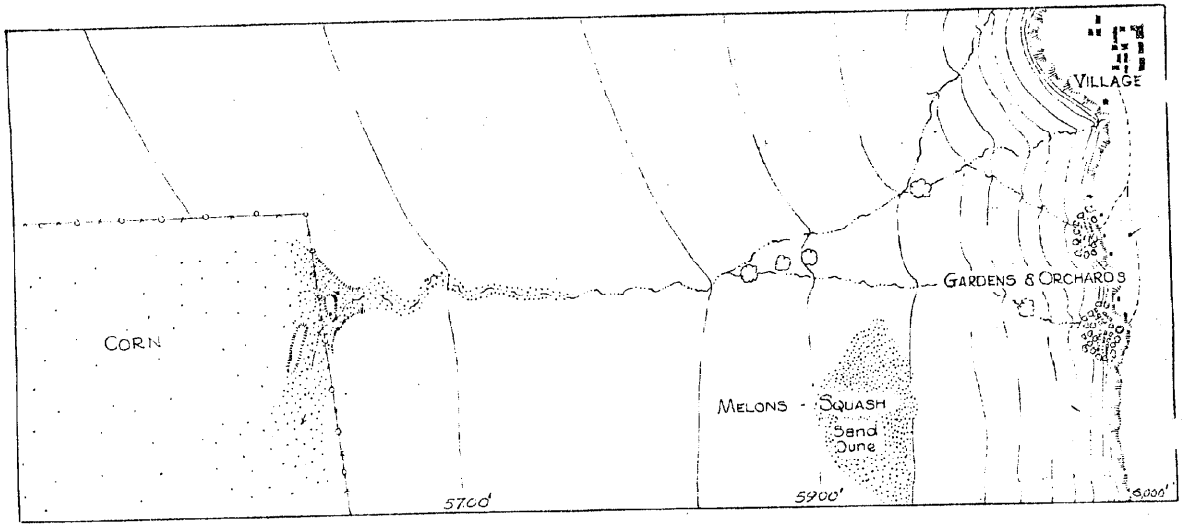
v Mound between
ots, in one field, used
two operators.

