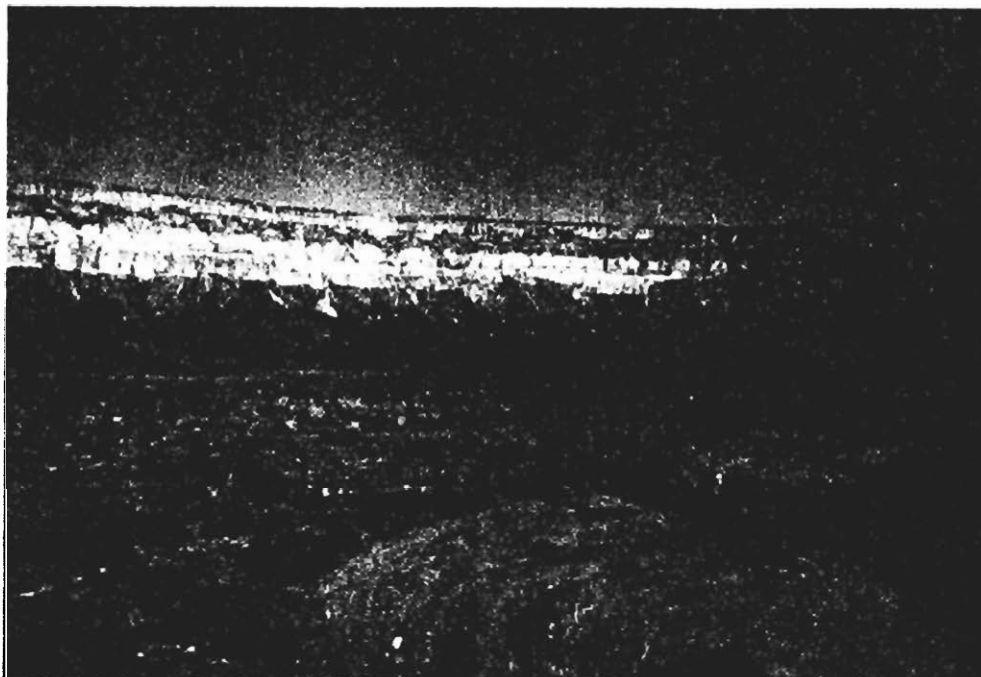


RANGE CAPACITY AND TERRESTRIAL ECOSYSTEM EVALUATION
OF THE HAVASUPAI TRADITIONAL USE LANDS

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SUMMARY

The terrestrial ecosystem and range analysis survey for the Havasupai Traditional Use Lands was initiated in April and completed in July, 1982. Of the 95,300 acres within the survey boundary, approximately 40,000 acres contain soil mapping delineations that were accessible to survey crews. The remaining acres were inaccessible and were not inventoried.

The climate of the HTUL area is quite variable due to the modified effects of relief, aspect, and topography. It is characterized by hot, dry summers, and cold, moist winters. Generally, the western portion is hotter and dryer than the eastern.

The HTUL represents a portion of the Grand Canyon section of the Colorado Plateau Physiographic Province. Out of the eleven geologic formations found within the survey area, only five contributed to soil pedogenesis (i.e., in descending order, Kaibab, Toroweap, Coconino, Hermit, and Supai formations). Landforms are characterized by nearly level to strongly sloping bench and terraces, to steep and extremely steep talus and scarp slopes.

Four vegetative communities indigenous to the Colorado Plateau were recognized, but only three were mappable at the existing scale. The following climatic climax vegetation communities are listed in order of occurrence. Blackbrush/galleta is found between National Canyon and approximately Great Thumb Mesa. From Fossil Bay to Royal Arch Creek, a break in vegetative communities exists with Utah juniper/big sagebrush occurring on steep talus slopes and pinyon pine/Utah juniper/big sagebrush occurring on the Esplanade bench.

During the course of the survey, nine soil mapping units were identified and delineated of which three occur as complexes, three occur as associations, and three occur as miscellaneous land types. Six soil taxons were identified, sampled and classified to family phases according to Soil Taxonomy.

Mapping units 104, 174, and 175 occur on benches and terraces with a slope range of 0 to 15 percent. These mapping units are shallow to very shallow over bedrock, and support low densities of vegetation. Range forage production potential and soil revegetation suitability is low.

Mapping units 176 and 177 occur on talus slopes above the Esplanade Sandstone with a slope range of 40 to 120 percent. These mapping units typically have two soil taxonomic units with one soil component being moderately deep to deep over bedrock, and the other being shallow over bedrock. The steepness of slope and active erosional processes that are occurring exclude these mapping units from grazing.

Mapping unit 178 occurs on terraces on the Esplanade Sandstone with a slope range of 15 to 40 percent. This mapping unit typically has two soil taxonomic units with one soil component being moderately deep to deep over bedrock, and the other being shallow over bedrock. Range forage production potential and soil revegetation suitability is low.

Mapping units 179 and 181 represent the steep vertical cliffs above and below the Esplanade Sandstone. They are inaccessible to livestock and were not inventoried.

Mapping unit 180 occurs on the Esplanade with a slope range of 0 to 40 percent. It is essentially barren except for small residual pockets of soil which support sparse vegetative cover.

The grazing potential for the HTUL is very low. This is the result of harsh climatic conditions, shallow soils which inhibit forage production, water availability, forage distribution, and soil stability. The competition with wildlife will further limit this potential. Without expensive range improvements (i.e., trick tanks, fences, trails) and constant herding practices, proper grazing of livestock will not be possible.

Currently, there is not a single portion of the HTUL that can be grazed by domestic livestock at this time. The HTUL was classified as either having potential capacity or no capacity. Inaccessibility, lack of available forage, accelerated erosion, and a general lack of effective ground cover are the major reasons for these classifications. Even areas given a potential capacity classification may be misleading because they are generally small isolated islands surrounded by bedrock.

INTRODUCTION

INTRODUCTION

In pursuit of Public Law 93-620 to establish a management plan for the Havasupai Traditional Use Lands, hereafter referred to the HTUL, the Grand Canyon National Park - USDI, and the Kaibab National Forest - USDA, signed a Memorandum of Understanding in March 1982. This document contracted the Forest Service to inventory the livestock grazing capacities and terrestrial ecosystems within the HTUL.

The HTUL contain approximately 95,300 acres. Its boundaries are defined by the following land forms: the Colorado River on the north, Royal Arch Creek to the east, National Canyon to the west, and the South Rim of the Grand Canyon National Park (exclusive of the current Havasupi Indian reservation). Figure 1 shows the proximity of the HTUL within the Grand Canyon National Park and northwestern Arizona.

The climate of the HTUL area is quite variable due to the modified effects of relief, aspect, and topography. It is characterized by hot, dry summers and cold, moist winters. As one travels from east (Royal Arch Creek) to west (National Canyon) the effects of varying air temperatures and moisture can be observed by the different plant communities. Generally, the western portion is hotter and dryer than the eastern. This is due in part to the following factors:

1. The western portion is generally lower in elevation and is exposed to the prevailing west-southwestern winds which causes a higher evapotranspiration demand.
2. The orographic effect of the Kaibab plateau on the eastern side increases precipitation in that zone.

These factors influence the microclimate which determines the native plant communities and their productivity. Data is presented for local weather stations (Table 1) in an attempt to extrapolate for the HTUL. However, this data represents a small area influenced by site specific variables. Therefore, measured data from adjacent National Forest land is used to establish central concepts and trends.

The average annual air temperature ranges from 46°F to 56°F. The hottest months are June and July with the coldest being December and January. Mean annual precipitation ranges from 10 to 16 inches. Approximately 65 percent seasonally occurs between the months of October and June. During the months of July through September, there are long periods when little or no effective moisture is received due to high evaporation rates and runoff. Summer precipitation generally occurs in the form of high intensity thunderstorms with moisture originating from the Gulf of Mexico; whereas winter precipitation comes from moist air masses from the Pacific Ocean. Winter precipitation occurs predominately as snow and remains on the ground for only a day or two.

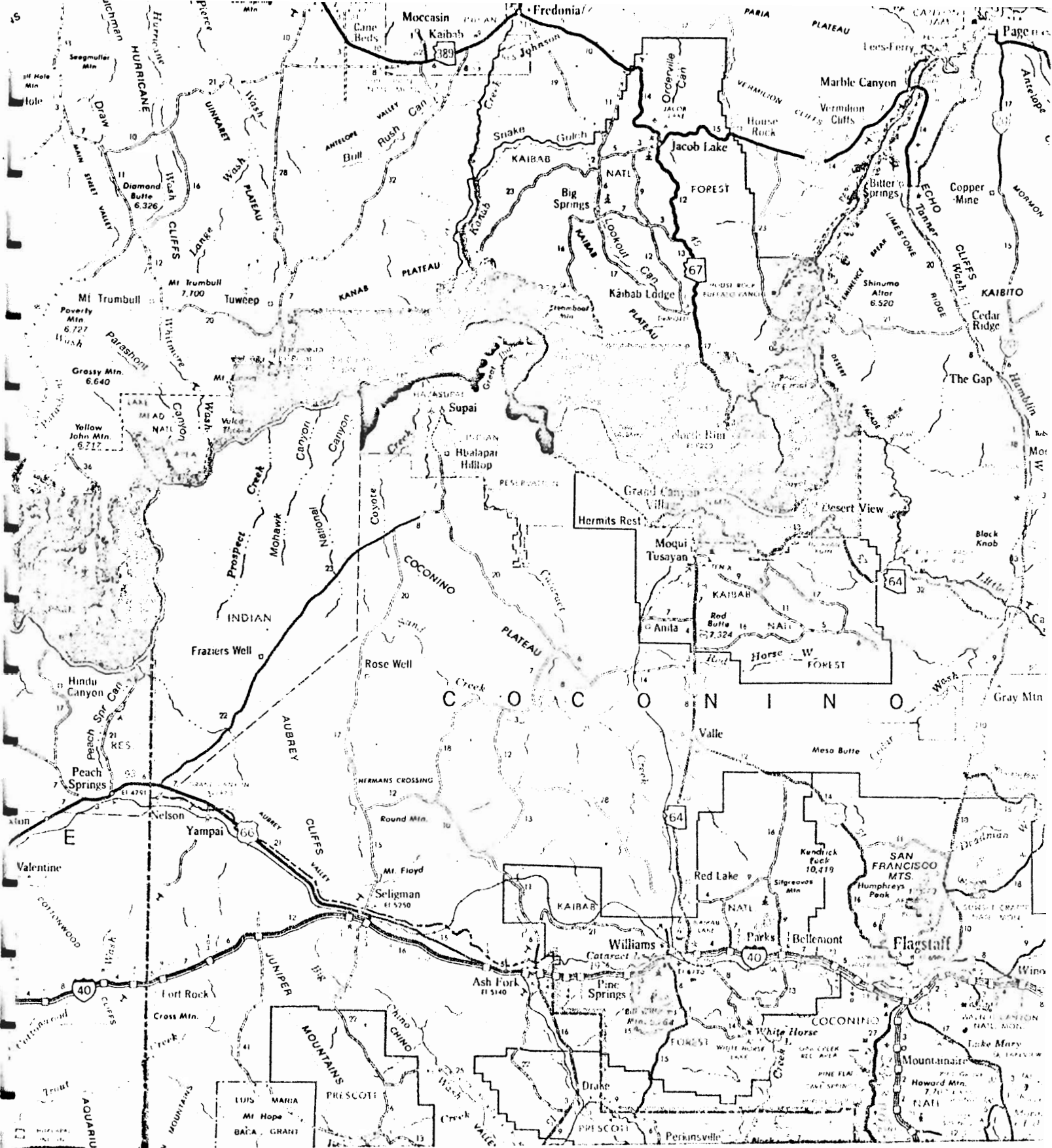


Figure 1. Map of northwestern Arizona showing the Havasupai Traditional Use Lands (in black) in Grand Canyon.



Map location

Table 1. Climatic Characteristics for Supai and Tuweep, Arizona
(Sellers and Hill, 1974 and Brown, 1982)

<u>Climatic Measurement</u>	<u>Supai</u>	<u>Tuweep</u>
Range in total annual precipitation (in.)	4.1-13.2	4.8-16.8
Mean annual precipitation (in.)	8.4	11.4
% total annual precipitation falling July-September	33	36
Range in yearly temperature extremes (°F)	-4 to 111	0 to 108
Mean air temperature (°F)	61.3	58.1
Mean maximum air temperature (°F)	76.7	69.6
Mean minimum air temperature (°F)	45.8	44.5

The HTUL represents a portion of the Grand Canyon section of the Colorado Plateau Physiographic Province (refer to Table 2 for geologic formations).

Approaching from the South Rim, the upper canyon sides display vertical cliffs of Kaibab and Toroweap Limestone and Coconino Sandstone formations. The cliffs terminate in very steep talus and scarp sideslopes comprised of Hermit Shale with debris from the upper cliff formers. The phenomenon observed on the cliff forming portions of the HTUL is the result of rock failure with debris removal by gravity. This form of erosion is the result of frost wedging within a fracture plane or the loss of strength due to erosion of underlying strata. The talus slopes extend to the shelf forming bench of Esplanade Sandstone. This structural bench extends to the vertical cliffs of the lower Supai formations.

Below the lower Supai formation, sheer cliffs of Redwall, Devonian, and Muav Limestones extend to the Colorado River. Older cambrian and pre-cambrian sandstones and shists are exposed, but they are generally located east of the Great Thumb Mesa.

Rock types are Paleozoic sedimentaries from Pennsylvanian, Permian, and Mississippian periods. Parent materials where minimal soil genesis has occurred are dominately residual sandstones and shales, with limestone and sandstone colluvium being secondary. Minor acres of recent mixed alluvium are in small drainages and fans.

Water is the major agent contributing to weathering, transport, and deposition on benches and drainages. Mass wasting of fractured vertical cliffs preclude the presence of colluvium on talus slopes. On the western portion of the survey area, the effects of wind is noticeable by the presence of coppice dunes or plant stools.

Four vegetative communities indigenous to the Colorado Plateau were recognized, but only three were mappable at the existing scale. In order of occurrence beginning at National Canyon and continuing to approximately Great Thumb Mesa is the Coleogyne ramosissima - Hilaria Jamesii (Blackbrush/Galleta) climatic climax which comprises the highest percentage of the HTUL. Within the Fossil Bay area, a break in vegetative communities occurs with the steep talus slopes being mapped as Juniperous osteosperma - Artemesia tridentata (Utah Juniper/Big Sagebrush) and the Esplanade bench mapped as Pinus edulis/Juniperous osteosperma/Artemesia tridentata (Pinyon Pine/Utah Juniper/Big Sagebrush). Both of these climatic climax plant communities occupied a very limited range within the HTUL survey.

Table 2. Geologic Time, Formations and Parent Materials for Havasupai Use Lands Survey Area
Grand Canyon National Park

Era	Period	Approx Age in Millions of Years		Formation	Parent Materials
Paleozoic	Permian	225-270	Kaibab	limestone colluvium	
			Toroweap	limestone-sandstone colluvium	
			Coconino	sandstone colluvium	
			Hermit	shales-siltstones colluvium, residuum	
			Supai	sandstone residuum shale residuum	
	Pennsylvanian	270 to 300	Esplanade red beds	limestone	
			Redwall	limestone	
			Temple Butte and other Devonian material	limestone	
			Muav Bright Angel Tapeato	limestone and dolomite shale sandstone	
			Vishnu	schist	
Archeozoic	Precambrian	600 to ?			

Six soil types were identified, sampled, and classified to family phases according to Soil Taxonomy (refer to Appendix A for classifications). Mapping Units 104, 174 and 175 occur on benches and terraces and are characterized by having gentle to moderately gentle slope inclinations (0 to 15 percent). These mapping units are typically shallow to very shallow (0 to 20 inches deep) over bedrock. The soil components support low densities of vegetation. The amount of exposed bedrock will vary considerably between delineations. The range forage production potential and soil revegetation suitability is low.

Mapping Units 176 and 177 occur on talus and scarp slopes above the Esplanade Sandstone and are characterized by having very steep to extremely steep slope inclinations (40 to 120 percent). These mapping units typically have two soil taxonomic units with one soil component being moderately deep to deep over bedrock (20 to 60 inches), and the other being shallow to bedrock (less than 20 inches). The steepness of slope and active erosional processes that are occurring exclude these mapping units from any sound grazing management system. The range forage production potential and soil revegetation suitability is low.

Mapping Unit 178 occurs on terraces on the Esplanade Sandstone and is characterized by having steep to moderately steep slope inclinations (15 to 40 percent). This mapping unit typically has two soil taxonomic units with one soil component being moderately deep to deep over bedrock (20 to 60 inches), and the other being shallow to bedrock (less than 20 inches). The soil components support low densities of vegetation. The range forage production potential and soil revegetation suitability is low.

Mapping Units 179 and 181 represent the steep vertical cliffs above and below the Esplanade Sandstone. They are inaccessible to livestock and were not inventoried.

Mapping Unit 180 occurs on the Esplanade and usually is associated with breaks into steep canyons. It is characterized by having a gentle to moderately steep slope inclination (0 to 40 percent), and less than 15 percent soil. It is essentially barren except for small residual pockets of soil which do support a sparse vegetative cover.

Figure 2 shows the typical sequence of soil mapping units as they are found within the HTUL. This cross section amplifies the extreme variation in slope inclinations within the HTUL and shows the narrow range that is considered accessible for grazing (Esplanade Sandstone).

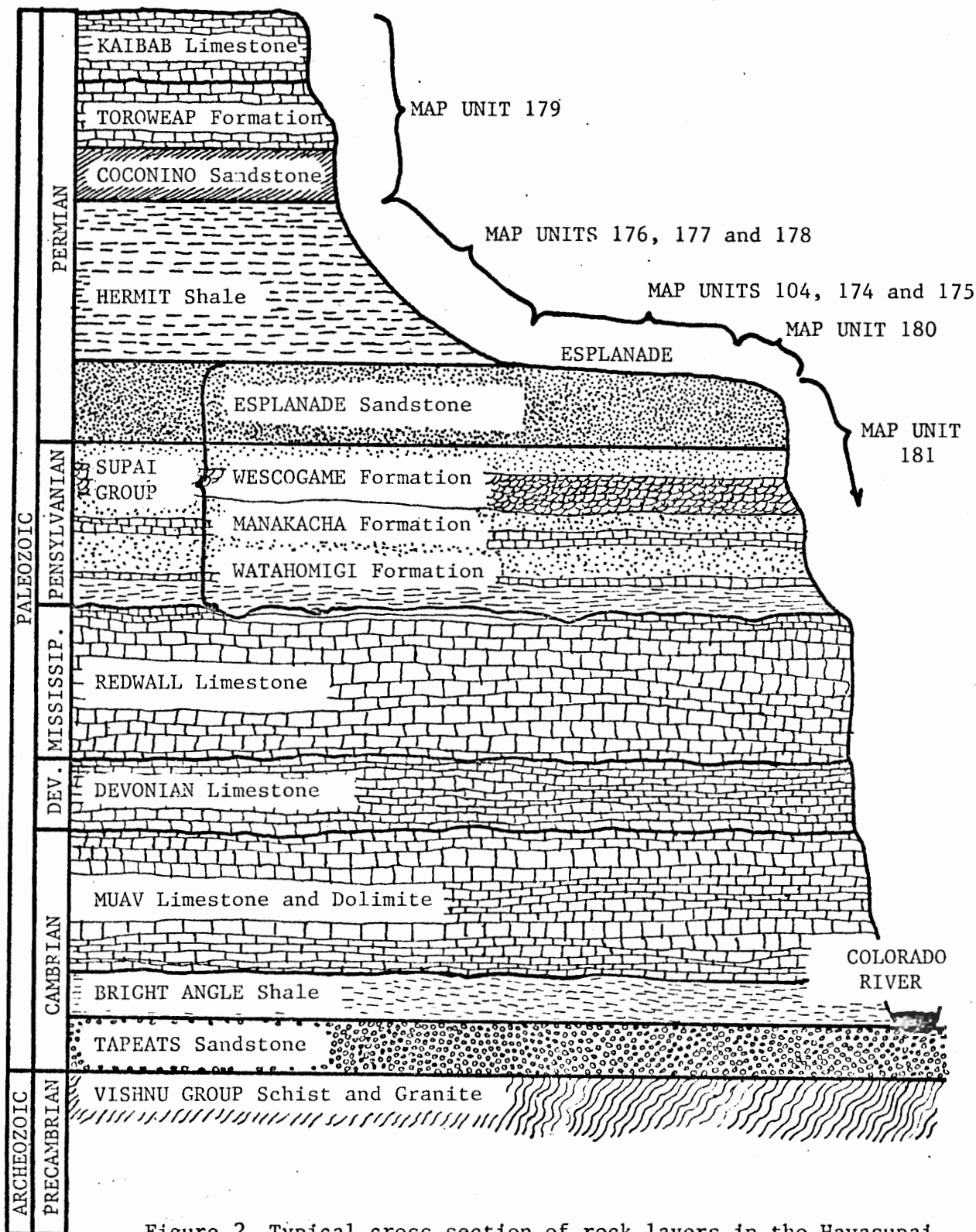


Figure 2. Typical cross section of rock layers in the Havasupai Traditional Use Lands vicinity in Grand Canyon, with land forms and associated soil mapping units.