PICAL FIELD





GARDEN PLOTS



TRANSITION ZONES

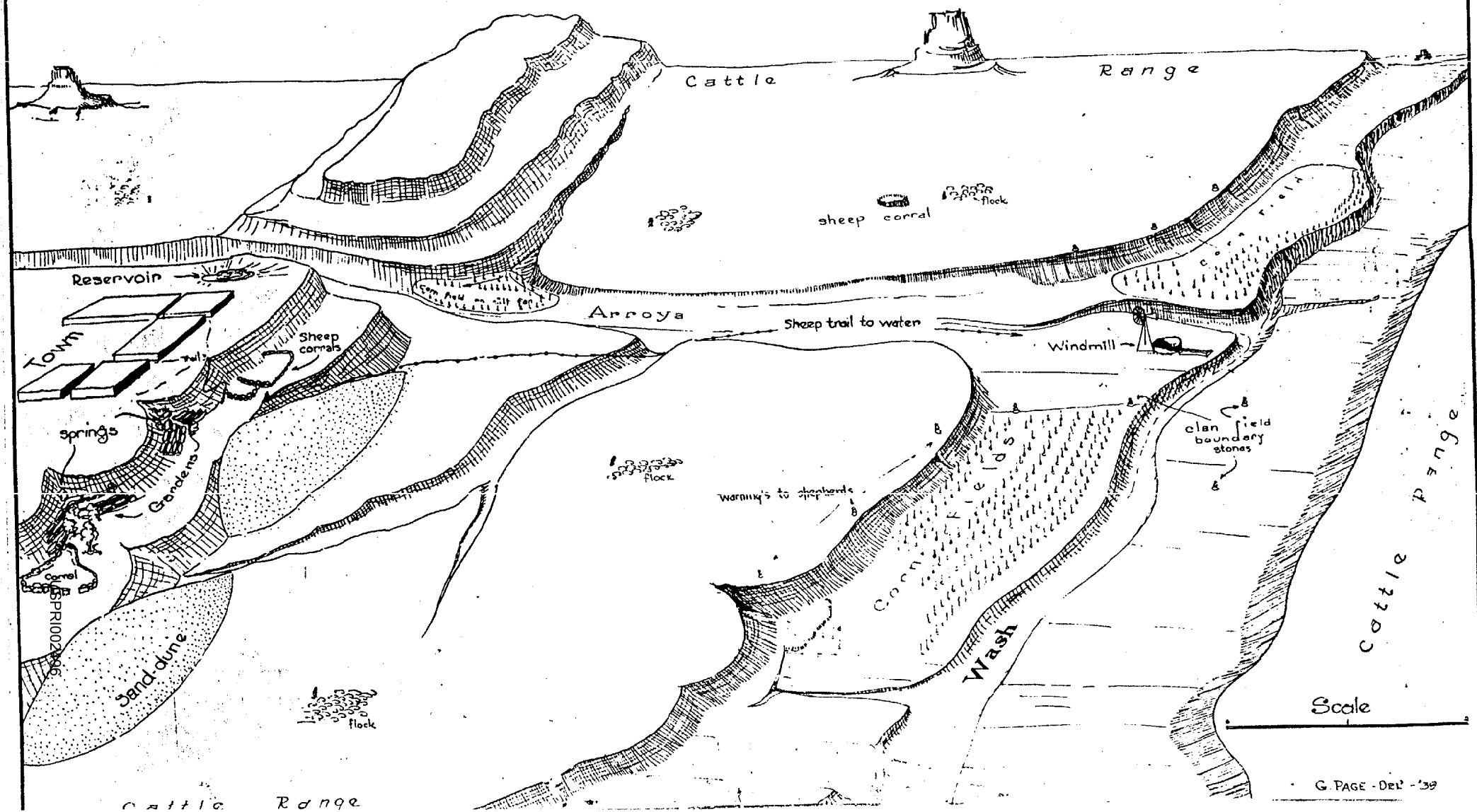
0' 400'

GORDON B. HAGE '39

PLATE XV

N-2326

THE RELATION OF VILLAGE TO ECONOMIC BASE



Hotivella Hopi and Clans summarize as follows -

4 - spider - clan
1 - spirit - "
12 - Eagle - "
8 - coyote
4 - rabbit
4 - sun
6 - reed
4 - sand
1 - water
6 - greasewood
1 - pumpkin
2 - Katchina
4 - cloud
3 - Badger
1 - snake
1 - Tcuwungwa
1 - parrot.

Russel Maktee - spider
Rubin Chukaichie - spider
James Chuhongva - spirit
Mathew Chianimptewa - Eagle
Jacob Ahovoneva - coyote
Walter Albert - Rabbit
Earl Albert - Rabbit
Sockwyteva - sun
Harley Tuiegva - reed
Dennis Quemagouse - coyote
Lester Quanimptewa - sand
Joel Posiehongoma - coyote
Rex Nuvahoiema - water
Dan Nasieneiteva - greasewood
Simon Polingyumptewa - greasewood
William Pahongva - sun
Sidney Nasiyumptewa - greasewood
David Monaya - pumpkin
Carl Talasvyma - Katchina
Asha Holahema - Eagle
Ira Lakenema - Eagle
Jefferson Hoonteva - Eagle
Titus Lamson - Reed
Alfred Lomahoema - coyote
Gilbert Tevaquaptewa - greasewood
Percy Lomaquahu - Eagle
Mary Masaletateva - Reed
Henry Kuevema - sun
Carrol Talowell - spider
Koyayeva - Katchina
Willis Koyayeva - cloud
Neil Kootahongneva - badger
Joe Pecphongva - Badger
Herbert Masayetteva - Rabbit
Lawrence Lomatuya - Eagle
Charlie Komaquaptewa - Eagle
Joe " - "
Saul " - "
Paul Senet - Eagle
Suhongva - coyote
Franklin Suhu - sand
Quaquahongva - sand
Alonzo Honanie - reed
Anna Howeea - coyote
Homer Humeyumptewa - Sweetgrass
Hoateva Tuvangyoema - coyote
Perry - Sehongva - reed
Emory Selaquaptewa - badger
Aquilla Kuwanletsteva - sand
Allen " reed
Geo. Nasiiweseuva - spider
Wm. Armstrong - parrot
Henry Tewanie - eagle
Saul Talas - rabbit
John Tawtechongva - snake
Hugh " - cloud
Floyd " - cloud
Jonathan Talawyma - sun
Benj. Wytewa - Eagle
Columbus Tawangyumptewa - coyote
Samuel Tewahongva - cloud
Stanley Pasht - greasewood