The grazing potential of the HTUL is extremely low. This is a result of the following environmental factors:

1. The soil taxonomic classifications are shallow, or very shallow to bedrock. This restricts potential forage production and revegetation because it limits the effective rooting depths of forage species as well as the available water holding capacities of the soils. The synergistic effect between these two factors results in very low forage production potentials.
2. Access to potential grazing land is difficult or nonexistent. This will and does currently effect livestock distribution. The feral horse population within the HTUL is presently overgrazing localized areas.
3. Water availability is scarce and contributes to poor livestock distribution.
4. The potential for competition between wildlife and livestock, although currently unknown because of the lack of data, will further reduce the grazing capacity of the HTUL.

Currently, there is not a single portion of the HTUL that is considered to be full capacity acres. What this means is that livestock grazing should not be instituted until effective ground covers have lowered existing soil erosion rates to an acceptable level. This necessitates the complete removal of all feral horses that are currently grazing in the HTUL, and a sound monitoring system to determine when the potential capacity acres change to full capacity acres.

METHODOLOGY

METHODOLOGY

Terrestrial ecosystem mapping was done on color aerial photographs at a scale of 1:24,000. Map units were predelineated by stereoscope on the basis of topography, geology, and vegetation. Field documentation was collected to classify soils, establish important soil morphological characteristics influencing range management, and to verify accuracy of delineations.

Soils inventoried were classified to phases of families from Soil Taxonomy. The objective of soil taxonomy is to provide hierarchies of classes which permit understanding of the relationships between soils and the factors responsible for their characteristics. This is accomplished in part by establishing differentiae of important soil morphological properties. An example of this is the use of soil horizons or the lack of them in classification. An important distinction must be made between classification and taxonomy. Classification includes taxonomy but it is broader in scope and also considers classifications for specific practical purposes. An example of this is the phase designation on a mapping unit. Phases are used for a specific purpose and are not a part of taxonomy, therefore, they will vary from one survey area to another. The name of a phase indicates a feature that affects management (i.e., slope, percent surface coarse fragment, depth, etc.).

Taxonomic units, i.e., Lithic Ustorthents, loamy-skeletal, mixed (Calcareous), mesic are precisely defined and based on properties in Soil Taxonomy. They form the nucleus for naming mapping units. However, a limitation arises with Soil Taxonomy in that it does not allow equal consideration of the same soil properties at each category of classification (i.e., soil moisture, soil temperature). To overcome this problem, a system of Subgroup Modifiers was developed in Region 3 and was used in the HTUL survey. The recognition and use of Subgroup Modifiers should lead to additional subgroups in Soil Taxonomy. As an example, the soil taxonomic classification Lithic Ustorthent, loamy-skeletal, mixed (Calcareous), mesic occurs in three vegetative zones. These vegetative zones are Big Sagebrush/Galleta, Utah Juniper/Big Sagebrush, and Pinyon Pine/Utah Juniper/Big Sagebrush respectively. To show the effects of higher soil moisture regimes on these climatic climaxes, the Subgroup Modifier was used. In this case where the Lithic Ustorthent occurred in the Big Sagebrush/Galleta climatic climax, the Subgroup Modifier "dry" was used (i.e., Lithic Ustorthent, dry, loamyskeletal, mixed (Calcareous), mesic). Within the Utah Juniper/Big Sagebrush climatic climax, the Subgroup Modifier "typical" was used (i.e., Lithic Ustorthent, typical, loamy-skeletal, mixed (Calcareous), mesic). Finally within the Pinyon Pine/Utah Juniper/Big Sagebrush climatic climax, the Subgroup Modifier "moist"

was used (i.e., Lithic Ustorthent, moist, loamy-skeletal, mixed (Calcareous), mesic). In using this methodology important soil parameters (soil moisture) which are not considered by Soil Taxonomy have been recognized. Table 3 shows the soil, vegetation, and climatic factors which have influenced the soil classifications within the HTUL. This table represents the means as they are found within the Colorado Plateau, and not necessarily the HTUL (i.e., the mean elevations reported are higher than what was actually found in the HTUL).

Mapping units are made up of soils of different families, or of different phases of one family. During the course of the survey, nine soil mapping units were identified and delineated of which three occur as complexes, three occur as associations, and three units consist of miscellaneous land types.

Soil complexes are mapping units that are geographic mixtures of two or more kinds of soil (taxa) or miscellaneous land types that are in a pattern so intricate that the two components cannot be separated out at the scale of mapping. The name of a soil complex consists of the name of the dominant soils, joined by a hyphen. Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic, very cobbly sandy loam-Lithic Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic, very gravelly sandy loam complex, 15 to 40% slopes, is an example.

Soil associations are mapping units in which a geographic mixture of two or more kinds of soil (taxa) or a soil and miscellaneous land type occurs. The differentiating criteria between a soil association and soil complex is that within a soil association the major soil components occur in a regular pattern and are individually large enough to be delineated at the scale of mapping. The reason the soil components are not mapped separately is that:

(1) The relative proportions of each major component varies from one delineated area to another.

(2) To separate the two components would detract greatly from the readability of the map.

An association consists of the names of the dominate soils and/or miscellaneous area, joined by a hyphen. Lithic Ustic Torriorthents, winter precipitation, loamy, mixed (Calcareous), mesic, very shallow-Rock outcrop association, 0 to 15% slopes, is an example.

Table 3. Soil, Vegetation and Climatic Factors and Relationships for Colorado Plateau, Northern Arizona

Mean Elevation (ft.)	5000	5500	6000	6500
Mean Precipitation (in.)	10	12	14	16
Mean Annual Air Temp. (°F)	56	52	50	46
Mean Annual Soil Temp. (°F)	58	56	54	50
Climatic Climax	Cora Hija	Artr2 Hija	Juos Artr2	Pied Juos. Artr2
Soil Temp. Regime	Mesic	Mesic	Mesic	Mesic
Soil Moisture Regime	Aridic	Ustic	Ustic	Ustic
Subgroup Modifier	winter precip.	dry winter precip.	typical winter precip.	moist winter precip.
Soil Taxonomic	Ustic Torriorthents, loamy-skeletal, mixed (Cale.), mesic	Lithic Ustic Torriorthents, loamy-skeletal, mixed (Cale.), mesic	Typic Ustorthents, loamy-skeletal, mixed (Cale.), mesic	Lithic Ustorthents, loamy, mixed (Cale.), mesic
Mapping Units	104, 174, 177, 178	Not mappable at existing scale	176	175

Miscellaneous areas are landforms having little or no identifiable soil, i.e., cliffs and rubbleland. It must be recognized, however, that in some areas there will be soil in concentrations up to 15 percent. This type of mapping unit was designated to handle the steep inaccessible landforms above and below the Esplanade Sandstone. The name of a miscellaneous area consists of the name of the dominate land types, joined by a hyphen. Rock outcrop-Rubbleland, 80% to vertical slopes, is an example.

Soil loss was estimated through the application of the Universal Soil Loss Equation (hereafter referred to as USLE). USLE is the most widely used and accepted method for predicting sheet and rill erosion over a wide range of conditions.

USLE is written as $A = RKLSCP$, in which:

- A = Is the computed soil loss (sheet and rill erosion) in tons/acre/year. It defines the long-term soil loss from a given site. It does not measure sediment yield.
- R = The rainfall factor, which is the measure of raindrop energy of a storm in relation to the maximum 30 minute intensity. Within the HTUL this factor ranged from 25 in the Blackbrush/Galleta climatic climax to 40 in the Pinyon Pine/Utah Juniper/Big Sagebrush climatic climax.
- K = Is the soil erodibility factor which represents the capability of a soil surface to resist erosion. It is a function of the soils physical and chemical properties (i.e., texture, organic matter soil structure). Within the HTUL this factor ranged from .18 (low erodibility) to .44 (high erodibility). The majority of soil taxonomic units, however, were in the moderate to high erodibility index. This is to be expected since most of the area in the HTUL had low vegetative ground covers which contribute very little organic matter to the soils.
- LS = Is the slope-effect factor. Soil loss is affected by both length and degree of slope. In applications of USLE they are combined into a single topographic factor. As a general rule, slope length decreases as slope increases in steepness. Within the HTUL, the slope-effect factor was a difficult parameter to evaluate because slope shapes tended to be complex.
- C = The cropping management or plant cover factor. The "C" factor values relate the effect of ground cover to the computation of erosion. Because the ground covers in the HTUL are very low, the C conversely is very high.

P = Erosion control practice factor. This factor refers to contour tillage and other management practices that reduce runoff water. Within the HTUL this was held at a constant of 1.00 in all USLE runs.

Step Subfactor - This modification of the original USLE equation was necessitated by the fact that in southwestern rangelands slopes are broken up by steps. This value was held at a constant 1.00 since the effects of mid-slope steps were not apparent in the HTUL.

Depression Storage Subfactor - This value is obtained by estimating the proportion of the existing on-site erosion that will be trapped by pitting, stump holes, and rolled up debris found on a slope. This value was held at a constant of 1.00 since the effects of depression storage were not apparent in the HTUL.

When assumptions concerning the factors of USLE are not completely understood, the evaluation will invariably lead to misapplication. This equation was developed to predict soil loss on an average annual basis and not on a storm-by-storm basis. The values used in USLE for a mapping unit are the means established for that unit. Areas of inclusion soils with different cover factors, as an example, will not be considered. Computed erosion rates are the best available predictions and should not be considered absolute data, samples, or measurements.

Therefore, the use of relic areas where the impacts of man are minimal must be used. USLE information is used both quantitatively (i.e., the computed soil loss) and also qualitatively. A qualitative comparison was made during the HTUL survey. By comparing slopes where ground covers are maximized (i.e., relic areas) and inventoring the grazed areas where ground covers were substantially less, a range of soil loss could be established. This range helps in determining geologic or natural erosion rates from accelerated erosion rates. The results of this application of USLE to the HTUL is presented in Appendix C.

The range evaluation was conducted to standards set by FSH 2209.21, Region 3, USDA Forest Service. The objective was to determine the current condition, trend, and capability of the range to sustain grazing. From this information, a desired level of forage use can be established under management without deterioration of the associated resources and with minimum conflicts with other uses.

Range condition and trend are necessary parameters in the establishment of a management plan for the HTUL. Condition is an evaluation of the current status of the plant communities and soils inventoried relative to their ability to produce a stable biotic community. Trend is a measurement of the change in condition over a period of time. The evaluation of trend is indicative of whether stocking levels, range improvements, and management direction is affecting condition in a positive or negative manner.

Within Region 3, there are essentially three types of transects presently used to establish range condition and trend.

1. Three-Step Clusters: This method is instituted for a long-term evaluation of range condition and trend. It is a permanent staked transect within a previously selected key area.
2. Paced Transects: The information collected on pace transects are used to supplement the three-step clusters. The number of paced transects is subject to changes in range condition.
3. Ocular Estimates: Once actual measured transects are completed, ocular estimates of range condition and trend are instituted.

Within the HTUL, paced transects and ocular estimates were the methods employed. There are, however, four permanent three-step clusters within the HTUL. There were two specific reasons why the clusters were not read during the HTUL inventory.

- (1) The four enclosures were recently constructed, and National Park Service personnel have inventoried them.
- (2) The clusters have been constructed on mapping unit inclusion areas (i.e., deeper soils than is normally found on the HTUL). The information gathered would have biased subsequent data.

The information collected using any of the three methods is essentially the same. The benefit of the three-step cluster is that it is virtually the only way that trend can be ascertained.

Information taken on paced and ocular transect include: species composition, forage cover, plant vigor, vegetation condition, soil stability, ground cover, production, and other notable features.

Grazing capability is the ability of various sites to support grazing by domestic livestock on a sustained yield basis. Areas were divided into three capability areas.

- (1) Areas that are incapable of being grazed (NC): This designation applies to steep, inaccessible slopes or areas of little or no forage with naturally unstable soils.

- (2) Areas that have the potential for grazing (PC): This designation applies to areas where current on-site soil loss exceeds allowable soil loss because it lacks sufficient effective ground covers to protect the soil.
- (3) Areas that are suited for grazing (FC): This designation applies to areas that are stable in respect to on-site soil loss.

Every range produces available forage which occurs in patches, zones, or belts depending upon the ecological site factors of each. The objective of analyzing production is to establish an estimated grazing capacity that permits plants to meet physiological growth requirements while considering associated multiple uses.

Production surveys key into those areas where the forage crop is being produced and how it is being used. Only desirable perennial forage species are clipped and evaluated. Because species vary with changes in vegetative type and condition, the amount of production will change accordingly. Production within the HTUL survey was recorded regardless of capability classification (i.e., NC, PC, FC).

Allowable use is determined from proper use and is the level of grazing utilization that can be permitted on an area when all influencing factors are considered. Allowable use is limited by range condition, management intensity, soil stability, water distribution, terrain and season of use. As an example, if the key species to be grazed is black grama, the allowable use of this species in fair to better range land is 30 to 40 percent. If range conditions are poor, the allowable use will accordingly drop to protect the physiological growth requirements of the plant.

Grazing capacity is the total number of domestic animal unit months (AUMS) an area can support on a sustained yield basis without damage to the range or other related resources. Normally, production data is not used in determining grazing capacity. Capacities are determined through evaluation of existing livestock numbers and their resulting levels of forage utilization. This is accomplished by clipping an ungrazed plot and comparing it to a grazed plot. However, since the HTUL lacks data on the existing forage consumption, and season of use, it is virtually impossible to use this methodology. Therefore, the use of total production and allowable use was needed to determine grazing capacity.

It must be emphasized that normally grazing capacity is only calculated on full capacity land (FC). Within the HTUL, there are no acres given to this classification. The reason for determining AUMS on the potential capacity acres is to give an indication of the number of livestock that can be run once the soils have stabilized.

RESULTS

TERRESTRIAL ECOSYSTEM EVALUATION AND INTERPRETATIONS

Mapping units 104, 174, and 175 were inventoried on the Esplanade bench and can be characterized as being very shallow, weakly developed, and exhibiting varying concentrations of rock outcrop. Plants are generally pedestalled and achieve their small degree of stability largely from algal colonization. These soils are coarse to medium textured and are forming on sandstone, and shale bedrock. These units make up approximately 15 percent (14,219 acres) of the HTUL, and are rated low for both range forage production potential and revegetation suitability.

Mapping units 176, and 177 were inventoried on the steep talus slopes above the Esplanade bench and below the Coconino Sandstone. Typically, both units have two soil taxonomic classifications, one being moderately deep to deep over bedrock, and the other being shallow to bedrock. The soils can be characterized as being weakly developed, and exhibiting a high percentage of stones and boulders on the surface. These units make up approximately 9 percent (8,766 acres) of the HTUL, and are rated low for both range forage production potential and revegetation suitability.

Mapping unit 178 was inventoried on the lower toe slopes, and occupied an intermediate position between the very steep talus and nearly level bench soils. Typically, this unit has two soil taxonomic classifications, one being moderately deep to deep over bedrock, and the other being shallow to bedrock. These soils can be characterized as being weakly developed, and containing a high percentage of internal coarse fragments. This unit makes up approximately 4 percent (4,142 acres) of the HTUL, and is rated low for both range forage production potential and revegetation suitability.

Mapping units 179 and 181 represent the steep vertical cliffs above and below the Esplanade Sandstone. They are inaccessible to livestock and were not inventoried. These units make up approximately 63 percent (60,376 acres) of the HTUL inventory area.

Mapping unit 180 was inventoried on the Esplanade bench and usually was associated with breaks into steep canyons. Typically, this unit contains less than 15 percent soil, and is essentially barren. This unit makes up approximately 8 percent (7,824 acres) of the HTUL inventory area.

Table 4 represents the mapping legend used in the HTUL inventory. Included in this table is the soil mapping unit number, soil taxonomic classification, subgroup modifier, soil phase, vegetation classification, and slope.

Table 4.

Terrestrial Ecosystem Survey
Havasupai Use Lands
Grand Canyon National Park
Mapping Legend

Map Unit No.	Soil		Vegetation Taxonomic	Slope %
	Taxonomic	Subgroup Modifier Phase		
104	Lithic Ustic Torriorthents, loamy, mixed (calcareous), mesic	winter precip. very shallow	Coleogyne ramosissima Hilaria jamesia	0-15
174	Rock Outcrop		Barren	
	Rock Outcrop		Barren	
175	Lithic Ustic Torriorthents, loamy, mixed (calcareous), mesic	winter precip. very shallow	Coleogyne ramosissima Hilaria jamesia	0-15
	Lithic Ustorthents, loamy, mixed (calcareous), mesic	winter precip. moist very fine sandy loam	Pinus edulis Juniperous osteosperma Artemesia tridentata	0-15
	Rock Outcrop		Barren	
	Rock Outcrop		Barren	

Table 4.

Terrestrial Ecosystem Survey
Havasupai Use Lands
Grand Canyon National Park
Mapping Legend

Map Unit No.	Soil			Vegetation Taxonomic	Slope %
	Taxonomic	Subgroup Modifier	Phase		
176	Typic Ustorthents, loamy-skeletal, mixed (calcareous), mesic	winter precip.	very stony sandy loam	Juniperous osteosperma/ Artemesia tridentata	40-120
177	Lithic Ustorthents, loamy-skeletal, mixed (calcareous), mesic	winter precip. typical	very gravelly sandy loam	Juniperous osteosperma/ Artemesia tridentata	
	Ustic Torriorthents, loamy-skeletal, mixed (calcareous), mesic	winter precip.	deep	Coleogyne ramosissima Hilaria jamesia	40-120
	Lithic Ustic Torrior- thents, loamy-skeletal, mixed (calcareous), mesic	winter precip.	very gravelly sandy loam	Coleogyne ramosissima Hilaria jamesia	
178	Ustic Torriorthents, loamy-skeletal, mixed (calcareous), mesic	winter precip.	very cobbly sandy loam	Coleogyne ramosissima Hilaria jamesia	15-40
	Lithic Ustic Torrior- thents, loamy-skeletal, mixed (calcareous), mesic	winter precip.	very gravelly sandy loam	Coleogyne ramosissima Hilaria jamesia	

Table 4.

Terrestrial Ecosystem Survey
Havasupai Use Lands
Grand Canyon National Park
Mapping Legend

Map Unit No.	Soil			Vegetation Taxonomic	Slope %
	Taxonomic	Subgroup Modifier	Phase		
179	Rock Outcrop			Barren	80 to vertical
180	Rock Outcrop			Barren	0-40
181	Rock Outcrop			Barren	80 to vertical
	Rubbleland			Barren	

Interpretations

Survey Interpretations

This section of the report presents soil interpretations relating to range and watershed management.

Table 5 presents these interpretations and other information. An explanation of the information presented in each column of the table is explained in Sections 1.1 and 1.2 below.

1.1 Range Management

Column (1) Map Symbol

Column (2) Map Unit Name and Components

Column (3) Range Forage Production Potential

Forage production potential results from a combination of inherent soil properties and related environmental conditions. Forage production is the amount of perennial grasses, reported in pounds/acre, produced annually under the potential natural vegetation community and that is available and palatable to livestock or wildlife.

Column (4) Range Herbage Potential

Herbage production potential results from a combination of inherent soil properties and related environmental conditions. Herbage production is the total amount of herbaceous vegetation reported in pounds/acre, that is produced annually under the potential natural vegetation community measured to a height of 4.5 feet. This includes grasses, shrubs, and trees.

Column (5) Range Revegetation Potential

Revegetation ratings are based on soil morphological parameters such as surface coarse fragments, soil depth, carbonates, and the amount of exposed rock outcrop. The relationship of soil and landform characteristics influences the economic and physical application of rangeland improvement practices utilizing such techniques as drilling, plowing, and seeding.

1.2 Watershed Management

Column (6) Hydrologic Soil Groups

Soil classification into these groups is based on the intake of water at the end of long duration storms, after prior wetting and opportunity for swelling and without consideration of slope or the protection of vegetation.

There are four hydrologic soil groups:

- Group A (very low runoff potential)
- Group B (low runoff potential)
- Group C (moderate runoff potential)
- Group D (high runoff potential)

Hydrologic Soil Groups are further subdivided into subgroups by including a depth notation. Soils that are 20 inches or less to rock, the number 1 is added to the group symbol. For those deeper than 20 inches, the number 2 is used. The number 3 designates miscellaneous materials (e.g., rock outcrop).

Column (7) Allowable Soil Loss

This is the amount of soil loss that can occur without permanent impairment of land productivity.

Column (8) Current Soil Loss

This is the amount of soil loss that presently is occurring based on the average slope and ground cover conditions.

Column (9) Potential Soil Loss

This is the maximum amount of soil loss that could occur if all of the protective vegetation and litter was removed.

Column (10) Natural Soil Loss

The amount of erosion that would occur under natural conditions. This figure is based on relic areas within and adjacent to the Traditional Use Lands.

TABLE 5. INTERPRETATIONS RELATIVE TO RANGE AND WATERSHED MANAGEMENT FOR HAVASUPAI TRADITIONAL

MAP SYMBOL	MAP UNIT NAME AND COMPONENTS	FORAGE PRODUCTION POTENTIAL LBS/AC	HERBAGE PRODUCTION POTENTIAL LBS/AC	RANGE REVEGETATION POTENTIAL	HYDROLOGIC SOIL GROUP
104	Lithic Ustic Torriorthents, winter, precip., loamy, mixed, (calcareous), mesic, very shallow Rock outcrop	50	100	Low	B-3
174	Rock outcrop Lithic Ustic Torriorthents, winter precip., loamy, mixed, (calcareous), mesic, very shallow	100	200	Low	B-3
175	Lithic Ustorthents, winter precip., loamy, mixed, (cal- careous), mesic, very fine sandy loam Rock outcrop	75	125	Low	B-3
176	Typic Ustorthents, winter precip., loamy-skeletal, mixed, (calcareous), mesic, very stony sandy loam Lithic Ustorthents, winter precip., typical, loamy- skeletal, mixed, (calcareous), mesic, very gravelly sandy loam	100 25	300 100	Low Low	B-2 B-3

USE LANDS

ALLOWABLE SOIL LOSS	CURRENT SOIL LOSS	POTENTIAL SOIL LOSS	NATURAL SOIL LOSS
---------------------------	-------------------------	---------------------------	-------------------------

----- Ton/Ac/Yr -----

.50	1.11	1.69	.90
-----	------	------	-----

.50	.54	.85	.39
-----	-----	-----	-----

.50	.89	1.56	.43
-----	-----	------	-----

2.0	5.29	9.37	3.47
-----	------	------	------

2.0	5.13	13.84	2.69
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TABLE 5 INTERPRETATIONS RELATIVE TO RANGE AND WATERSHED MANAGEMENT FOR HAVASUPAI TRADITIONAL

MAP SYMBOL	MAP UNIT NAME AND COMPONENTS	FORAGE PRODUCTION POTENTIAL LBS/AC	HERBAGE PRODUCTION POTENTIAL LBS/AC	RANGE REVEGETATION POTENTIAL	HYDROLOGIC SOIL LOSS
177	Ustic Torriorthents, winter precip., loamy-skeletal, mixed, (calcareous), mesic, deep	50	125	Low	B-2
	Lithic Ustic Torriorthents, winter precip., loamy-skeletal, mixed, (calcareous), mesic, very gravelly sandy loam	25	100	Low	B-3
178	Ustic Torriorthents, winter precip., loamy-skeletal, mixed, (calcareous), mesic, very cobbly sandy loam	75	150	Low	B-2
	Lithic Ustic Torriorthents, winter precip., loamy-skeletal, mixed, (calcareous), mesic, very gravelly sandy loam	25	100	Low	B-3

USE LANDS (CONTINUED)

	ALLOWABLE SOIL LOSS	CURRENT SOIL LOSS	POTENTIAL SOIL LOSS	NATURAL SOIL LOSS
	Ton/Ac/Yr			
	2.0	3.65	5.48	3.09
	2.0	8.0	17.27	3.36
	1.0	1.55	2.01	.93
	1.0	2.61	3.91	1.81

MAP UNIT DESCRIPTIONS

The mapping unit descriptions are in numerical order and contain the following information:

Map Symbol, Mapping Unit Name
Landform
Geology
Slope
Acreage Extent Within HTUL
Percentage of HTUL
Average Precipitation
Average Elevation
Soils and Map Unit Characteristics
Range Evaluation

Landform: Describes the features that make up the surface of the mapping unit.

Geology: Denotes the dominate formation that has contributed to the pedogenesis of that taxonomic classification.

Slope: Indicates the range of slope inclinations that are found on the mapping unit. Slope separations are made when significant changes in management occur.

Acreage Extent Within HTUL: The area in acres that a mapping unit occupies within the HTUL survey area.

Percentage of HTUL: The area in percent that a mapping unit occupies within the HTUL survey area.

Average Precipitation: This is based on isohyetal maps which gives the yearly average for the survey area.

Average Elevation: The mean elevation that the mapping unit occurred at.

Soils and Map Unit Characteristics: Describes the type of mapping unit and important morphological characteristics that influence grazing capacity.

Range Evaluation: Relates important range data that was collected on that mapping unit (i.e., production, grazing capability, range condition, soil stability) and the effects on capacity within the HTUL.

Mapping Unit: 104--Lithic Ustic Torriorthents, winter precipitation, loamy, mixed (Calcareous), mesic, very shallow-Rock outcrop association, Cora, 0 to 15% slopes.



Photo #1. Closeup view of Mapping Unit 104 in the Chikapanagi Mesa area. The highly erosive soils formed from Hermit Shale support sparse vegetation. A potential for severe erosion exists for the majority of acres within this unit.

Landform: Nearly level to strongly sloping benches and terraces on plateau land.

Geology: Hermit Shale

Slope: 0 to 15 percent

Acreage Extent Within HTUL: 2,902

Percent of HTUL: 3

Average Precipitation: 10 inches.

Average Elevation: 4,500

Soils and Map Unit Characteristics: Very shallow (10 inches or less) weakly developed soils comprise 70% of this unit. Rock outcrop of siltstones and shale comprise 30%. The soil component supports sparse vegetation due to the inherent instability of the parent materials. Low plant productivity is the result of low soil moisture holding capacity, high surface soil temperatures, and harsh microclimates. Sheet erosion is dominant, however, rill erosion is common in areas of concentrated flow due to lack of effective ground and canopy covers. Surface soil textures are highly erosive due to an abundance of noncohesive very fine and fine sand size particles. These soils have surface and profile coarse fragments which break down upon wetting. Algal colonizations are not common for this map unit.

Range: This unit is classified as having no allowable capacity (NC). It is incapable of being grazed by domestic livestock under reasonable management goals. Five range pace transects were run and blackbrush was the dominant species. Utah agave, prickly pear cactus, sand dropseed, mesa dropseed, Indian ricegrass, snakeweed, and galleta were associated with the blackbrush on this mapping unit. Forage production of perennial grasses was 0-25 pounds (air dried) per acre on four transects and 50 pounds per acre on P-20, which was located on an ungrazed, inaccessible mesa (also referred to as a relict area) on Gatagama Terrace. Forage production potential is very low.

Range vegetation condition scores were 5, 6, 7, and 18 on four transects. This rating is classified as very poor. The transect on the ungrazed mesa had a score of 25 which is poor. Soil stability scores were all very poor except on the ungrazed mesa where a low poor rating was obtained.

These soils are inherently unstable. They are not capable of producing more vegetation than is presently found. Even on the ungrazed mesa, rills, alluvial deposits and pedestaled plants are common. These areas will not become grazable in any reasonable length of time.

Mapping Unit: 174--Rock outcrop-Lithic Ustic Torriorthents, winter precipitation, loamy, mixed (Calcareous), mesic, very shallow association, Cora, 0 to 15% slopes.



Photo #2. Typical view across Mapping Unit 174. The desert shrub plant communities of this unit generally exist on very shallow undeveloped soils with varying percentages of associated rock outcrop.

Landform: Nearly level to strongly sloping benches on rocky plateaus.

Geology: Esplanade Sandstone

Slope: 0 to 15 percent

Acreage Extent Within HTUL: 9,743

Percent of HTUL: 10

Average Precipitation: 10 inches per year.

Average Elevation: 4,500

Soils and Map Unit Characteristics: Rock outcrop of sandstones of the Supai formation comprises 60% of the association. Very shallow (10 inches or less) weakly developed soils comprise the remaining 40%. The soil component supports low densities of vegetation including shrubs and grasses. Plants are generally pedestalled and achieve their small degree of stability largely from algal colonization. Small pockets of alluvial wash and blown sands occur as undelineable shallow and moderately deep inclusions. These soils are coarse to

medium textured and are forming on sandstone bedrock. Small areas of Supai siltstone red beds occur with the sandstone soil component. These areas are minor in extent and are easily recognizable due to reddish soil color and low productivity similar to mapping unit 104.

Range: This unit is classified as 80% having no allowable capacity (NC) and 20% having potential capacity for grazing (PC). The NC areas are bedrock or very shallow soils which are incapable of being grazed by domestic livestock under reasonable management goals. The PC areas are small pockets of shallow and moderately deep soils that are hard to delineate. They are areas varying from five to twenty-five acres in size and are widely scattered across the mapping unit.

Seventeen range pace transects were run and blackbrush was the dominant species. Other species inventoried were Utah agave, datil yucca, Mormon tea, turpentine broom, prickly pear cactus, desert ceanothus, snakeweed, shrub live oak, and Fremont barberry. Lesser amounts of galleta and dropseed species are the major grass plants on these harsh sites. The shallow to moderately deep soils present slightly different vegetation compositions due to better soil moisture conditions. Blackbrush still dominated these sites, but a wide variety of grass species could be found. Fourwing saltbrush becomes more abundant on the better soils. Indian ricegrass, black grama, stipa species, and side-oates grama were inventoried also. Little bluestem and inland bluegrass were found on relict mesas. Data presented in the appendix will contain a more complete list of all species found.

Forage production of perennial grass was measured to be 0-25 pounds (air dried) per acre on the NC portion of the unit, 50-100 pounds per acre on the PC portion, and 70-200 pounds per acre on relict areas.

Range vegetation condition scores were generally in the poor classification with four transects scoring in the very poor range. One transect (P-23) located on a relict mesa scored a high fair condition. Soil stability scores were all poor except for P-23 which had a fair rating and for P-28 which had a very poor rating.

The very shallow soils on the NC areas are inherently unstable. They are not capable of producing more vegetation than is presently found. This is due to the low water holding capacities and limited rooting depths. The bedrock portion, obviously, cannot produce usable forage. The only potential for future grazing exists on the small pockets of shallow to moderately deep soils. These scattered areas are barely holding their own under existing wildlife and feral horse use. The potential capacity acres do not contain sufficient ground covers to protect the soil resource. The average effective ground cover is 30 percent while 35 percent is needed to protect the soil. When the effective ground cover reaches 35 percent, the areas can be reclassified as having full capacity. The fact that these

areas are widely scattered and are often separated by inaccessible canyons will make it extremely difficult to maintain proper forage utilization when the sites become stable. A herder will have to be with livestock to ensure proper use and to ensure that animals are moved in a timely manner. If this is not done, overgrazing will occur with a corresponding loss of site productivity. These sites could be reduced to bedrock by excessive removal of protective vegetation and consequent soil loss.

Mapping Unit: 175--Lithic Ustorthents, winter precipitation, moist, mixed (Calareous), mesic, very fine sandy loam - Rock outcrop association, Pied/Juos/Artr2, 0 to 15% slopes.



Photo #3. Relatively small benches of Mapping Unit 175 are found between Royal Arch Creek and Fossil Canyon. Scattered canopies of pinyon pine-Utah juniper and an abundance of shrubs commonly found above the rim indicate that this area receives more precipitation than the extensive acreage of desert shrub plant communities found west of Fossil Canyon and Great Thumb Mesa.

Landform: Nearly level to strongly sloping benches of plateau land.

Geology: Esplanade Sandstone

Slope: 0 to 15 percent.

Acreage Extent Within HTUL: 1,574

Percent of HTUL: 2

Average Precipitation: 16 inches per year.

Average Elevation: 5,000

Soils and Map Unit Characteristics: Shallow, weakly developed soils comprise 55% of this association. Rock outcrop of Supai sandstones comprise 45%. Minor inclusive areas of Hermit Shale occur within

the unit. This mapping unit supports low densities and canopy cover of trees, shrubs, and grasses. Unprotected interspaces exhibit accelerated sheet and rill erosion and pedestalling of plants. Microclimate associated with this mapping unit differs from areas west due to topographic exposure and prevailing winds. There is no access to this mapping unit suitable for livestock and makes up only 2% of the study area.

Range: This unit, like Unit 174, is classified as 80% having no allowable capacity (NC) and 20% having potential capacity for grazing (PC). The NC areas are bedrock or very shallow soils which are incapable of being grazed by domestic livestock under reasonable management goals. The PC areas are small pockets of deeper soils varying from five to twenty acres in size. These pockets are widely scattered over the mapping unit and are hard to delineate. The potential capacity acres do not contain sufficient ground covers to protect the soil resource. The average effective ground cover is 20% while 40% is needed to protect the soil. When the effective ground cover reaches 40%, the areas can be reclassified as having full capacity.

Five range pace transects were run on this unit. Two were in Fossil Bay and three were in an area adjacent to Apache Point. Transects in Fossil Bay were dominated with stipa species. Other associated species were snakeweed, galleta, sand dropseed, black grama, blue grama, Mormon tea, and rabbitbrush. The shallow soils were more dominated by Nevada greasewood, prickly pear, narrowleaf mahogany, datil yucca, and rabbitbrush. Scattered Utah juniper and pinyon pine can be found over most of the unit.

Forage production of perennial grass was 0-25 pounds (air-dried) per acre on the NC portion of the unit, 125-200 pounds per acre on the PC portion adjacent to Apache Point, and 300-350 pounds per acre on the deeper soils in Fossil Bay.

Range vegetation condition scores were fair in Fossil Bay and poor to fair adjacent to Apache Point. Soil stability scores were all in the poor classification.

Comments found in the last paragraph for Mapping Unit 174 are pertinent to this unit also.

Mapping Unit: 176--Typic Ustorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic, very stony sandy loam-Lithic Ustorthents, winter precipitation, typical, loamy-skeletal, mixed (Calcareous), mesic, very gravelly sandy loam complex, Juos/Artr2, 40 to 120% slopes.

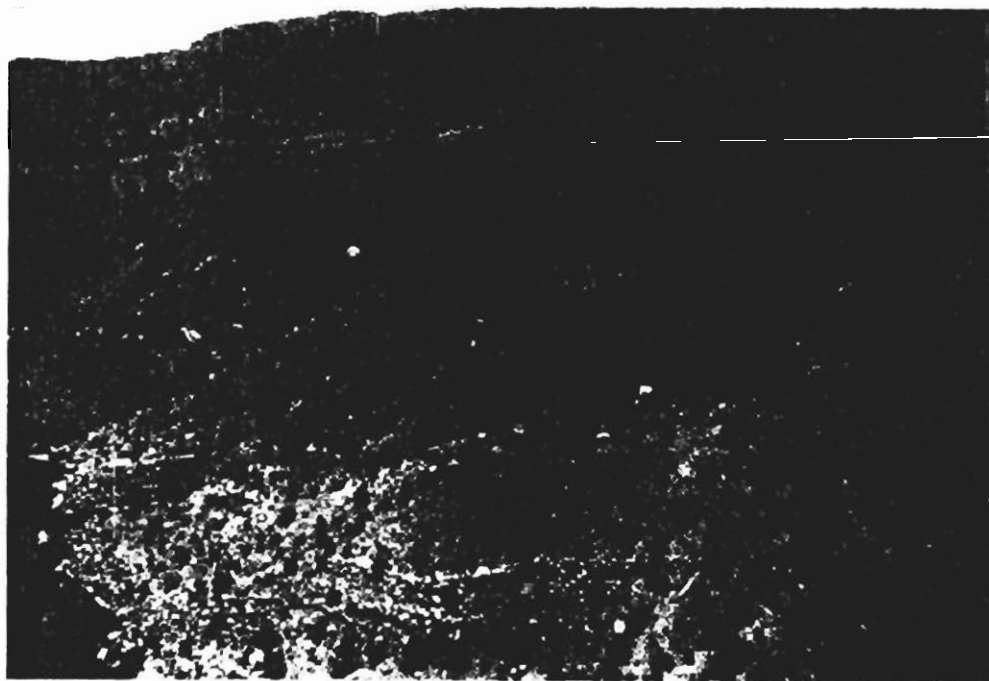


Photo #4. Canopy covers dominated by Utah juniper and big sagebrush are found on steep talus slopes between Royal Arch Creek and Fossil Canyon. Soils forming in colluvial materials of Coconino Sandstone and Kaibab Limestone have no significant profile development and depths are variable over Hermit Shale bedrock.

Landform: Steep and very steep talus and escarpment sideslopes.

Geology: Mixed colluvial material from Coconino, Toroweap, and Kaibab formations.

Slope: 40 to 120 percent.

Acreage Extent Within HTUL: 2,582

Percent of HTUL: 3

Average Precipitation: 14 inches per year.

Average Elevation: 5,500 feet.

Soils and Map Unit Characteristics: Typic Ustorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic comprises 60% of the complex. Lithic Ustorthents, winter precipitation, typical, loamy-skeletal, mixed (Calcareous), mesic occupy 40%. This mapping unit supports sparse stands of Utah juniper and big sagebrush along an intermediate position between very shallow bench soils and rock outcrop of above vertical cliffs. Areas of big sagebrush plant communities are inclusive within this map unit, but were undelineable at the present scale. Existing erosion is largely gravational creep with additional sheet wash, rill and gully erosion, resulting from steep slopes, unstable parent materials and low ground and canopy cover percentages. Surface stones and boulders aid in reducing overland flow, but concentrate runoff into defined channels. Pedestalling of plants and rock fragments is common. This unit occurs in the eastern section of the survey area where the microclimate is less harsh, and the effects of exposure, aspect and wind on soil moisture and temperature are not as variable.

Range: This mapping unit is classified as having no allowable capacity (NC) because of unstable soil conditions. Mass wasting in the form of gravatational creep and land flows (planar movement) is evident. Litter dams, plant pedestalling, rilling and gullying are found along the entire length of the slope. Any grazing by livestock will result in increased degradation of the resources.

Comparing the soils map with the range map will show some differences along the lower edge of this unit. There are small areas varying in size from 3-35 acres of Mapping Unit 175 which were combined with the talus slopes for range purposes. If livestock use of the talus slopes is ever implemented, the animals will not graze the steeper slopes until the accessible, lower slopes are denuded. The animals will then be forced onto the steeper slopes. This will greatly accelerate soil loss on both areas.

Vegetation consists of a sparse overstory of Utah juniper and pinyon pine. The understory around Apache Point consisted of rabbitbrush, sand dropseed, prickly pear cactus, yucca, sagebrush, squirreltail, galleta, and longtongue bluegrass. Conditions improved in Fossil Bay where longtongue bluegrass, black grama, and stipa species dominated the slopes.