Note :-
Lists of Hotivella Hopis owned sheep & cattle -

Summary of clans of 1st mesa

3 - Badger - clans
1 - Tobacco - "
3 - Katchina - "
3 - rabbit - "
2 - mustard - "
3 - Bear - "
2 - coyote - "
1 - Parrot - "
1 - Pumpkin - "
1 - Water - "
1 - Sand - "
2 - Snake - "
6 - Sun - "

List of 1st Mesa Hopis owned stocks -

- ✓ Suttla - Badger
- ✓ Lellete - tobacco
- ✓ Laney Dashee - Katchina
- ✓ Jason Dashee - rabbit
- ✓ Old Man Dashee - Katchina
- ✓ Jacob Coochise - mustard
- ✓ Ami - Badger
- ✓ Palevama - Badger
- ✓ Duwapa - Bear
- ✓ Singonteewa - coyote
- ✓ Lankis - coyote
- ✓ Jordan Adam - mustard
- ✓ Paul Grover - Katchina
- ✓ Chewegon - parrot
- ✓ Ed - " - sand
- ✓ Davis Mahe - pumpkin
- ✓ Dennis Naquin - Bear
- ✓ Eldridge Pooche - water
- ✓ Samuel Nahsee - rabbit
- ✓ Theyer Talas - rabbit
- ✓ Morris Paukgana - Bear
- ✓ Tom Sali - snake
- ✓ Mathew " - snake

Dewright Lomaseama - sun
Fred " - sun
Sankey " - sun
Harry " - "

Lawrence Lomavaya - sun
Juanita " - sun

Note: This completes the 149 Mesa stockowners on our list.

c/o Toreva Day School
Polacca, Arizona
Feb. 1, 1959.

Mr. J. Nixon Hadley
Soil Conservation Service
Box 1151
Gallup, New Mexico

Dear Nick:

My comments and corrections on the semi- final draft of the Human Dependency Survey of the Hopi Land Managment Unit, are probably familiar to you, for they are essentially the same as the criticisms I made of the Statistical Summary. However, in the latter case, the manner in which the figures were arrived at is explained in the introduction, while in this instance it is not.

p.3 It is worth noting that the last census showed slightly over 3000 in District 6 (does not include Moencopi in 5).

p. 4 The people who live at the foot of the mesa at Second Mesa are congregated around the Mission on the east side of the mesa, not at Toreva.

p. 4 Large flocks of sheep are also herded 12-20 miles from the mesa- particularly around Talahogan, Coyote Springs, Little Burro Springs, and Burro Springs.

p. 6 The wage income is exceptionally high- following year 50,000 dollars. Even in the year from which the figures are taken, the whole amount was not spent in District 6. Part went to Navajo labor in 4, althouhg administered from the Keams Canyon Agency.