Mapping Unit: 177--Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic, deep-Lithic Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic, very gravelly sandy loam complex, Cora, 40 to 120% slopes.



Photo #5. Steep colluvial talus slopes west of Fossil Bay and the Great Thumb Mesa support desert shrub vegetation dominated by blackbrush. Soil depths vary over Hermit Shale bedrock and stone to boulder size surface and profile coarse fragments are common.

Landform: Steep to very steep talus and escarpment sideslopes.

Geology: Mixed colluvial material from Coconino, Toroweap, and Kaibab Formations.

Slope: 40 to 120 percent.

Acreege Extent Within HTUL: 6,184

Percent of HTUL: 6

Average Precipitation: 10 inches per year.

Average Elevation: 5,500 feet.

Soils and Map Unit Characteristics: Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic comprise 60% of the complex. Lithic Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic occupy 40%. This mapping unit supports stands of blackbrush and associated desert shrubs which reflect a hotter, dryer condition than similar landforms in the eastern section. Topographic exposure and prevailing southwesternly winds account for less effective precipitation, low plant available water and high soil temperatures causing a reduction in potential plant productivity. Existing soil erosion processes include sheet, rill, and gravatational creep. Factors contributing to these accelerated conditions are steep gradients, unstable parent materials, and low ground and canopy cover percentages. Pedestalled plants and rock fragments are common.

Range: This mapping unit is classified as having no allowable capacity (NC) because of unstable soil conditions. Mass wasting in the form of gravatational creep and land flows (planar movement) is evident. Litter dams, plant pedestalling, rilling and gullyng are found along the entire length of the slope. Bighorn sheep beds are common in areas where big sagebrush was inventoried. Any grazing by livestock will result in lower effective ground covers and higher rates of erosion.

Vegetation is dominated by blackbrush. Minor inclusions contain big sagebrush, fourwing saltbush, Apache plume, Mormon tea, yucca, long-tongue bluegrass, and squirreltail.

Mapping Unit: 178--Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic, very cobbly sandy loam-Lithic Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic, very gravelly sandy loam complex, Cora, 15 to 40% slopes.

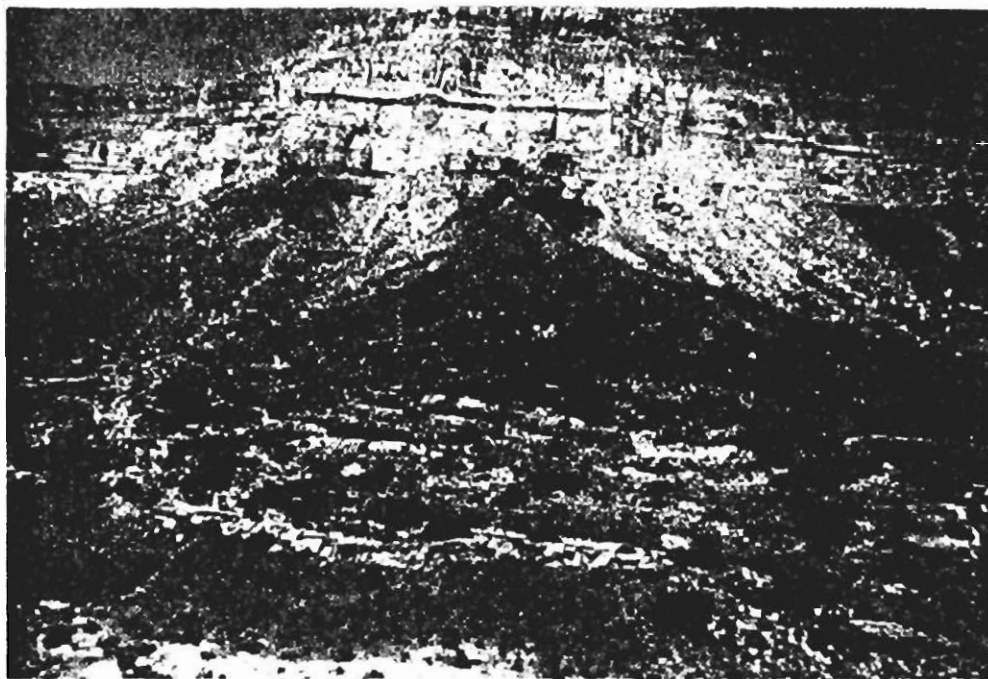


Photo #6. Lower toe slopes of talus (Coconino sandstone/Kaibab limestone) are moderately steep in Mapping Unit 178. This allows better accessibility to the potential capacity acres between the Great Thumb Mesa and National Canyon.

Landform: Moderately steep talus slopes.

Geology: Mixed colluvial material from Coconino, Toroweap, and Kaibab Limestone.

Slope: 15 to 40 percent.

Acreage Extent Within HTUL: 4,142

Percent of HTUL: 4

Average Precipitation: 10 inches per year.

Average Elevation: 5,000 feet.

Soils and Map Unit Characteristics: Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic comprises 70% of the complex. Lithic Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (Calcareous), mesic occupy 30%. This map unit occurs at an intermediate position between very steep talus slopes and nearly level bench soils. These soils support blackbrush plant communities and other associated desert shrub species. This map unit generally occurs throughout the survey area. Existing erosion processes are combined sheet and rill. Pedestalling of plants is common. The upper, steeper segments of this map unit are less stable and more eroded than the lower, gently sloping portions. Factors contributing to unstable and degraded soil conditions are sparse vegetation, high geologic erosion rates, unconsolidated parent materials and steep gradients.

Range: This unit is classified as 20% having no allowable capacity (NC) and 80% having potential for grazing (PC). The NC areas are shallow soils having no potential to provide sufficient effective ground cover for soil stabilization. They produce little or no forage. The PC areas are completely dominated by blackbrush.

Eight range pace transects were run on this unit. Vegetation is dominated by blackbrush with minor inclusions of fourwing saltbrush, Mormon tea, winterfat, yucca, rabbitbrush, and black grama. Most plants are pedestalled. Sheet and rill erosion is common.

Forage production of perennial grass was 0-50 pounds (air-dried) per acre. Production in Fossil Bay ranged from 0-20 pounds per acre. Potential production is low due to the low water holding capacities of the soils, the unstable landscape position, and the dominance of the vegetation by blackbrush. It is unlikely that these areas will stabilize enough to support livestock grazing.

Range vegetation condition scores were in the poor to very poor classification. Soil stability scores were split between the poor and fair classification due to larger amounts of surface rock. Small rocks and gravel are found behind shrubs as litter dams.

The potential capacity acres do not contain sufficient ground cover to protect the soil resource. The average effective ground cover is 60% while 75% is needed to protect the soil. When the effective ground cover reaches 75%, the areas can be reclassified as having full capacity.

Mapping Unit: 179--Rock outcrop, 80% to vertical slopes.

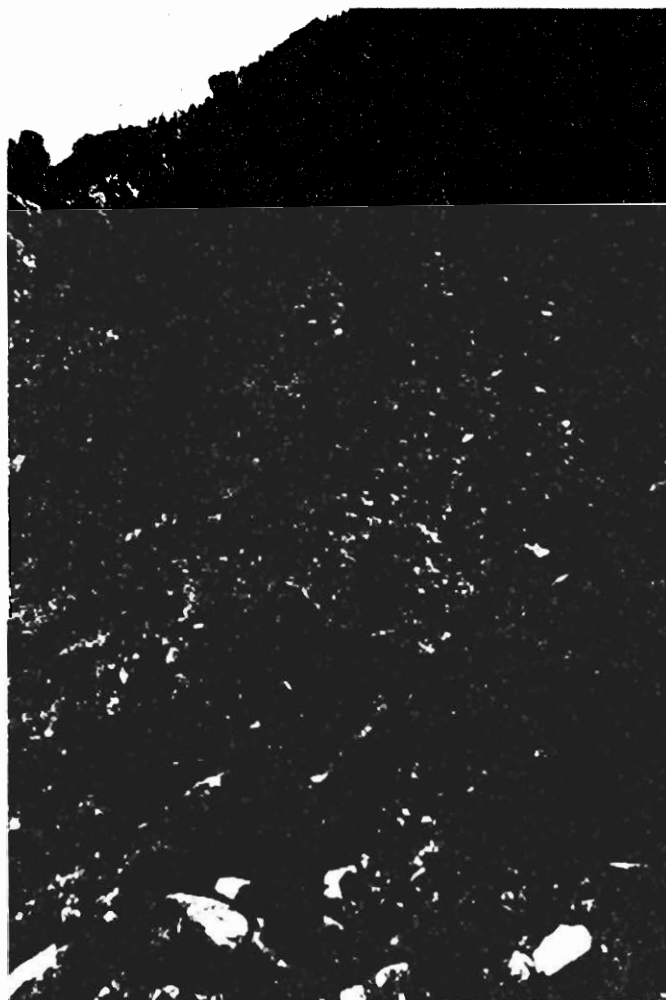


Photo #7. Vertical cliffs of Coconino Sandstone and Kaibab and Toroweap Limestone form rimrock barriers which extend from top of colluvial talus slope to edge of the canyon rim.

Landform: Rock outcrop.

Geology: Coconino, Toroweap, and Kaibab formations.

Slope: 80 percent to vertical.

Acreage Extent Within HTUL: 5,212

Percent of HTUL: 5

Average Precipitation: 14 to 16 inches per year.

Average Elevation: 5,500 to 6,000 feet.

Range: Classified as having no allowable capacity (NC) due to lack of forage and being inaccessible.

Mapping Unit: 180--Rock outcrop, 0 to 40% slopes.

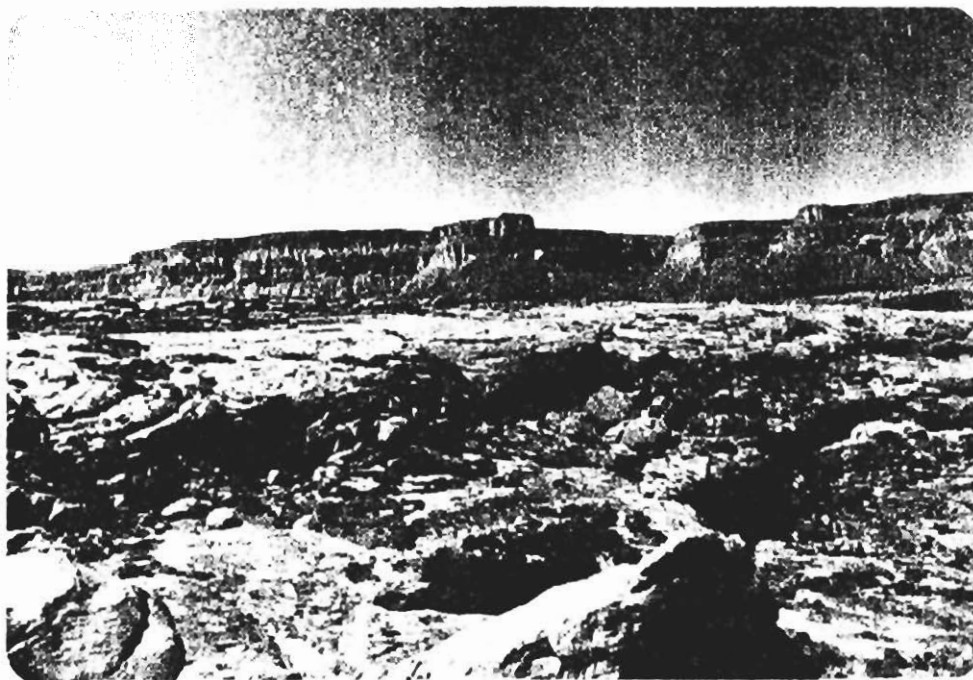


Photo #8. Areas of exposed Supai sandstone bedrock often comprise considerable acreage with only small undelineable pockets of very shallow soil supporting small islands of limited vegetation.

Landform: Benches and sideslopes.

Geology: Esplanade Sandstone

Slope: 0 to 40 percent.

Acreage Extent Within HTUL: 7,824

Percent of HTUL: 8

Average Precipitation: 10 to 12 inches.

Average Elevation: 4,000 to 5,000 feet.

Range: Classified as having no allowable capacity (NC) due to lack of forage and having no potential to produce forage.

Mapping Unit: 181--Rock outcrop - Rubbleland, 80% to vertical slopes.



Photo #9. Vertical cliffs and unconsolidated rock debris extend from lower Supai formation to Colorado River drainage. Very steep inaccessible areas of shallow soils derived from talus occur as inclusions.

Landforms: Steep and very steep talus and escarpment.

Geology: Lower Supai, Redwall, Devonian, Muav, and Bright Angel formations.

Slope: 80% to vertical cliffs.

Acreage Extent Within HTUL: 55,164

Percent of HTUL: 58

Average Precipitation: 10 inches per year.

Average Elevation: 4,000 feet.

Range: Classified as having no allowable capacity (NC) due to lack of forage and being inaccessible.

RANGE EVALUATION AND INTERPRETATIONS

Condition and Trend

Thirty-nine pace transects were run on the study area. Thirteen were rated very poor; twenty-one were rated poor; four were rated fair; and one was rated good. Most of the transects rated fair and good were in Fossil Bay and on relict mesas; these areas show no signs of ever having been grazed in the past. One transect (P-4) rated fair was in the Apache Point area. This area has not been grazed in about ten years and appears to be improving.

Soil stability on thirty-three transects was rated very poor or poor while fair ratings were found on six transects. The fair ratings were due to larger amounts of rock on the soil surface.

Trend expresses the direction of change, if any, in condition in response to past and existing livestock management practices combined with other environmental factors. It is difficult to determine trend in the study area due to this being the first range evaluation in the HTUL. No apparent trend was given to most sites. Most browse plants reflected low use and vigorous growth (photo #10), but there was little accumulated litter. Soils with erosion pavement had few, if any, plants established, but this could be a result of extremely shallow soils where plants may never become established (photo #11).

Pedestalled grasses and shrubs were common throughout the study area (photo #12). All talus slopes exhibited soil movement (photo #13). The Esplanade bench exhibited large bare spaces with prominent runoff patterns, and large areas of exposed bedrock (photo #14). A high percentage of plants were growing on soils 1-6 inches deep (photo #15). These plants could be pulled out very easily by grazing animals.

Grazing Capability

The Havasupai Traditional Use Lands were classified as either PC or NC. Nothing was found that could be classified as FC. Inaccessibility, lack of available forage, accelerated erosion, and a general lack of effective ground cover are major reasons for these classifications. Even areas given a PC classification may be misleading because they are small, isolated "islands" surrounded by bedrock or Hermit Shale soils (photo #16). Getting livestock to these "islands" will be a monumental task in itself. Should a decision



Photo #10 Vigorous fourwing saltbush plant exhibiting good growth form. Forster Canyon is visible in the background. The 100%-120% slopes preclude trail construction into Fossil Bay.

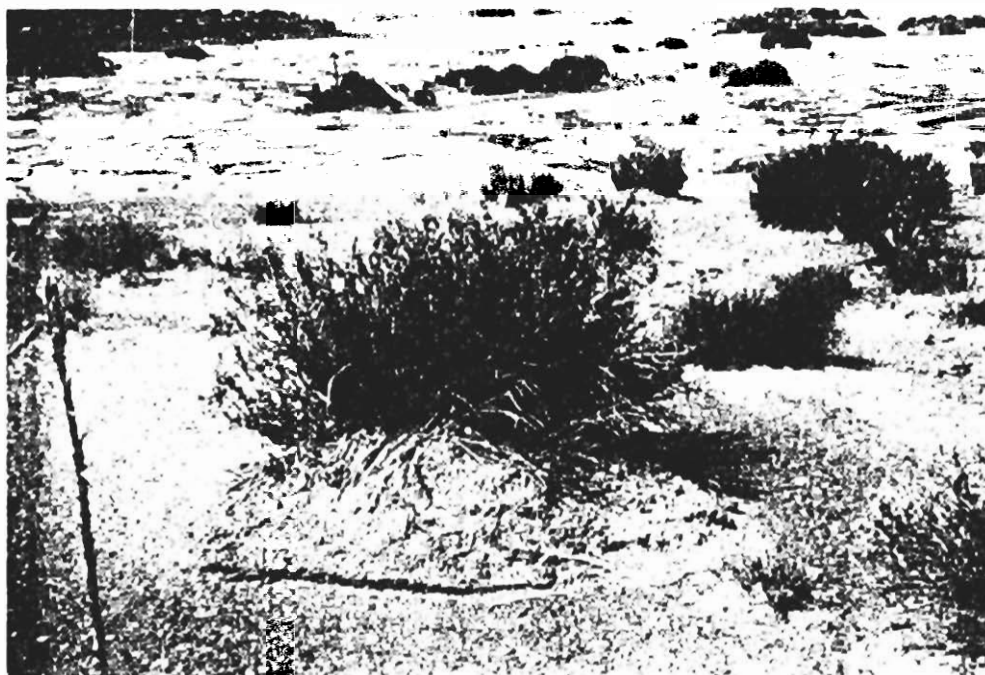


Photo #11 Erosion pavement resulting in a pedestalled blackbrush plant. Exposed bedrock nearby increases runoff which results in soil loss.

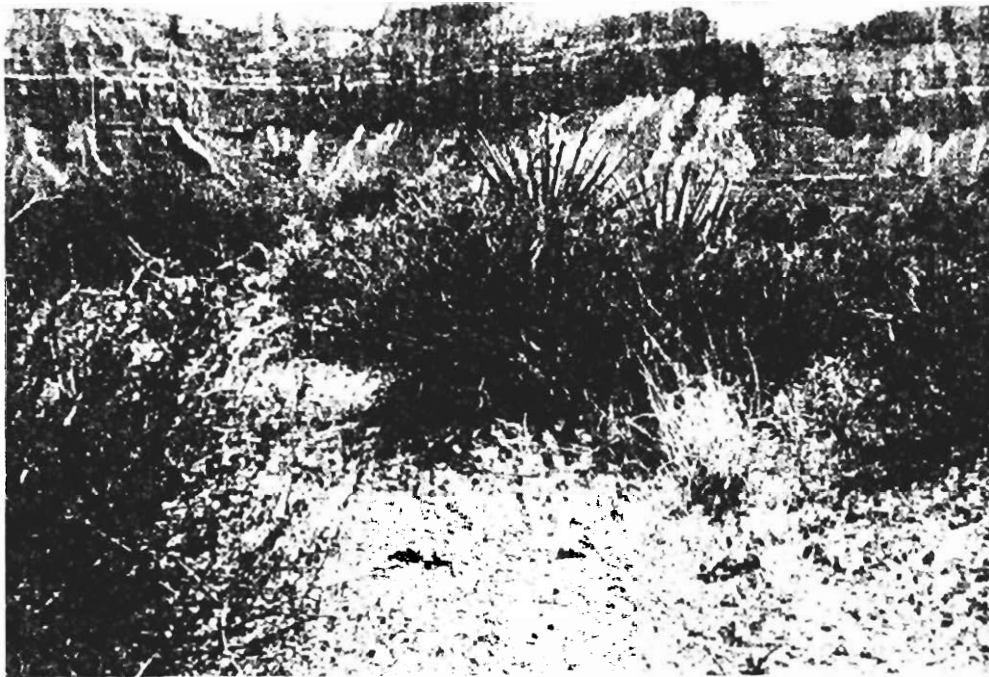


Photo #12. Pedestalled grasses and shrubs on Mapping Unit 174.



Photo #13. Talus slope showing rock and soil buildup above sagebrush plants. Bighorn sheep were using these areas. Utilization of the sagebrush was light to moderate.



Photo #14. Typical view of Mapping Unit 174. Large areas of shallow, bare soil with patches of bedrock dominate the landscape. Runoff patterns are obvious. Litter is scarce to nonexistent.



Photo #15. Small deposits of poorly developed soil exist between patches of bedrock. Plants growing on these deposits can be easily pulled out.

be made to graze these areas in the future, careful and constant inspections must be made to ensure that proper forage utilization is not exceeded. Excess use on these fragile, highly erodible soils could result in irreversible site degradation.

About two dozen feral horses were seen during this study (photo #17). Fresh sign seen elsewhere indicate that an additional dozen may be present in the study area. Bighorn sheep and deer sign was evident over about 75% of the study area. Where both wildlife and horse use occurs, the grazing capacity is already exceeded. Additional impacts from domestic livestock would place additional stress on native wildlife species living in an already harsh environment.

Forage Production and Allowable Use

Large mesas (photo #18) extend for a half mile or more into the canyon. They may have two or three areas containing 1-20 acres of moderately deep soil where forage production is 100-200 pounds per acre. These are the areas exhibiting past and current horse use. It was extremely difficult to delineate these areas on aerial photographs, and most of the time it could not be done. Therefore, estimates were made by percentages of soil type for these areas. These are best estimates and should be considered in this light. Except around Apache Point and in Fossil Bay where no sign of livestock use was seen, forage production averaged less than 50 pounds per acre of perennial, desirable grasses. Some desirable browse species were found, but production estimates were not made because the species make up only a small portion of the plant community.

Blackbrush is the dominate shrub found in the study area. Studies of blackbrush show a poor to fair palatability for livestock and a deficiency in phosphorus and protein during the winter. The plant develops a spinescent growth form at maturity, making the plant less desirable for livestock. The species is of some value to game animals, particularly bighorn sheep. Blackbrush is not considered as a desirable browse species in this study other than receiving occasional light use by browsing animals when using other nearby plants.

Allowable use for the study area is set at 35%, assuming areas classified as having potential capacity become stable enough to support livestock grazing. This percentage is based upon a winter grazing season of 11/1 - 3/30 and a three pasture deferred, rest rotation system of grazing where one pasture is rested every season. If this proposed season and/or management scheme is not adhered to, then the allowable use will have to be reduced to 20-25% to compensate for the change.



Photo #16. A small 10 acre "island" of moderately deep soil. Proper livestock distribution to these areas will be difficult when the soils stabilize.



Photo #17. Four horses seen along edge of terrace north of the Great Thumb. Note the bedrock exposed. This rock is accelerating water flow across the soil. Livestock use in these areas will accelerate the soil loss.

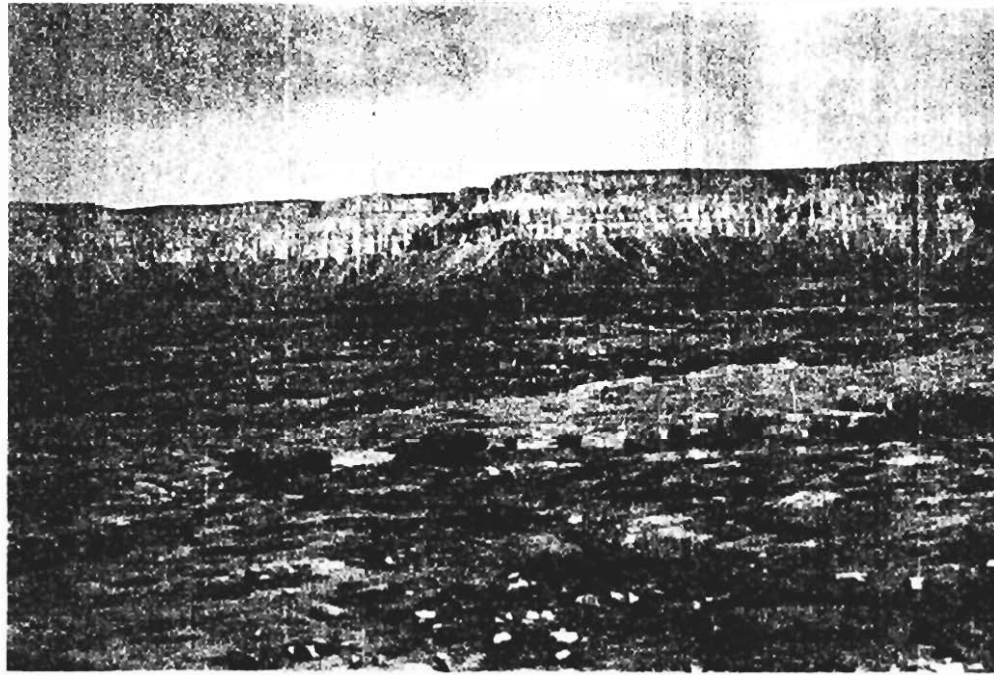


Photo #18. Typical mesa extending into the canyon. A small area containing moderately deep soil can be seen in the background. The foreground shows some plants still growing on a small, poorly developed pocket of very shallow soil. This situation will limit management possibilities when areas become stable enough to support livestock grazing.

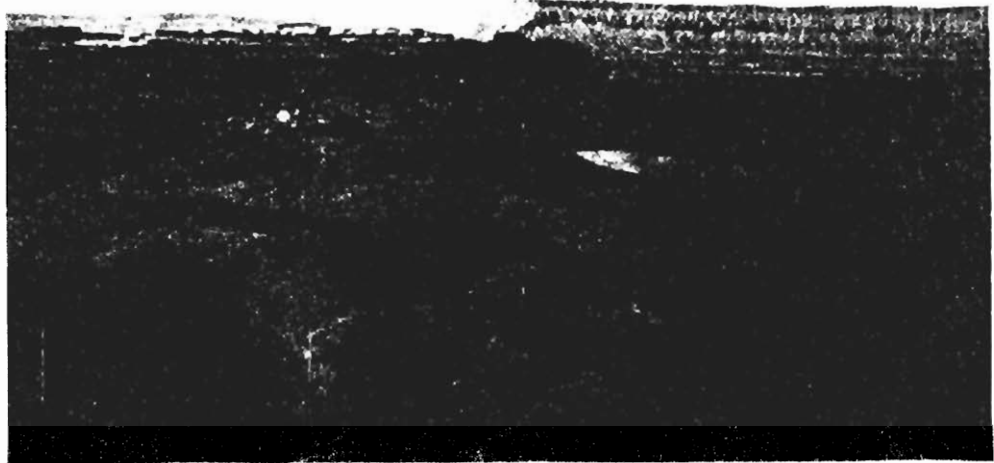


Photo #19. Several areas contain potholes of water following precipitation. These contain water for short periods but should not be relied on for domestic livestock consumption.



Photo #20. Typical situation of algal community development showing the absence of it in erosional channels with the adjacent areas having a rather dense mat. This mat or crust has been shown to be instrumental in soil binding, water retention, and nitrogen fixation.

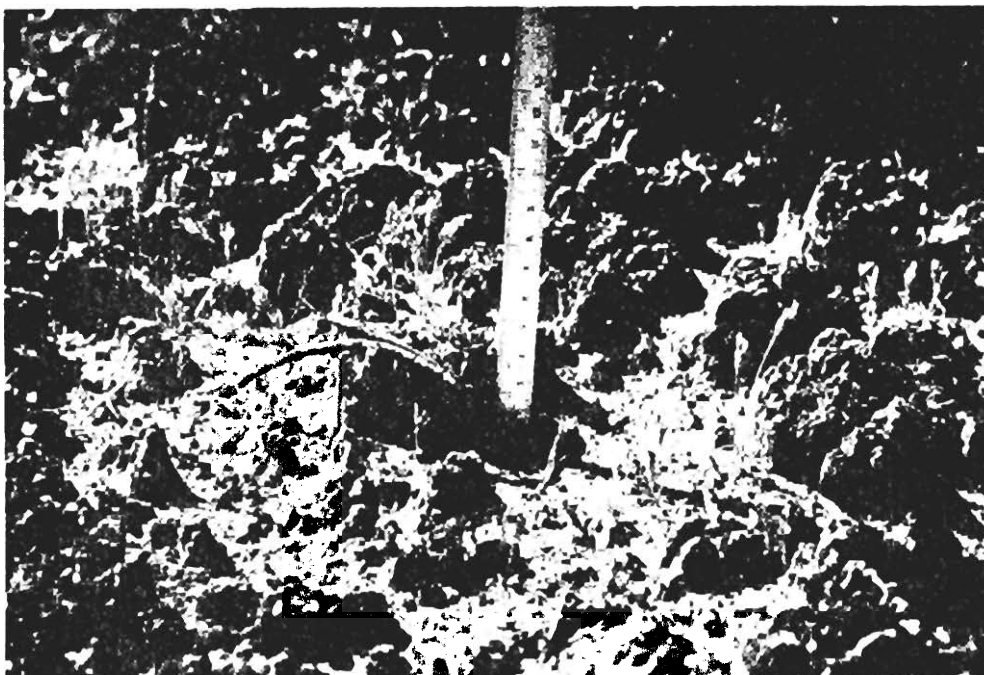


Photo #21. Closeup photo shows pinnacles which form as a result of raindrop impact. This situation is prevalent where pressure is applied causing the mat to disintegrate. This roughened surface when intact has a significant effect on overland flow.

Grazing Capacity and Management Potential

Grazing capacities are established only for areas delineated as suitable for grazing (FC). The study area contained no areas in this classification.

However, an estimated capacity for lands classified as having potential capacity was determined. It is not recommended that these areas be grazed, but that livestock be deferred until the sites become stable enough to support grazing. Feral horses should be removed so the degradation they are currently causing will cease and recovery can begin.

The study area contains harsh and complex terrain that makes management difficult (photo #18). For the sake of discussion, the study area is broken into eight management units. Only three are considered for future grazing due to limited forage production and poor accessibility on the remaining five units. All units are listed in Table 6 and are shown on Figure 3.

Unit A is located around Apache Point. Access overland is nonexistent today. An old trail extends around Apache Point and drops onto a talus slope on the east side. The trail is washed out. Considering the small estimated capacity (11 AUM's or 2 cows for 5 months), it is hardly justified to rebuild and maintain this trail. A reliable water source was not found on this unit though a shallow pot hole was seen with water following rain on the east side of Forster Canyon. The Havasupai tribal map shows a spring in the head of Forster Canyon. It was not observed while crossing the canyon. Even had a spring been found, it would not be accessible for livestock due to extremely rough, steep terrain.

Unit B is located north of Great Thumb Mesa. It contains large amounts of slickrock, inaccessible land and very little area classified as P.C. It contains 4 AUM's.

Unit F is located south of Flat Iron Butte. It contains only steep rugged terrain with very little area classified as PC. It contains only 1 AUM.

Unit G is located in Fossil Bay. While it does contain some areas that could be classified as PC, the area is inaccessible to livestock. The area had no sign to indicate that livestock have ever been there. There are no talus slopes extending through the Coconino Sandstone cliffs on which access would have to be made. Trail construction around Forster Canyon or the Great Thumb is not considered feasible for 38 AUM's (7 cows for 5 months) on potential grazing land.

Unit H is located around the head of Matkatamiba Canyon, an area with only steep irregular terrain. It contains limited forage that would be very difficult to use from either neighboring Unit C or D. It contains only 1 AUM.

The bulk of the lands classified as PC are located in Units C, D, and E. Natural breaks in steep canyons form boundaries for these units. They are accessible from Havasu Canyon and from the northern end of Great Thumb Mesa.

Unit C encompasses areas around Chikapanagi Mesa and Panameta Terrace. While three springs were seen, their reliability is not known. Development of two small trick tanks with adequate water storage would prove valuable but expensive since access for materials would be by helicopter. This unit contains 16 AUM's (6 cows for 2.5 months).

Unit D encompasses areas around Sinyala and Matkatamiba Mesas. Possibly three seeps exist but their reliability is questionable. Some old horse sign was found on Matkatamiba Mesa, but accessibility is questionable without some trail work across the Sinyala fault being done first. Livestock will not use the area north of the fault without being purposely pushed there. Three trick tanks should be developed in this unit to provide dependable water. These, too, would be expensive due to access problems. This unit contains 17 AUM's (6 cows for 2.5 months).

Unit E is located west of Havasu Canyon around Yumtheska Point. Several pot holes exist, but were dry during this study. Development of three trick tanks should be done to provide dependable water. This would be expensive due to access problems. This unit contains 21 AUM's (8 cows for 2.5 months).

Even when Units C, D, and E become stable forage producing areas, it is highly questionable that grazing livestock on these units is economically justified. This is due to the low production capacities, coupled with the high costs associated with any structural range improvements (i.e., fences, trick tanks).

ESTIMATED CAPACITY FOR POTENTIAL CAPACITY AREAS

Table 6

MGT UNIT	SOIL UNIT	GROSS ACRES	% P.C.	NET ACRES	AVE. LBS. PRODUCTION EXISTING	TOTAL PRODUCTION	ALLOWABLE USE %	FORAGE AVAILABLE	FORAGE PER AUM	AUM
A	175	765	20	153	150	22,950	35	8,033	730	11
B	174	771	20	154	50	7,700	35	2,695	730	4
C	174	1,430	20	286	50	14,300	35	5,005	730	7
C	178	907	80	726	25	18,150	35	6,353	730	9
D	174	3,176	20	635	50	31,750	35	11,113	730	15
D	178	181	80	145	25	3,625	35	1,269	730	2
E	174	2,040	20	408	50	20,400	35	7,140	730	10
E	178	1,113	80	890	25	22,250	35	7,788	730	11
F	174	279	20	56	50	2,800	35	980	730	1
G	174	888	20	178	125	22,250	35	7,788	730	11
G	175	499	20	100	325	32,500	35	11,375	730	16
G	178	1,112	80	890	25	22,250	35	7,788	730	11
H	174	127	20	25	50	1,250	35	438	730	1

The three units could be grazed with a three pasture deferred, rest rotation grazing system. This system is shown graphically below:

	<u>Month</u>					
<u>Year 1</u>	<u>Nov</u>	<u>Dec</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u># Animals</u>
Unit C	G	G	G			6
Unit D			G	G	G	6
Unit E						
 <u>Year 2</u>						
Unit C						
Unit D	G	G	G			6
Unit E			G	G	G	6
 <u>Year 3</u>						
Unit C			G	G	G	6
Unit D						
Unit E	G	G	G			6

G = Grazing Period

This assumes mature cattle are to be grazed. The capacity for horses would be one half the number of cattle. Yearling numbers would be slightly higher than for mature cattle, depending upon the size of the yearlings.

Grazing these units when PC sites become stable will require close herding of the animals to ensure proper livestock distribution is obtained. Monitoring actual forage utilization will require close and numerous inspections. If this is not done, rapid deterioration of soils, vegetation, and wildlife habitat will occur. This would be damaging to bighorn sheep as their diet and the diet of domestic livestock significantly overlap.

Additional work, prior to placing livestock in these areas, should be done to make an actual count of bighorn sheep. Once numbers and herd boundaries are established, then AUM's should be allocated for the bighorn sheep to ensure protection of their habitat. From the amount of bighorn sheep sign observed, it is highly possible that all existing forage may be necessary for the maintenance of current bighorn sheep populations.

MANAGEMENT RECOMMENDATIONS

MANAGEMENT RECOMMENDATIONS

The Havasupi Traditional Use Lands pose severe restrictions to any grazing by domestic livestock. The harsh climatic conditions, shallow soils, limited water, and poor accessibility are but a few of the problems. Before any grazing system is implemented, the following steps are recommended:

1. Complete removal of existing feral horse populations.
2. Determine current populations and boundaries of bighorn sheep. Once this is established, allocate AUM's for the bighorn sheep. The ratio of 4:1 should be used in determining bighorn sheep to cattle AUM's.
3. Measurements on the potential capacity acres should be done in 1987 to see if effective ground covers have risen enough to stabilize the soils. Currently, the mean effective ground cover on mapping units 174, 175, and 178 is 30 percent, 20 percent, and 60 percent respectively. If in 1987 the mean effective ground covers on these mapping units has risen to 35 percent, 40 percent, and 75 percent, reclassify to full capacity.
4. If measurements in 1987 still show effective ground covers to be inadequate, remeasure in 1990 and 1995. If measurements of effective ground cover in 1995 indicate that soil loss is still excessive, consider reclassification of the entire HTUL to no capacity.
5. If the mean effective ground covers have increased enough to stabilize soil loss, redetermine estimated AUM's accordingly to ensure adequate forage for bighorn sheep populations. Allocate AUM's to management units. Stock areas in accordance with management system indicated in text. Ensure that herders maintain proper livestock distribution by frequent inspections.
6. Determine feasibility of building trick tanks as indicated on range maps.

Possibly the most important step is the complete removal of existing feral horses. They are currently using the existing rangeland in excess. Once they have been removed, recovery of depleted forage can begin. This may, over time, produce enough litter to stabilize soil loss on the potential capacity acres.

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BIBLIOGRAPHY

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APPENDIX A

SOIL TAXONOMIC LEGEND
AND
MODAL SOIL PROFILE DESCRIPTIONS

Terrestrial Ecosystem Survey
Havasupai Use Lands
Grand Canyon National Park
Taxonomic Legend

<u>Soil</u>			<u>Vegetation</u>
<u>Taxonomic Unit 1/</u>	<u>Map Unit</u>	<u>Parent Mat. Lithology Formation</u>	<u>Taxonomic Unit</u>
Entisols			
Orthents			
Torriorthents			
Lithic Ustic winter precip.			
loamy, mixed	104	Hermit shale	Cora
(Cale.), mesic	174	Esplanade sandstone	Hija
loamy-skeletal,	177, 178	Hermit shale	Cora
mixed (Cale.),		Kaibab limestone	
mesic		Coconino sandstone	Hija
Torriorthents			
Ustic			
winter precip.			
typical			
loamy-skeletal,	177, 178	Hermit shale	Cora
mixed (Cale.),		Kaibab limestone	Hija
mesic		Coconino sandstone	
Orthents			
Ustorthents			
Lithic			
winter precip.			
loamy-skeletal,	176	Hermit shale	Juos
mixed (Cale.),		Kaibab limestone	Artr2
mesic		Coconino sandstone	
Lithic			
winter precip.			
moist			
loamy, mixed (Cale.),	175	Esplanade sandstone	Pied
mesic			Juos
			Artr2
Typic			
winter precip.			
loamy-skeletal, mixed	176	Hermit shale	Juos
(Cale.) mesic		Kaibab limestone	Artr2
		Coconino sandstone	

Lithic Ustic Torriorthents, winter precipitation, loamy, mixed (calcareous), mesic.

Lithic Ustic Torriorthents, winter precipitation, loamy, mixed (calcareous), mesic consists of very shallow and shallow well drained soils that formed in residuum from sandstone and shale. They are on nearly level to strongly sloping benches and terraces with slopes of 0 to 15 percent. Mean annual precipitation is approximately 10 inches of which 65 percent seasonally occurs between the months of October and June. Mean annual air temperature is about 56°F. Average elevation is 5000 feet.

Colors are for dry soil unless otherwise noted.

A--0 to 1 inch; reddish yellow (5 YR 6/6) very fine sandy loam, yellowish red (5 YR 5/6) moist; weak thin platy structure; loose, loose, nonsticky, nonplastic; few very fine roots, few very fine vesicular pores; 5 percent gravel; strongly effervescent with disseminated lime; moderately alkaline (pH 8.0); abrupt smooth boundary (1/2 to 1 inch thick).

C--1 to 10 inches; reddish yellow (5 YR 6/6) gravelly very fine sandy loam, yellowish red (5 YR 5/6) moist; single grain loose, loose, nonsticky, nonplastic; few very fine and fine roots; few very fine interstitial pores; violently effervescent with disseminated lime; moderately alkaline (pH 8.2); abrupt wavy boundary (4 1/2 to 17 inches thick).

R--10 inches; hard unweathered sandstone bedrock.

Range in Characteristics: The estimated mean annual soil temperature at a depth of 20 inches is about 58°F. The depth to bedrock ranges from 5 to 18 inches.

The A horizon has hue of 2.5 to 5 YR, value 3 through 6 dry and 3 or 4 moist, and chroma of 4 or 6. The texture of the fine earth fraction is sandy loam, fine sandy loam or very fine sandy loam. The horizon has 5 to 30 percent coarse fragment by volume. The reaction class ranges from mildly alkaline to moderately alkaline (pH 7.6 - 8.2).