In the same chart the figures on non-commercial income are misleading, without the information of the inflationary nature of the dollar value of corn and orchard produce in terms of dollars. On the other hand, livestock income whether commercial or non-commercial represents real dollar value, since both wool, and lambs are sold at market prices. Because of the greater production of agricultural goods in District 6, in comparison with other units, it tends to raise the income and the rating of the unit.

p. 13 Much the same criticism applies to this non-commercial income chart. The value placed on orchard 96070 dollars as against 106,490 dollars for corn is ridiculous in terms of the role played by each in domestic consumption. A proportion of 10 to 1 would more nearly state the relative dependence upon them.

p 15 Table VI, the dollar value of crops per acre is more or less meaningless, since a very insignificant proportion enters into trade at all. The role played in actual consumption would be (1) corn (2) beans (3) melons and squash (4) orchard (5) vegetables. Vegetable production is limited to chile and onions, and they are raised only where they can be irrigated from springs

at Wipo, Talahogan, below Hotevila, etc. The comment below the chart implies that the income could be raised by changing the number of acres devoted to the various classes of crops.

p. 16 The figure of 82,000 dollars for cars and trucks needs qualification. Only Hopi storekeepers or those having permanent government jobs, with rare exceptions are truck owners. The other factor is that most of them are purchased on installment plans, so that 82,000 dollars was contracted for, but was paid out of the following year's income as well as the one in which the figures were taken.

p 17 The figure 6,300 on food raised sold to the trader and sold back to the Hopi is questionable. Is it certain that no Navajos in the distrct were purchasers of these items? The reason I query this, is because the usual pattern of exchange within the group takes place without the assistance of the trader.

The local production of wheat will do more than any single change in the present economy of the Hopi to make it approach self containment.

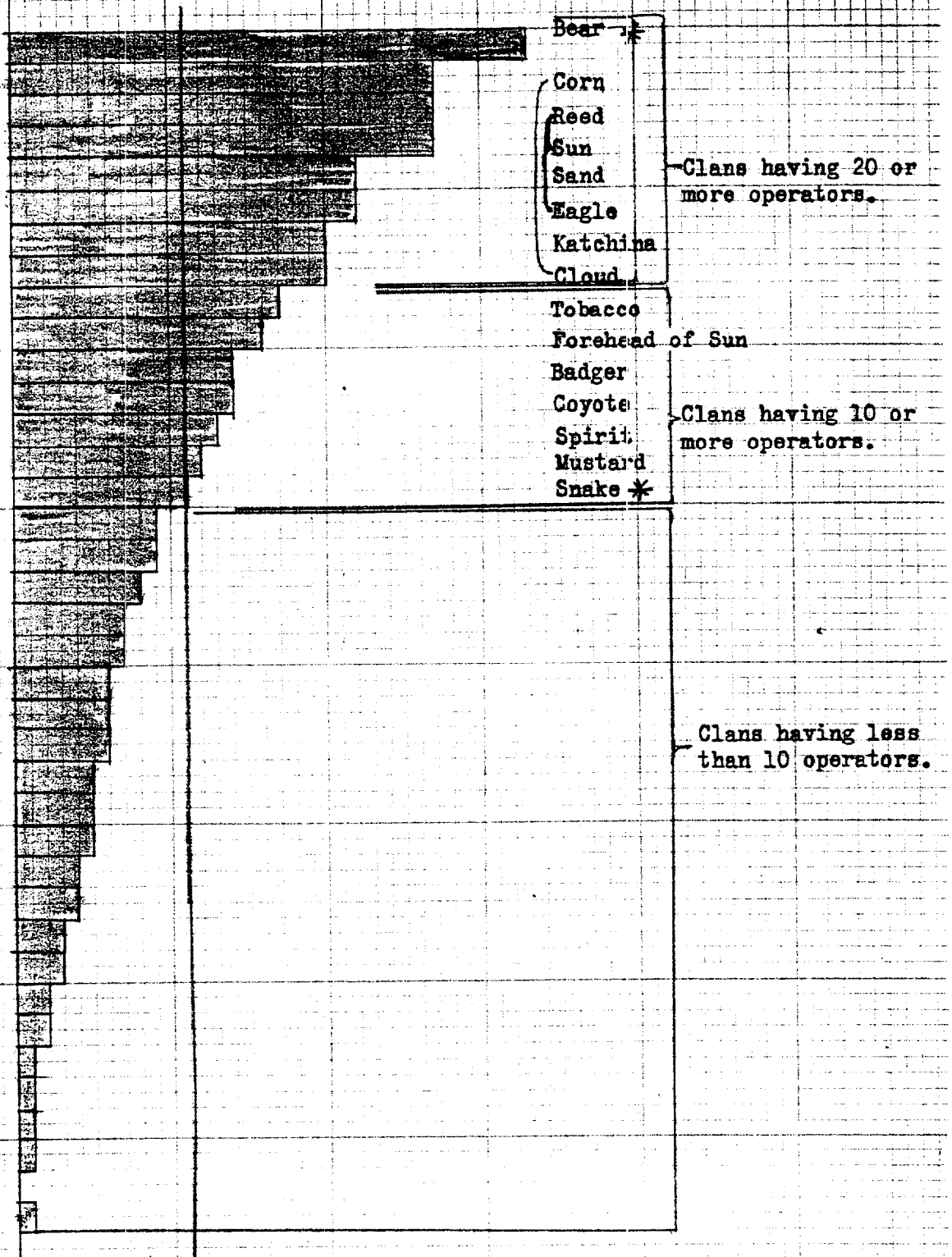
I believe if the factors enumerated here, were mentioned in an introduction to the report on District 6, or better, were embodied in the report at the relevant places, it would tend to correct what are now misleading impressions.

Very truly yours,

Ed.

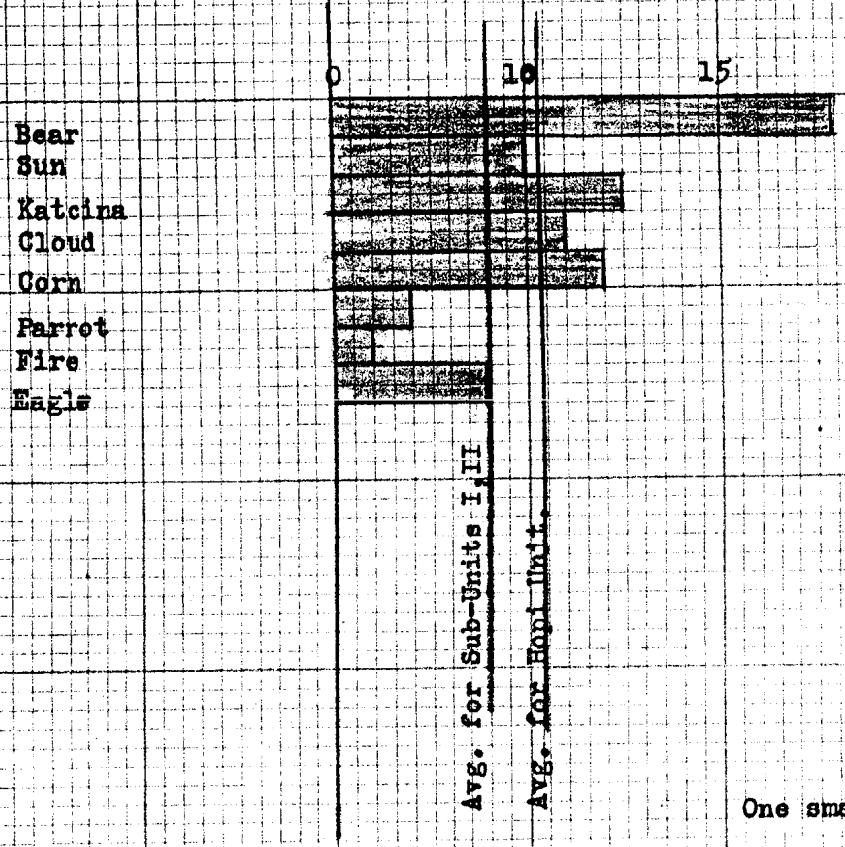
Edward A. Dennard

Clan Rankin - Stock Ownership



1 square = 1 operator.