The C horizon has hue of 2.5 or 5 YR, value 2.5 through 6 dry and 3 through 5 moist, and chroma of 4 or 6. The texture of the fine earth fraction is fine sandy loam or very fine sandy loam. The horizon has 5 to 25 percent coarse fragment content by volume. The reaction class ranges from mildly alkaline to moderately alkaline (pH 7.8 - 8.3).

Lithic Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (calcareous), mesic

Lithic Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (calcareous), mesic consists of shallow well drained soils that formed in colluvium and residuum from limestone, sandstone and shale. They are on moderately steep to very steep talus and escarpment sideslopes with slopes of 15 to 120 percent. Mean annual precipitation is approximately 10 inches of which 65 percent seasonally occurs between the months of October and June. Mean annual air temperature is about 56°F. Average elevation is 5000 feet.

Colors are for dry soil unless otherwise noted.

A--0 to 1 inch; light brown (7.5 YR 6/4) very gravelly sandy loam, brown (7.5 YR) moist; moderate fine platy structure; slightly hard, very friable, nonsticky, nonplastic; few very fine roots; many very fine vesicular pores; 50 percent gravel, strongly effervescent; mildly alkaline (pH 7.8); clear smooth boundary, (1 to 2 inches thick).

C1--1 to 9 inches; brown (7.5 YR 5/4) very gravelly fine sandy loam, brown (7.5 YR 4/4) moist; single grain; loose, loose nonsticky, nonplastic; few very fine and fine roots; common very fine interstitial pores; 40 percent gravel, violently effervescent; moderately alkaline (pH 8.0); clear smooth boundary (9 to 16 inches thick).

C2--9 to 12 inches; light brown (7.5 YR 6/4) very gravelly sandy loam, brown (7.5 YR 5/4) moist; single grain; loose, loose, nonsticky, nonplastic; few very fine roots; few very fine interstitial pores; 35 percent gravel and 5 percent cobble; violently effervescent; moderately alkaline (pH 8.0); abrupt irregular boundary (9 to 16 inches thick).

12 inches; hard unweathered sedimentary bedrock.

Range in Characteristics: The estimated mean annual soil temperature at a depth of 20 inches is about 58°F. The depth to bedrock ranges from 10 to 18 inches.

The A horizon has hue of 5 YR to 7.5 YR, value 5 or 6 dry and 4 through 6 moist, and chroma of 4. The texture of the fine earth fraction is loam, sandy loam or fine sandy loam. The horizon has 25 to 50 percent coarse fragment content by volume. The reaction class ranges from neutral to moderately alkaline (pH 7.2 - 7.8).

The C horizon has hue of 5 YR to 7.5 YR, value 5 or 6 dry and 4 through 6 moist, and chroma of 3 or 4. The texture of the fine earth fraction is fine sandy loam. The coarse fragment ranges from 35 to 65 percent by volume. The reaction class ranges from mildly alkaline to moderately alkaline (pH 7.4-8.0).

Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (calcareous), mesic

Ustic Torriorthents, winter precipitation, loamy-skeletal, mixed (calcareous), mesic consists of moderately deep and deep well drained soils that formed in colluvium from limestone and sandstone. They are on steep to very steep talus and escarpment sideslopes with slopes of 40 to 120 percent. Mean annual precipitation is approximately 10 inches of which 65 percent seasonally occurs between the months of October and June. Mean annual air temperature is about 56°F. Average elevation is 5000 feet.

Colors are for dry soil unless otherwise noted.

A--0 to 2 inches; pale brown (10 YR 6/3) very cobbly sandy loam, brown (10 YR 4/3) moist; weak very thin platy parting to weak very thin subangular blocky structure; loose, loose, nonsticky, nonplastic; few very fine and fine roots; common very fine interstitial pores; 10 percent gravel, 30 percent cobble, 15 percent stone; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2); clear irregular boundary (1 to 4 inches thick).

C1--2 to 8 inches; light brown (7.5 YR 6/4) extremely cobbly sandy loam, brown (7.5 YR 5/4) moist; weak fine and medium subangular blocky substructure; soft, very friable, nonsticky, nonplastic, few very fine, common fine and few medium roots; common very fine tubular pores; 5 percent gravel, 35 percent cobble and 20 percent stone; violently effervescent; moderately alkaline (pH 8.2); gradual irregular boundary (32 to 56 inches).

C2--8 to 40 inches; reddish yellow (7.5 YR 7/6) extremely stony sandy loam, strong brown (7.5 YR 5/6) moist; single grain; loose, loose, nonsticky, nonplastic; few fine and medium roots; few very fine interstitial pores; 20 percent gravel, 20 percent cobble, 40 percent stone; violently effervescent with disseminated lime; moderately alkaline (pH 8.2); abrupt irregular boundary.

R--40 inches; hard unweathered sedimentary bedrock.

Range in Characteristics: The estimated mean annual soil temperature is approximately 58°F. The depth to bedrock ranges from 34 to more than 60 inches.

The A horizon has hue of 5 YR to 10 YR, value 5 through 7 dry and 4 or 5 moist, and a chroma of 4 or 6. The texture of the fine earth fraction is loam, sandy loam or fine sandy loam. The rock fragment content ranges from mildly alkaline to moderately alkaline (pH 7.8 - 8.2).

The C horizon has hue of 2.5 YR to 10 YR, value 5 through 7 dry and 3 through 7 moist, and chroma of 4 or 6. The texture of the fine earth fraction is sandy loam and fine sandy loam. The rock fragment content ranges from 35 to 80 percent by volume. The reaction class ranges from mildly alkaline to moderately alkaline (pH 7.4 - 8.2).

Lithic Ustorthents, winter precipitation, typic, loamy-skeletal, mixed (calcareous), mesic

Lithic Ustorthents, winter precipitation, typic, loamy-skeletal, mixed (calcareous), mesic consists of shallow well drained soils that formed in residuum from sandstone. They are on steep to very steep talus and escarpment sideslopes with gradients of 40 to 120 percent. Mean annual precipitation is approximately 14 inches of which 65 percent seasonally occurs between the months of October and June. Mean annual air temperature is about 50°F. Average elevation is 6000 feet.

Colors are for dry soil unless otherwise noted.

A--0 to 2 inches; yellowish red (5 YR 5/6) very gravelly sandy loam, yellowish red (5 YR 4/6) moist; weak fine platy structure; slightly hard, very friable, nonsticky, nonplastic; few very fine roots; common very fine vesicular pores; 30 percent gravel and 10 percent cobble; neutral (pH 7.0); clear smooth boundary (1 to 3 inches thick).

C1--2 to 6 inches; red (2.5 YR 5/6) very gravelly loamy sand, red (2.5 YR 4/6) moist; single grain; loose, loose, nonsticky, nonplastic; few very fine roots; few very fine vesicular pores; 25 percent gravel and 15 percent cobble; neutral (pH 7.0); clear smooth boundary (4 to 9 inches thick).

C2--6 to 14 inches; yellowish red (5 YR 5/6) very gravelly sandy loam, yellowish red (5 YR 4/6) moist; slightly hard, loose, nonsticky, nonplastic; few very fine roots; few very fine tubular pores; 35 percent and 15 percent cobble; mildly alkaline (pH 7.4); abrupt irregular boundary (2 to 6 inches thick).

R--14 inches; hard unweathered sandstone bedrock.

Range in Characteristics: The mean annual soil temperature at a depth of 20 inches is approximately 54°F. The depth to bedrock ranges from 7 to 18 inches.

The A horizon has hue of 5 YR and 7.5 YR, value 5 and 6 dry and 3 or 4 moist, and chroma of 4 or 6. The texture of the fine earth fraction is loam and sandy loam. The rock fragment content ranges from 30 to 45 percent by volume. The reaction class ranges from neutral to mildly alkaline (pH 7.0 - 7.5).

The C horizon has hue of 2.5 YR and 5 YR, value 4 through 6 dry and 4 moist, and chroma of 6. The texture of the fine earth fraction is loamy sand, loam or sandy loam. The coarse fragment content ranges from 40 to 65 percent by volume. The reaction class ranges from mildly alkaline to moderately alkaline (pH 7.4 - 7.9).

Lithic Ustorthents, winter precipitation, moist, loamy, mixed (calcareous), mesic

Lithic Ustorthents, winter precipitation, moist, loamy, mixed (calcareous), mesic consists of shallow well drained soils that formed in residuum from sandstone. They are on nearly level to strongly sloping benches and terraces with slopes of 0 to 15 percent. Mean annual precipitation is about 16 inches of which 65 percent seasonally occurs between the months of October and June. Mean annual air temperature is about 46°F. Average elevation is 6500 feet.

Colors are for dry soil unless otherwise noted.

A--0 to 2 inches; reddish yellow (5 YR 6/6) very fine sandy loam, reddish brown (5 YR 4/4) moist; moderate medium platy structure; soft, very friable, nonsticky, nonplastic; few very fine roots; few very fine and fine vesicular and common very fine interstitial pores; strongly effervescent with disseminated lime; mildly alkaline (pH 7.4); clear smooth boundary (1 to 2 inches thick).

C1--2 to 7 inches; reddish yellow (5 YR 6/6) very fine sandy loam, yellowish red (5 YR 4/6) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; common very fine and few fine roots; common very fine interstitial and few very fine tubular pores; strongly effervescent with disseminated lime; mildly alkaline (pH 7.4); clear wavy boundary (5 to 6 inches thick).

C2--7 to 13 inches; reddish yellow (5 YR 6/8) gravelly very fine sandy loam, yellowish red (5 YR 5/6) moist; single grain; loose, nonsticky, nonplastic; few very fine roots; few very fine interstitial pores; 20 percent gravel; strongly effervescent with disseminated lime; mildly alkaline (pH 7.8); abrupt irregular boundary (6 to 7 inches thick).

R--13 inches; hard unweathered sandstone bedrock.

Range in Characteristics: The mean annual soil temperature at a depth of 20 inches is about 50°F. The depth to bedrock ranges from 7 to 13 inches.

The A horizon has hue of 5 YR, value 6 dry 4 moist and chroma of 6. The texture of the fine earth fraction is fine sandy loam or very fine sandy loam. The coarse fragment content ranges from 5 to 15 percent by volume. The reaction class ranges from mildly alkaline to moderate alkaline (pH 7.4 - 8.2).

The C horizon has a hue of 5 YR, value 6 dry and 5 moist, and chroma of 6 or 8. The texture of the fine earth fraction is fine sandy loam or very fine sandy loam. The coarse fragment content ranges from 5 to 20 percent by volume. The reaction class ranges from mildly alkaline to moderately alkaline (pH 7.8 - 8.2).

Typic Ustorthent, winter precipitation, loamy-skeletal, mixed (calcareous), mesic

Typic Ustorthents, winter precipitation, loamy-skeletal, mixed (calcareous), mesic consists of moderately deep and deep well drained soils that formed in colluvium from limestone and sandstone. They are on steep to very steep talus and escarpment side-slopes with slopes of 40 to 120 percent. Mean annual precipitation is approximately 14 inches of which 65 percent seasonally occurs between the months of October and June. Mean annual air temperature is about 50°F. Average elevation is 6000 feet.

Colors are for dry unless otherwise noted.

A--0 to 1 inch; light brown (7.5 YR 6/4) very stony sandy loam, brown (7.5 YR 4/4) moist; moderate fine platy structure; soft, very friable, nonsticky, nonplastic; few very fine roots; common very fine vesicular pores; 20 percent gravel, 5 percent cobble and 20 percent stone; strongly effervescent with disseminated lime; mildly alkaline (pH 7.8); abrupt smooth boundary (1 to 3 inches thick).

AC--1 to 9 inches; light brown (7.5 YR 6/4) very gravelly fine sandy loam, brown 7.5 YR 4/4) moist; weak very fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; common very fine and few fine roots; few very fine tubular pores; 30 percent gravel, 10 percent cobble and 15 percent stone; violently effervescent with disseminated lime; moderately alkaline (pH 7.9); clear wavy boundary (0 to 9 inches thick)

C--9 to 30 inches; reddish yellow (5 YR 7/6) extremely stony sandy loam, reddish yellow (5 YR 6/6) moist; single grain; loose, loose, nonsticky, nonplastic; few very fine and coarse roots; few very fine interstitial pores; violently effervescent with disseminated lime; moderately alkaline (pH 8.0) (20 to 57 inches thick).

R--30 inches; hard unweathered sedimentary bedrock.

Range in Characteristics: The mean annual soil temperature at a depth of 20 inches is about 54°F. The depth to bedrock ranges from 30 to more than 60 inches.

The A horizon has hue of 7.5 YR, value 5 or 6 dry and 4 moist, and chroma of 4. The texture of the fine earth fraction is sandy loam or fine sandy loam. The rock fragment content ranges from 55 to 65 percent by volume. The reaction class ranges from mildly alkaline to moderately alkaline (pH 7.8 - 8.4).

The C horizon has hue of 5 YR and 7.5 YR, value 5 or 6 dry and 4 moist, and chroma of 4. The texture of the fine earth fraction is sand loam or fine sandy loam. The rock fragment content ranges from 55 to 70 percent by volume. The reaction class is predominantly moderately alkaline (pH 8.0 - 8.2).

APPENDIX B

UNIVERSAL SOIL LOSS EQUATION TABLES

APPENDIX

The Universal Soil Loss Equation (USLE) is used in the quantitative evaluation of effective ground covers versus soil loss and this relationship to range management. Effective ground cover is defined by the following equation:

$$\text{Effective Ground Cover} = \frac{\text{Vegetation} + \text{Litter} + \text{Rock Fragments}}{\text{Veg.} + \text{Litter} + \text{Rock Fragments} + \text{Bare Soil}}$$

Rock Fragments + 3/4" to 24" (Exclusive of bedrock)

Once the means for the various parameters used in USLE are calculated (i.e., K factor, LS factor, average slope, etc.) and the range in effective ground covers known, the USLE model is run to quantify soil loss. There are several categories of soil loss that are depicted on the tables, they are:

- (1) Allowable Soil Loss (ASL): The maximum rate of soil loss that can occur while sustaining inherent site productivity. (Generates line between full capacity and potential capacity).
- (2) Current Soil Loss (CSL): The rate of soil loss occurring under existing conditions of effective ground covers.
- (3) Potential Soil Loss (PSL): The rate of soil loss that would occur under conditions of complete removal of the vegetation and litter portion of effective ground cover (maximum rate).
- (4) Natural Soil Loss (NSL): The rate of soil loss under conditions associated with climax category (minimum rate). The boundary between potential capability and no capability is the line of constant slope as determined at the point where ASL is equivalent to NSL. The use of relic areas where effective ground covers are maximized was ~~used~~ needed to determine NSL. When NSL exceeds ASL the lands must be classified as NC.

Of the nine soil mapping units used in the HTUL inventory, six were used in the USLE model. These units represent the accessible areas that livestock could conceivably use, and correspondingly the portion of the HTUL that will be impacted.

Mapping units 104, 176, and 177 represent units where the natural soil loss exceeds the allowable established for that unit. All three of these mapping units have been assigned a no capacity grazing designation. This is the result of:

(1) The mapping unit occupying slopes that are geologically unstable (mapping units 176 and 177).

(2) The soils are very shallow to bedrock, and support a sparse vegetative cover (mapping unit 104).

Mapping units 174, 175, and 178 are units where the natural soil loss will under certain conditions fall below the allowable. In most cases (mapping units 174 and 175), because of the dominance of very shallow soils and rock outcrop, the unit naturally loses more soil than the allowable established for it. However, there are portions of these units where moderately deep soils occur and the soil loss values approach acceptable levels. Until they do fall below the allowable, they are still classified as PC acres.

EROSION BY SLOPE-LENGTH AND COVER FACTOR
 SOIL: 104 LITHIC USTIC TORRIORTHENTS, W-P, L, M, (CAL), M, 0-15% SLOPES
 VEGETATION: CORA-1

R FACTOR = 25.00 PERCENT CANOPY COVER = .0
 K FACTOR = .44 SURFACE COVER TYPE = W
 P FACTOR = 1.00 EROSION UNITS = TONS/ACRE/YEAR
 STEP SUBFACTOR = 1.00 DEPRESSION STORAGE SUBFACTOR = 1.00

PERCENT EFFECTIVE GROUND COVER

0 5 10 15 20 25 30 35 40 45

COVER FACTOR

.451 .383 .327 .286 .252 .223 .193 .176 .156 .137

SLOPE SLOPE SLOPE-LENGTH
 PERCENT LENGTH FACTOR

EROSION RATES

1	125	.14	.69	.59	.50	.44	.39	.34	.30	.27	.24	.21
2	125	.21	1.04	.83	.76	.65	.58	.52	.46	.41	.36	.32
3	100	.29	1.44	1.22	1.04	.91	.80	.71	.63	.56	.50(1)	.44
4	100	.40	1.93	1.69(3)	1.44	1.26	1.11(2)	.98(4)	.87	.77	.69	.60
5	100	.53	2.63	2.23	1.91	1.67	1.47	1.30	1.15	1.03	.91	.80
6	100	.67	3.32	2.82	2.41	2.11	1.86	1.64	1.46	1.30	1.15	1.01
7	75	.71	3.52	2.99	2.55	2.23	1.97	1.74	1.55	1.37	1.22	1.07
8	75	.86	4.27	3.62	3.09	2.71	2.38	2.11	1.87	1.66	1.48	1.30
9	75	1.02	5.06	4.30	3.67	3.21	2.83	2.50	2.22	1.97	1.75	1.54
10	75	1.19	5.90	5.01	4.28	3.74	3.30	2.92	2.59	2.30	2.04	1.79
11	50	1.12	5.56	4.72	4.03	3.52	3.10	2.75	2.44	2.17	1.92	1.69
12	50	1.28	6.35	5.39	4.60	4.03	3.55	3.14	2.79	2.48	2.20	1.93
13	50	1.44	7.14	6.07	5.18	4.53	3.99	3.53	3.14	2.79	2.47	2.17
14	50	1.62	8.04	6.83	5.83	5.10	4.49	3.97	3.53	3.14	2.78	2.44
15	50	1.81	8.93	7.63	6.51	5.69	5.02	4.44	3.94	3.50	3.11	2.73

1. ALLOWABLE SOIL LOSS (ASL)
2. CURRENT SOIL LOSS (CSL)
3. POTENTIAL SOIL LOSS (PSL)
4. NATURAL SOIL LOSS (NSL)

EROSION BY SLOPE-LENGTH AND COVER FACTOR
 SOIL: 174 LITHIC USTIC TORRIORTHENTS, L, M, (CAL), M, 0-15% SLOPES
 VEGETATION: CORA-1

R FACTOR = 25.00 PERCENT CANOPY COVER = 25.0
 K FACTOR = .44 SURFACE COVER TYPE = W
 P FACTOR = 1.00 EROSION UNITS = TONS/ACRE/YEAR
 STEP SUBFACTOR = 1.00 DEPRESSION STORAGE SUBFACTOR = 1.00

PERCENT EFFECTIVE GROUND COVER

0 5 10 15 20 25 30 35 40 45

COVER FACTOR

-.356 -.306 -.265 -.234 -.210 -.188 -.169 -.152 -.136 -.121

EROSION RATES

SLOPE SLOPE SLOPE-LENGTH
 PERCENT LENGTH FACTOR

1	125	.14	.55	.47	.41	.36	.32	.29	.26	.23	.21	.19
2	125	.21	.82	.71	.61	.54	.49	.43	.39	.35	.31	.28
3	100	.29	1.14	.93	.85(3)	.75	.67	.60	.54(2)	.48(1)	.43	.39(4)
4	100	.40	1.57	1.35	1.17	1.03	.92	.83	.74	.67	.60	.53
5	100	.53	2.03	1.73	1.54	1.36	1.22	1.10	.99	.89	.79	.71
6	100	.67	2.62	2.26	1.95	1.72	1.55	1.39	1.25	1.12	1.00	.89
7	75	.71	2.73	2.39	2.07	1.83	1.64	1.47	1.32	1.19	1.06	.95
8	75	.86	3.37	2.89	2.51	2.21	1.99	1.73	1.60	1.44	1.29	1.14
9	75	1.02	3.99	3.43	2.97	2.63	2.36	2.11	1.90	1.71	1.53	1.36
10	75	1.19	4.66	4.01	3.47	3.06	2.75	2.46	2.21	1.99	1.78	1.58
11	50	1.12	4.39	3.77	3.26	2.88	2.59	2.32	2.08	1.87	1.68	1.49
12	50	1.28	5.01	4.31	3.73	3.29	2.96	2.65	2.38	2.14	1.91	1.70
13	50	1.44	5.64	4.85	4.20	3.71	3.33	2.98	2.68	2.41	2.15	1.92
14	50	1.62	6.34	5.45	4.72	4.17	3.74	3.35	3.01	2.71	2.42	2.16
15	50	1.81	7.09	6.09	5.28	4.66	4.18	3.74	3.36	3.03	2.71	2.41

1. ALLOWABLE SOIL LOSS (ASL)

2. CURRENT SOIL LOSS (CSL)

3. POTENTIAL SOIL LOSS (PSL)

4. NATURAL SOIL LOSS (NSL)

EROSION BY SLOPE-LENGTH AND COVER FACTOR
 SOIL: 175 LITHIC USTORTHERENTS, W-P, L, M, (CAL), M, O-15% SLOPES
 VEGETATION: PIED/JUOS/ARTR

R FACTOR = 40.00 PERCENT CANOPY COVER = 25.0
 K FACTOR = .42 SURFACE COVER TYPE = G
 P FACTOR = 1.00 EROSION UNITS = TONS/ACRE/YEAR
 STEP SUBFACTOR = 1.00 DEPRESSION STORAGE SUBFACTOR = 1.00

PERCENT EFFECTIVE GROUND COVER

0 5 10 15 20 25 30 35 40 45

COVER FACTOR

.394 .320 .261 .217 .182 .153 .128 .107 .089 .074

SLOPE SLOPE-LENGTH
 PERCENT LENGTH FACTOR

EROSION RATES

1	125	.14	.93	.75	.61	.51	.43	.36	.30	.25	.21	.17
2	125	.21	1.39	1.13	.92	.77	.64	.54	.45	.38	.31	.26
3	100	.29	1.92	1.56(3)	1.27	1.06	.89(2)	.75	.62	.52	.43(4)	.36
4	100	.40	2.65	2.15	1.75	1.46	1.22	1.03	.86	.72	.60	.50(1)
5	100	.53	3.51	2.85	2.32	1.93	1.62	1.36	1.14	.95	.79	.66
6	100	.67	4.43	3.60	2.94	2.44	2.05	1.72	1.44	1.20	1.00	.83
7	100	.82	5.43	4.41	3.60	2.99	2.51	2.11	1.76	1.47	1.23	1.02
8	75	.86	5.69	4.62	3.77	3.14	2.63	2.21	1.85	1.55	1.29	1.07
9	75	1.02	6.75	5.43	4.47	3.72	3.12	2.62	2.19	1.83	1.53	1.27
10	50	.97	6.42	5.21	4.25	3.54	2.97	2.49	2.09	1.74	1.45	1.21
11	50	1.12	7.41	6.02	4.91	4.08	3.42	2.88	2.41	2.01	1.67	1.39
12	50	1.28	8.47	6.88	5.61	4.67	3.91	3.29	2.75	2.30	1.91	1.59
13	50	1.44	9.53	7.74	6.31	5.25	4.40	3.70	3.10	2.59	2.15	1.79
14	50	1.62	10.72	8.71	7.10	5.91	4.95	4.16	3.48	2.91	2.42	2.01
15	50	1.81	11.98	9.73	7.94	6.60	5.53	4.65	3.89	3.25	2.71	2.25

1. ALLOWABLE SOIL LOSS (ASL)

2. CURRENT SOIL LOSS (CSL)

3. POTENTIAL SOIL LOSS (PSL)

4. NATURAL SOIL LOSS (NSL)

EROSION BY SLOPE-LENGTH AND COVER FACTOR
 SOIL: 176 TYPIC USTORTHERENTS, W-P, TYPICAL, L-SK, M-(CAL), M, 40-120% SLO
 VEGETATION: JUOS/ARTR

R FACTOR = 35.00 PERCENT CANOPY COVER = 25.0
 K FACTOR = .22 SURFACE COVER TYPE = W
 P FACTOR = 1.00 EROSION UNITS = TONS/ACRE/YEAR
 STEP SUBFACTOR = 1.00 DEPRESSION STORAGE SUBFACTOR = 1.00

		PERCENT EFFECTIVE GROUND COVER									
		50	55	60	65	70	75	80	85	90	95
		COVER FACTOR									
		.103	.095	.083	.072	.061	.050	.040	.031	.021	.012
SLOPE PERCENT	SLOPE-LENGTH FACTOR	EROSION RATES									
		40	50	60	70	80	90	100	110	120	130
40	40	3.00	6.65	5.85	5.11	4.44	3.76	3.08	2.46	1.91	1.29
50	40	11.27	9.37(3)	8.24	7.20	6.25	5.29(2)	4.34	3.47(4)	2.69	1.82(1)
60	40	14.64	12.17	10.71	9.36	8.12	6.88	5.64	4.51	3.49	2.37
65	35	15.26	12.69	11.16	9.75	8.46	7.17	5.88	4.70	3.64	2.47
70	35	16.80	13.97	12.29	10.74	9.31	7.89	6.47	5.17	4.01	2.72
75	35	13.29	15.21	13.38	11.69	10.14	8.59	7.04	5.63	4.37	2.96
80	30	18.28	15.20	13.37	11.63	10.13	8.59	7.04	5.63	4.36	2.96
85	30	19.58	16.28	14.32	12.51	10.86	9.20	7.54	6.03	4.67	3.17
90	30	20.82	17.31	15.23	13.31	11.54	9.78	8.02	6.41	4.97	3.37
100	25	21.12	17.56	15.45	13.50	11.71	9.92	8.13	6.50	5.04	3.42
110	25	23.03	19.15	16.85	14.72	12.77	10.82	8.87	7.09	5.50	3.72
120	25	24.75	20.58	18.10	15.82	13.72	11.63	9.53	7.62	5.91	4.00

1. ALLOWABLE SOIL LOSS (ASL)
2. CURRENT SOIL LOSS (CSL)
3. POTENTIAL SOIL LOSS (PSL)
4. NATURAL SOIL LOSS (NSL)

EROSION BY SLOPE-LENGTH AND COVER FACTOR
 SOIL: 176 LITHIC USTORTHERENTS, W-P, L-SK, M, (CAL), M, 40-120% SLOPES
 VEGETATION: JUOS/ARTR

R FACTOR = 35.00 PERCENT CANOPY COVER = 25.0
 K FACTOR = .24 SURFACE COVER TYPE = W
 P FACTOR = 1.00 EROSION UNITS = TONS/ACRE/YEAR
 STEP SUBFACTOR = 1.00 DEPRESSION STORAGE SUBFACTOR = 1.00

		PERCENT EFFECTIVE GROUND COVER									
		50	55	60	65	70	75	80	85	90	95
		COVER FACTOR									
		.108	.095	.083	.072	.061	.050	.040	.031	.021	.012
		EROSION RATES									
SLOPE PERCENT	SLOPE LENGTH	40	50	60	70	80	90	100	110	120	130
40	40	8.00	7.26	6.38	5.58	4.84	4.10	3.36	2.69	2.08	1.41
50	40	11.27	10.22	8.99	7.86	6.82	5.77	4.73	3.79	2.93	2.10
60	40	14.64	13.28	11.68	10.21	8.85	7.50	6.15	4.92	3.81	2.58
70	40	18.00	16.59	14.60	12.75	11.06	9.37	7.68	6.15	4.76	3.23
80	40	21.36	19.58	17.76	15.62	13.65	11.84	10.03	8.22	6.53	5.10
90	40	24.72	22.45	20.89	18.38	16.06	13.93	11.80	9.67	7.74	6.00
100	40	28.08	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67	7.74
110	40	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67
120	40	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80
40	50	11.27	10.22	8.99	7.86	6.82	5.77	4.73	3.79	2.93	2.10
50	50	14.64	13.28	11.68	10.21	8.85	7.50	6.15	4.92	3.81	2.58
60	50	18.00	16.59	14.60	12.75	11.06	9.37	7.68	6.15	4.76	3.23
70	50	21.36	19.58	17.76	15.62	13.65	11.84	10.03	8.22	6.53	5.10
80	50	24.72	22.45	20.89	18.38	16.06	13.93	11.80	9.67	7.74	6.00
90	50	28.08	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67	7.74
100	50	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67
110	50	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80
120	50	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93
40	60	14.64	13.28	11.68	10.21	8.85	7.50	6.15	4.92	3.81	2.58
50	60	18.00	16.59	14.60	12.75	11.06	9.37	7.68	6.15	4.76	3.23
60	60	21.36	19.58	17.76	15.62	13.65	11.84	10.03	8.22	6.53	5.10
70	60	24.72	22.45	20.89	18.38	16.06	13.93	11.80	9.67	7.74	6.00
80	60	28.08	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67	7.74
90	60	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67
100	60	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80
110	60	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93
120	60	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06
40	70	18.00	16.59	14.60	12.75	11.06	9.37	7.68	6.15	4.76	3.23
50	70	21.36	19.58	17.76	15.62	13.65	11.84	10.03	8.22	6.53	5.10
60	70	24.72	22.45	20.89	18.38	16.06	13.93	11.80	9.67	7.74	6.00
70	70	28.08	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67	7.74
80	70	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67
90	70	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80
100	70	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93
110	70	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06
120	70	44.88	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38
40	80	21.36	19.58	17.76	15.62	13.65	11.84	10.03	8.22	6.53	5.10
50	80	24.72	22.45	20.89	18.38	16.06	13.93	11.80	9.67	7.74	6.00
60	80	28.08	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67	7.74
70	80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67
80	80	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80
90	80	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93
100	80	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06
110	80	44.88	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38
120	80	48.24	44.88	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89
40	90	24.72	22.45	20.89	18.38	16.06	13.93	11.80	9.67	7.74	6.00
50	90	28.08	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67	7.74
60	90	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67
70	90	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80
80	90	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93
90	90	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06
100	90	44.88	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38
110	90	48.24	44.88	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89
120	90	51.60	48.24	44.88	41.52	38.16	34.80	31.44	28.45	25.45	23.03
40	100	28.08	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67	7.74
50	100	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80	9.67
60	100	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93	11.80
70	100	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06	13.93
80	100	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38	16.06
90	100	44.88	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89	18.38
100	100	48.24	44.88	41.52	38.16	34.80	31.44	28.45	25.45	23.03	20.89
110	100	51.60	48.24	44.88	41.52	38.16	34.80	31.44	28.45	25.45	23.03
120	100	54.96	51.60	48.24	44.88	41.52	38.16	34.80	31.44	28.45	25.45

1. ALLOWABLE SOIL LOSS (ASL)
2. CURRENT SOIL LOSS (CSL)
3. POTENTIAL SOIL LOSS (PSL)
4. NATURAL SOIL LOSS (NSL)

EROSION BY SLOPE-LENGTH AND COVER FACTOR
 SOIL: 177 USTIC TORRIORTHENTS-W-P-L-SK-M-(CAL), M-40-120X SLOPES
 VEGETATION: CORA-1

R FACTOR = 25.00 PERCENT CANOPY COVER = 25.0
 K FACTOR = .18 SURFACE COVER TYPE = W
 P FACTOR = 1.00 EROSION UNITS = TONS/ACRE/YEAR
 STEP SUBFACTOR = 1.00 DEPRESSION STORAGE SUBFACTOR = 1.00

PERCENT EFFECTIVE GROUND COVER

50 55 60 65 70 75 80 85 90 95

COVER FACTOR

.108 .095 .083 .072 .061 .050 .040 .031 .021 .012

SLOPE SLOPE SLOPE-LENGTH
 PERCENT LENGTH FACTOR

EROSION RATES

(86)

40	40	8.00	3.89	3.42	2.99	2.59	2.20	1.80	1.44	1.12	.76	.43
50	40	11.27	5.43(3)	4.82	4.21	3.65(2)	3.09(4)	2.54	2.03(1)	1.57	1.07(FC)	.61
60	40	14.64	7.12	6.25	5.47	4.74	4.02	3.29	2.64	2.04	1.38	.79
65	35	15.26	7.42	6.52	5.70	4.94	4.19	3.43	2.75	2.13	1.44	.82
70	35	16.80	8.16	7.13	6.27	5.44	4.61	3.78	3.02	2.34	1.59	.91
75	35	13.29	8.89	7.82	6.83	5.93	5.02	4.12	3.29	2.55	1.73	.99
80	30	18.28	8.88	7.81	6.83	5.92(PC)	5.02	4.11	3.29	2.55	1.73	.99
85	30	19.58	9.52	8.37	7.31	6.34	5.37	4.41	3.52	2.73	1.85	1.06
90	30	20.82	10.12	8.90	7.78	6.75	5.72	4.68	3.75	2.90	1.97	1.12
100	25	21.12	10.26	9.03	7.89	6.84	5.80	4.75	3.80	2.95	2.00	1.14
110	25	23.03	11.19	9.85	8.60	7.46	6.32	5.18	4.15	3.21	2.18	1.24
120	25	24.75	12.03	10.53	9.24	8.02	6.79	5.57	4.45	3.45	2.34	1.34

1. ALLOWABLE SOIL LOSS (ASL)

2. CURRENT SOIL LOSS (CSL)

3. POTENTIAL SOIL LOSS (PSL)

4. NATURAL SOIL LOSS (NSL)

EROSION BY SLOPE-LENGTH AND COVER FACTOR
 SOIL: 177 LITHIC USTIC TORRIORTHENTS, W-P, L-SK, M, (CAL), M, 40-120%
 VEGETATION: CORA-1

R FACTOR = 25.00 PERCENT CANOPY COVER = 25.0
 K FACTOR = .35 SURFACE COVER TYPE = W
 P FACTOR = 1.00 EROSION UNITS = TONS/ACRE/YEAR
 STEP SUBFACTOR = 1.00 DEPRESSION STORAGE SUBFACTOR = 1.00

PERCENT EFFECTIVE GROUND COVER

	50	55	60	65	70	75	80	85	90	95
	.108	.095	.083	.072	.061	.050	.040	.031	.021	.012

COVER FACTOR

SLOPE SLOPE-LENGTH
 PERCENT LENGTH FACTOR

EROSION RATES

40	40	8.00	7.56	6.65	5.81	5.04	4.27	3.50	2.80	2.17	1.47	EC	.84
50	40	11.27	10.65	9.37	8.18	7.10	6.02	4.93	3.94	3.06	2.07		1.18
60	40	14.64	13.83	12.17	10.63	9.22	7.81	6.40	5.12	3.97	2.69		1.54
65	35	15.26	14.42	12.68	11.08	9.61	8.15	6.68	5.34	4.14	2.80		1.60
70	35	16.30	15.88	13.96	12.20	10.58	8.97	7.35	5.88	4.56	3.09		1.76
75	35	18.29	17.28	15.20	13.28	11.52	9.76	8.00	6.40	4.96	3.36		1.92
80	30	18.28	17.27(3)	15.20	13.28	11.52	9.76	8.00(2)	6.40	4.96	3.36(4)		1.92(1)
85	30	19.58	18.50	16.23	14.22	12.34	10.45	8.57	6.85	5.31	3.60		2.06
90	30	20.82	19.67	17.31	15.12	13.12	11.11	9.11	7.29	5.65	3.83		2.19
100	25	21.12	19.96	17.56	15.34	13.31	11.27	9.24	7.39	5.73	3.88		2.22
110	25	23.03	21.76	19.14	16.73	14.51	12.29	10.08	8.06	6.25	4.23		2.42
120	25	24.75	23.39	20.57	17.97	15.59	13.21	10.83	8.66	6.71	4.55		2.60

1. ALLOWABLE SOIL LOSS (ASL)

2. CURRENT SOIL LOSS (CSL)

3. POTENTIAL SOIL LOSS (PSL)

4. NATURAL SOIL LOSS (NSL)

EROSION BY SLOPE-LENGTH AND COVER FACTOR
 SOIL: 178 USTIC TORRIORTHENTS, W-P, L-SK, M, (CAL), M, 15-40% SLOPES
 VEGETATION: CORA-1

R FACTOR = 25.00 PERCENT CANOPY COVER = 25.0
 K FACTOR = .13 SURFACE COVER TYPE = W
 P FACTOR = 1.00 EROSION UNITS = TONS/ACRE/YEAR
 STEP SUBFACTOR = 1.00 DEPRESSION STORAGE SUBFACTOR = 1.00

		PERCENT EFFECTIVE GROUND COVER									
		COVER FACTOR									
		50	55	60	65	70	75	80	85	90	95
		.108	.095	.083	.072	.061	.050	.040	.031	.021	.012

SLOPE PERCENT LENGTH	SLOPE-LENGTH FACTOR	EROSION RATES									
		15	18	20	22	23	24	25	26	28	30
(88)	75	1.08	1.27	1.51	1.77	1.90	2.03	2.08	2.37	2.67	2.99
	75	1.44	1.51	1.54	1.54	1.66	1.77	1.82	2.37	2.67	2.99
	75	1.72	1.77	1.77	1.77	1.77	1.77	1.77	2.37	2.67	2.99
	75	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.37	2.67	2.99
	65	2.01(3)	2.01	2.01	2.01	2.01	2.01	2.01	2.37	2.67	2.99
	65	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.37	2.67	2.99
	65	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.37	2.67	2.99
	65	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.67	2.99
	60	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.99
	60	2.99	2.99	2.99	2.99	2.99	2.99	2.99	2.99	2.99	2.99
	60	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13
	55	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51
	55	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
	50	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01
	50	4.13	4.13	4.13	4.13	4.13	4.13	4.13	4.13	4.13	4.13
	45	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49	4.49

1. ALLOWABLE SOIL LOSS (ASL)
2. CURRENT SOIL LOSS (CSL)
3. POTENTIAL SOIL LOSS (PSL)
4. NATURAL SOIL LOSS (NSL)

R FACTOR =	25.00	PERCENT CANOPY COVER =	25.0
K FACTOR =	.35	SURFACE COVER TYPE =	W
P FACTOR =	1.00	EROSION UNITS =	TONS/ACRE/YEAR
STEP SUBFACTOR =	1.00	DEPRESSION STORAGE SUBFACTOR =	1.00

[illegible]

1. ALLOWABLE SOIL LOSS (ASL)
2. CURRENT SOIL LOSS (CSL)
3. POTENTIAL SOIL LOSS (PSL)
4. NATURAL SOIL LOSS (NSL)

APPENDIX C

TERRESTRIAL ECOSYSTEM GLOSSARY

Terrestrial Ecosystem

Glossary

allowable soil loss: The maximum rate of soil loss that a soil can sustain without undergoing permanent degradation. The Tolerance Limit of soil loss.

aridic: A soil moisture regime that has no moisture available for plants for more than half the cumulative time that the soil temperature at 50cm is above 50°C, and has no period as long as 90 consecutive days when there is moisture for plants while the soil temperature at 50cm is continuously above 80°C. "Resource Conservation Glossary."

calcareous soil: Soil containing sufficient free calcium carbonate or magnesium carbonate to effervesce carbon dioxide visible when treated with cold 0.1 normal hydrochloric acid. "Resource Conservation Glossary"

cemented: Indurated; having a hard, brittle consistency because the particles are held together by cementing substances such as humus, calcium carbonate, or the oxides of silicon, iron, and aluminum. The hardness and brittleness persist even when wet. "Resource Conservation Glossary"

climate: The sum total of all atmospheric or meteorological influences, principally temperature, moisture, wind, pressure and evaporation, which combine to characterize a region and give it individually by influencing the nature of its land forms, soils, vegetation, and land use. "Resource Conservation Glossary"

climatic climax: Theoretical community toward which all successional development in a given region is tending. "Fundamentals of Ecology"

climax: A plant community of the most advance type capable of development under and in dynamic equilibrium with the prevailing environment. "Glossary of Soil Science Terms"

climosequence: A sequence of related soils that differ, one from the other, in certain properties primarily as a result of the effect of climate as a soil-forming factor. "Glossary of Soil Science Terms"

cobble: Rock fragments ranging in size from three to ten inches in diameter.