CLAN RANKING -- STOCK OWNERS - SUB-UNITS I AND II *



One small square equals one operator

* This bar chart represents only those groups which are represented in the Clan-Corn Acreage Chart.

It is of interest to note that the Bear, Katcina, Cloud and Corn groups are above the group average.

AVERAGE ACRES PLANTED IN "OUR" SEC. #36

CLAN RANKINGS

One small square equals 2 acres

Average Number of Acres Planted Per Clan

Bear
Sun
Water
Cloud
Corn
Parrot
Fire
Eagle
Badger
Snake
Sparrow Hawk
Deer
Pumpkin
Coyote
Tobacco
Butterfly
Reed
Sand
Stick
Crow
Mud Turtle
Grey Hawk
Bluebird
Lizard

2/1/2000

Memo

To: Eileen Camilli

Subj: LC proposals

From: Chris Banet

Well here is the request, for two proposals. Please try to contain yourself. I'll be interested in your comments.

Request for Proposals
Little Colorado River adjudication
For additional work relating to *Identification of Farmed Lands*

First proposal

Task 1. Reconcile boundaries to BLM GCDBs. This applies to the exterior boundary from the confluence of the Little Colorado & the Big Colorado south and east to the New Mexico State Line. It also applies to the private holdings in the Winslow Tract and the Sanders New Lands. Boundary definitions are to be found in various executive orders and BIA maps (for Sander and Winslow areas). Other suspected private inholdings should be compared to GCDBs just incase an opportunity should present itself to improve on the accuracy of inholdings boundaries.

Task 2. Create two coverages. One will be the exterior boundary of the project area, and will include, but not delineate, inholdings, allotments, tribal lands of Navajo, Hopi and Zuni, and Hubbell National Landmark. The second coverage will encompass all of the area of the first, but have the inholdings (only ones which are confidently known), tribal lands, and allotments delineated.

Task 3. Meet and consult with BIA and DOJ individuals to assess project accomplishments and future requirements.

Task 4. Prepare seven sets of CDs containing information on the unioned fields and related data.

Second proposal

Task 1. Prepare a draft report documenting the process leading up to the development of the unioned fields. Report is to include the following sections:

a. Description of problem/formation of method concept (ID types of farming & photo interpret).
b. Literature review for establishment of photointerpretion as acceptable method for ID of farmed lands (short).
c. Methodology
    i. Identification of farming types. This will be comprised of ten sections with each section having a subsection for literature review/documentation and a subsection of description.
    ii. photointerprative efforts. This describes the process of multiple years, multiple interpreters and a kingpin.
    iii. GIS efforts. The process of developing a manuscript and digitizing.
d. Results. Mainly a series of table according to the Zaccharial example, example images, and contemporary photos.
e. Analysis. Musings on: percentage of each particular type of irrigation, comparison of results to findings of Hack and Page and any others, how much irrigated land not able to be identified by this method.
f. Appendix I Data dictionary
g. Appendix II CD
h. Appendix III List of each unioned field polygon, with farmed land type, acreage, tribal ownership, UTM location, PLS location and quadrangle.

Task 2. Fields trips.

a. Two night/three day trip to be attended by Camilli and/or Ebert, Heoptner, Cawley and BIA driver. Purpose of trip is to document contemporary use of technologies identified in typology of farmed lands. Info to be incorporated into draft report.
b. Two night/three day trip to be attended by Camilli and/or Ebert, Hoeptner, Cawley, Gigosa and BIA driver. Purpose of trip is to acquaint the unacquainted.

Task 3. Prepare final report. Final report to incorporate comments from BIA, DOJ and ~~Natural Resources Consulting Engineers.~~