color, soil: A color designation system that specifies the relative degrees of three simple variables of color: hue, value, and chroma.

colluvial: (1) In geology, material consisting of alluvium in part and also containing angular fragments of the original rock; also talus and cliff debris; material of avalanches. (2) in soils, material that has moved downhill and has accumulated on lower slopes and/or at the bottom of the hill; moved downhill by the force of gravity and to some extent by frost action and local wash. Also called colluvium. "Glossary of Soil Science Terms"

concretion (soils): A local concentration of a chemical compound, such as calcium carbonate or iron oxide, in the form of an aggregate or nodule of varying size, shape, hardness, and color. "Resource Conservation Glossary"

cryptogams: Any plant reproducing sexually without forming seeds. Antonym of phanerogam. Daubenmire. "Plant Geography."

current soil loss: The rate of soil erosion occurring under existing conditions.

depth, effective soil: The depth of soil material that plant roots can penetrate readily to obtain water and plant nutrients; the depth to a layer that differs sufficiently from the overlying material in physical or chemical properties to prevent or seriously retard the growth of roots. "Resource Conservation Glossary"

desert pavement: The layer of gravel or stones left on the land surface in desert regions after the removal of the fine material by wind erosion "Resource Conservation Glossary"

diagnostic horizons: (As used in the Soil Classification System of the National Cooperative Soil Survey in the United States): Combinations of specific soil characteristics that are indicative of certain classes of soils. Those which occur at the soil surface are called epipedons, those below the surface diagnostic subsurface horizons. "Resource Conservation Glossary"

calcic horizon: A mineral soil horizon of secondary carbonate enrichment that is more than 15cm (6 inches) thick, has a calcium carbonate equivalent of more than 15 percent, and has at least 5 percent more calcium carbonate equivalent than the underlying C horizon.

cambic horizon: A mineral soil horizon that has a texture of loamy very fine sand or finer, has soil structure rather than rock structure, contains some weatherable minerals, and is characterized by the lateration of removal of mineral material as indicated by mottling or gray colors, stronger chromas or redder hues than in underlying horizons, or the removal of carbonates. The cambic

horizon lacks cementation or induration and has too few evidences of illuviation to meet the requirements of the argillic or spodic horizon.

ochric epipedon: A surface horizon of mineral soil that is too light in color, too high in chroma, too low in organic carbon, or too thin to be a plaggan, mollic, umbric, anthropic, or histic epipedon, or that is both hard and massive when dry.

ecosystem: A community, including all the component organisms, together with the environment, forming an interacting system. "Resource Conservation Glossary"

edaphic climax: The ultimate vegetation where substratal peculiarities are sufficiently pronounced to produce a self-perpetuating vegetation that differs from the climatic climax of the area. "Plant Communities (Daubermire)"

edaphic factor: A condition or characteristic of the soil (chemical, physical, or biological) which influences organisms. "Resource Conservation Glossary"

effective precipitation: That portion of the total precipitation which becomes available for plant growth. "Glossary of Soil Science Terms"

eolian soil material: Soil material accumulated through wind action. The most extensive areas in the United States are silty deposits (loess), but large areas of sandy deposits also occur. "Resource Conservation Glossary"

erodible: Susceptible to erosion.

erosion: (1) The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. (2) Detachment and movement of soil or rock fragments by water, wind, ice or gravity. The following terms are used to describe different types of water erosion. "Resource Conservation Glossary"

forage production: The amount of vegetation that is produced annually under the potential natural vegetation community and that is available and palatable to livestock or wildlife.

gravel: Rock fragments ranging in size from 2mm to three inches in diameter

herbaceous vegetation: As used in the UNESCO Vegetation Classification System, "Mainly composed of grasses, grasslike plants, and forbs."

herbage production: The total amount of herbaceous vegetation that is produced annually under the potential natural vegetation community measured to a height of 4.5 feet. This includes grasses, shrubs and trees.

hydrologic soil group: These groups are based on the intake of water at the end of long duration storms, after prior wetting and opportunity for swelling and without consideration of slope or the protection of vegetation.

There are four Hydrologic Soil Groups:

Group A (Very low runoff potential)

Group B (Low runoff potential)

Group C (Moderate runoff potential)

Group D (High runoff potential)

Group A: Consists of soils that have a very rapid infiltration rate even when thoroughly wetted. These soils have very rapid to rapid permeability rates.

Group B: Consists of soils that have a moderate to rapid infiltration rate when thoroughly wetted and a moderately rapid permeability rate.

Group C: Consists of soils that have a moderate to slow infiltration rate when thoroughly wetted and a moderate to slow permeability rate.

Group D: Consists of soils that have a very slow to slow rate of infiltration when thoroughly wetted and have a moderately slow to very slow permeability rates.

included soils: Soils that are not present in every delineation of the subject mapping unit.

infiltration rate: A soil characteristic determining or describing the maximum rate at which water can enter the soil under specified conditions, including the presence of an excess of water. It has the dimensions of velocity (i.e., $\text{cm}^3 \text{ cm}^{-2} \text{ sec}^{-1} = \text{cm sec}^{-1}$) (Formerly, the infiltration capacity.) "Glossary of Soil Science Terms"

indigenous: Born, growing, or produced naturally in a region or country;
native: "Resource Conservation Glossary"

K-factor: The Soil Erodibility Factor used in the Universal Soil Loss Equation which represents the capability of a soil surface to resist sheet erosion. It is a function of the physical and chemical properties of the soil.

lithic contact: A boundary between soil and continuous, coherent underlying rock that has a hardness of three or more (Mohs scale).

lithology: The study of rocks based on the macroscopic examination of samples. "Glossary of Soil Science Terms"

major soils: Soils that are present in significant extent in every delineation of the subject mapping unit. Component soils.

mesic: A soil temperature regime that has mean annual soil temperatures of 8°C or more but less than 15°C and more than 5°C difference between mean summer and mean winter soil temperatures at 50cm.

microclimate: (i) The climate condition of a small area resulting from the modification of the general climatic conditions by local differences in elevation or exposure. (ii) The sequence of atmospheric changes within a very small region. "Glossary of Soil Science Terms"

mineral soil: A soil consisting predominantly of, and having its properties determined predominantly by, mineral matter, usually containing less than 20 percent organic matter but sometimes containing an organic surface layer up to 30 centimeters thick. "Resource Conservation Glossary"

order: An indication of the intensity of soil mapping. Order one is very intense and order five is very general. Orders two, three, and four are of intermediate intensity.

parent material (soils): The unconsolidated, more or less chemically weathered mineral or organic matter from which the solum of soils has developed by pedogenic processes. The C horizon may or may not consist of materials similar to those from which the A and B horizons developed. "Resource Conservation Glossary"

ped: A unit of soil structure, such as an aggregate, crumb, prism, block, or granule, formed by natural processes. See clod. "Resource Conservation Glossary"

permeability, soil: (i) The ease with which gases, liquids, or plant roots penetrate or pass through a bulk mass of soil or a layer of soil. Since different soil horizons vary in permeability, the particular horizon under question should be designated. (ii) The property of a porous medium itself that relates to the ease with which gases, liquids, or other substances can pass through it. Previously, frequently considered the "k" in Darcy's law. The "K" in intrinsic permeability. "Glossary of Soil Science Terms"

pH, soil: The negative logarithm of the hydrogen activity of a soil. The degree of acid (of alkalinity) of a soil as determined by means of a glass, quinhydrone, or other suitable electrode or indicator at a specified moisture content or soil-water ration and expressed in terms of the pH scale. "Resource Conservation Glossary"

phase, soil: A subdivision of a soil taxon, usually a soil series or other unit of classification based on characteristics that affect the use and management of the soil but which do not vary sufficiently to differentiate it as a separate soil series. A variation in a property or characteristic, such as degree of slope, degree of erosion, content of stones, texture of the surface, etc. Phases of soil series are the major components of the soil mapping units shown on detailed soil maps in the United States. "Resource Conservation Glossary"

plant available water: The amount of water that a soil can hold that is available for plant use (generally between 1/3 bar and 15 bars of tension).

potential soil loss: The maximum amount of sheet erosion a soil can have. It assumes total removal of canopy, vegetation, and litter.

productivity soil: The capacity of a soil, in its normal environment, for producing a specified plant or sequence of plants under a specified system of management. The "specified" limitations are necessary since no soil can produce all crops with equal success nor can a single system of management produce the same effect on all soils. Productivity emphasizes the capacity of soil to produce crops and should be expressed in terms of yields. "Glossary of Soil Science Terms"

reaction, soil: The degree of acidity or alkalinity of a soil, usually expressed as a pH value. Descriptive terms commonly associated with certain ranges in pH are extremely acid, less than 4.5; very strongly acid, 4.5-5.0; strongly acid, 5.1-5.5; medium acid, 5.6-6.0; slightly acid, 6.1-6.5; neutral, 6.6-7.3; mildly alkaline, 7.4-7.8; moderately alkaline, 7.9-8.4; strongly alkaline, 8.5-9.0; and very strongly alkaline, more than 9.0. "Resource Conservation Glossary"

rock fragments: All fragments greater than 2mm. Includes gravel, cobble, and stone.

runoff: That portion of the precipitation on an area which is discharged from the area through stream channels. That which is lost without entering the soil is called surface runoff and that which enters the soil before reaching the stream is called groundwater runoff or seepage flow from groundwater. (In soil science "runoff" usually refers to the water loss by surface flow; in geology and hydraulics "runoff" usually includes both surface and subsurface flow.) "Glossary of Soil Science Terms"

sedimentary rock: A rock formed from materials deposited from suspension or precipitated from solution and usually being more or less consolidated. The principal sedimentary rocks are sandstones, shales, limestones, and conglomerates. "Glossary of Soil Science Terms"

seral: A plant community that does not represent the potential natural vegetation, but that is intermediate in the sequence of plant community successional stages.

series (vegetation): Series is a subdivision of subformation. This class includes additional specificity of physiognomy and structure of the vegetation. Series are characterized by an individual climax dominant species determined by height and percent foliar cover and regional distribution.

shrub: As used in the UNESCO Vegetation Classification System, "mainly composed of caespitose woody phanerophytes 0.5 to 5 meters tall."

skeletal: Rock fragments greater than 2mm in diameter make up more than 35 percent by volume of the whole soil in the control section.

soil classification: The systematic arrangement of soils into groups or categories on the basis of their characteristics. Broad groupings are made on the basis of general characteristics; subdivisions on the basis of more detailed differences in specific properties. The categories of the system used in the U.S. since 1966 are briefly discussed below. "Resource Conservation Glossary"

order: The category at the highest level of generalization in the soil classification system. The properties selected to distinguish the orders are reflections of the degree of horizon development and the kinds of horizons present.

suborder: This category narrows the ranges in soil moisture and temperature regimes, kinds of horizons, and composition, according to which of these is most important. Moisture and/or temperature or soil properties associated with them are used to define the suborders of the orders Alfisols, Mollisols, Oxisols, Ultisols, and Vertisols. Kinds of horizons are used for the order Aridisols, composition for the orders Histosols and Spodosols, and combinations for the orders Entisols and Inceptisols.

great group: The classes in this category contain soils that have the same kind of horizons in the same sequence and have similar moisture and temperature regimes. Exceptions to the horizon sequences are made for horizons near the surface that may get mixed or lost to erosion if plowed.

subgroup: The great groups are subdivided into subgroups that show the central properties of the great group, intergrade subgroups that show properties of more than one great group, and other subgroups for soils with a typical properties that are not characteristic of any great group.

family: Families are defined largely on the basis of physical and mineralogic properties of importance to plant growth.

Entisols: Soils that have no diagnostic pedogenic horizons. They may be found in virtually any climate on very recent geomorphic surfaces, either on steep slopes that are undergoing active erosion or on fans and floodplains where the recently eroded materials are deposited. They may also be on older geomorphic surfaces if the soils have been recently disturbed to such depths that the horizons have been destroyed or if the parent materials are resistant to alternation, as is quartz.

soil genesis: 1) The mode of origin of the soil with special reference to the processes or soil-forming factors responsible for the development of the solum or true soil from the unconsolidated parent material. 2) A division of soil science concerned with the origin of soil. "Resource Conservation Glossary"

soil structure: The combination or arrangement of primary soil particles into secondary particles, units, or peds (Table 4). The secondary units are characterized and classified on the bases of size, shape, and degree of distinctness into classes, types, and grades, respectively. "Resource Conservation Glossary"

stones: Rock fragments 10 to 24 inches in diameter.

surface layer: The uppermost part of the soil, or "A1" horizon.

surface soil: The uppermost part of the soil ordinarily moved in tillage or its equivalent in uncultivated soils, ranging in depth from about 5 to 8 inches. Frequently designated as the plow layer, the Ap layer, or the Ap horizon. "Resource Conservation Glossary"

texture, USDA: The relative proportions of sand, silt and clay as described by classes established by the USDA.

topographic climax: Wherever local topography, usually operating through microclimate, produces a distinctive vegetative climax. "Plant Communities (Daubenmire)"

ustic: A soil moisture regime that is intermediate between the aridic and udic regimes and common in temperate sub-humid or semiarid regions, or in tropical and subtropical regions with a monsoon climate. A limited amount of moisture is available for plants but occurs at times when the soil temperature is optimum for plant growth. "Resource Conservation Glossary"

value, color: The relative lightness or intensity of color and approximately a function of the square root of the total amount of light. One of the three variables of color. See Munsell color system, hue, and chroma. "Resource Conservation Glossary"

woodland: As used in the UNESCO Vegetation Classification System, "Composed of trees at least 5 meters tall with crowns not usually touching but with a coverage of at least 40 percent."

xeric: A soil moisture regime common to Mediterranean climates that have moist cool winters and warm dry summers. A limited amount of moisture is present but does not occur at optimum periods for plant growth. Irrigation or summer fallow is commonly necessary for crop production. "Resource Conservation Glossary"

APPENDIX D

SUMMARY OF PAGE TRANSECTS

Table 7

SUMMARY OF PACE TRANSECTS

	<u>Mapping Designation</u>	<u>Soil Unit</u>	<u>Percent Composition</u>		
			<u>Decreaser</u>	<u>Increaser</u>	<u>Invader</u>
P-1	9 - SPHA, SPCR, OPUN P → 20% PC 80% NC	175	14	28	58
P-2	9 - Gusa, Hija, OPUN P → 20% PC 80% NC	175	10	34	56
P-3	9 - Chvi, SPCR, OPUN P → NC	176	14	30	56
P-4	9 - Hija, SPCR, Gusa F → 20% PC 80% NC	175	6	42	52
P-5	9 - Stco, Hija, Gusa F → NC	175	56	22	22
P-6	9 - Polo, Stco, Boer G → NC	176	72	10	18
P-7	9 - Stco, SPCR, Gusa F → NC	175	46	36	18
P-8	12 - Cora, EPHE VP → NC	178	0	12	88
P-9	12 - Cora, SPCR, Atca P → NC	174	14	48	38
P-10	12 - Cora, EPHE, Hija P → NC	174	4	28	68
P-11	12 - Cora VP → NC	178	0	10	90
P-12	12 - Cora, Agut, Cemo P → 20% PC 80% NC	174	18	19	63
P-13	12 - Cora, LESQ, Qutu P → 20% PC 80% NC	174	14	19	67

	<u>Mapping Designation</u>	<u>Soil Unit</u>	<u>Percent Composition</u>		
			<u>Decreaser</u>	<u>Increaser</u>	<u>Invader</u>
P-14	12 - Cora, Gusa, Qutu P → 20% PC 80% NC	174	15	19	66
P-15	12 - Cora, Gusa, Qutu VP → 20% PC 80% NC	174	0	24	76
P-16	12 - Cora, Gusa, Cegr VP → 20% PC 80% NC	174	12	18	70
P-17	12 - Cora, EPHE, Artr P → NC	177	10	16	74
P-18	12 - Cora VP → NC	104	0	10	90
P-19	12 - Cora, Agut, Yuba VP → 20% PC 80% NC	174	0	12	88
P-20	12 - Cora, Hija, OPUN P → NC	104	4	48	48
P-21	12 - Cora, Stco, Artr P → NC	174	28	20	52
P-22	12 - Cora, PSOR, Agut VP → NC	104	0	14	86
P-23	12 - Cora, Poin, Cele F → NC	174	24	42	34
P-24	12 - Cora, Opec, Chna P → 80% PC 20% NC	178	12	10	78
P-25	12 - Cora, OPUN, SPHA VP → 20% PC 80% NC	174	2	18	80
P-26	12 - SPHA, Cora, OPUN P → 20% PC 80% NC	174	6	32	62

	<u>Mapping Designation</u>	<u>Soil Unit</u>	<u>Percent Composition</u>		
			<u>Decreaser</u>	<u>Increaser</u>	<u>Invader</u>
P-27	12 - Cora, Agut, OPUN VP → NC	104	0	12	88
P-28	12 - Cora, Hiri, Gusa P → 20% PC 80% NC	174	4	42	54
P-29	12 - Cora, Epvi P → 80% PC 20% NC	174	4	20	76
P-30	12 - Stco, Cora, Gusa VP → 20% PC 80% NC	174	30	34	36
P-31	12 - Cora, Spfl, Gusa VP → NC	104	0	36	64
P-32	12 - Cora, Eula, Gusa P → 80% PC 20% NC	178	28	10	62
P-33	12 - Cora, Atca, Yuba P → 80% PC 20% NC	178	14	14	72
P-34	12 - Cora, SPHA, Stsp P → 80% PC 20% NC	178	18	16	66
P-35	12 - Cora, Yuba, Epvi VP → NC	177	2	12	86
P-36	12 - Hija, Cora, OPUN P → 20% PC 80% NC	174	2	52	46
P-37	12 - Hija, Cora, OPUN P → 20% PC 80% NC	174	8	54	38
P-38	12 - Cora, Eula, Yuba VP → 80% PC 20% NC	178	2	12	86
P-39	12 - Cora, Spfl, Atca P → 80% PC 20% NC	178	6	20	74

APPENDIX E

RANGE PACE TRANSECTS

PACED TRANSECT

Range Allotment TUL Date 4-5-82 Transect No. 9-28-1
 Aerial Photo No. WPS 78135 9-28 Place Interval 2 By Robert Shannon
 Game Mgmt. - Vegetative Type 9 Slope 1 1/2
 Key Area - 175 Soil Sandstone - Supai Aspect 11/22

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1/2"		X.001
2 1/2-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Supai

Comments: 120 lb / acre

Area is about 3-5 Ha in size. Would be 6 if large enough area existed to give rest of unit is reclassified erosion & shallow soil.

Leaf Measurements (Vigor)

Species	Size
1	2.5
2	4.0
3	3.0
4	2.5
5	4.5
6	3.0
7	3.0
8	5.0
9	2.0
10	4.0
Tot	
Ave	4.0

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	4	10	14	14	X2=28
Inc.	2	26	28	28	X1/2=7
Inv.	2	56	58	58	X-1=58
Tot.	8	92	100		
Cool Seas.					-23

CONDITION AND TREND RATING

from Scorecard C TUL Dated 6-77

VEGETATION

Forage Cover Index 8
 Composition 14
 Vigor 3
 Total 25
 Condition Class P
 Current Trend →
 Trend Indicators -

SOIL STABILITY

Bare Soil Index 4
 Soil Disturbance 20
 Factor -
 Total 24
 Condition Class -
 Current Trend -

P1-9-SPHA SPEC OPUN

P → 20% PC
 80% NC

Summary of Hits

Hits, all Plants 8
 Hits, all Rock 2
 Litter 6
 Bare Soil 84
 Total 100
 Hits, Dec. + Inc 6
 Hits, Cool Sea -

Grass appears to be improving though vigor isn't too good.

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

LOOP MEASUREMENTS

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

RANGE COMPOSITION	
1	100%
2	100%
3	100%
4	100%
5	100%
6	100%
7	100%
8	100%
9	100%
10	100%
11	100%
12	100%
13	100%
14	100%
15	100%
16	100%
17	100%
18	100%
19	100%
20	100%
21	100%
22	100%
23	100%
24	100%
25	100%
26	100%
27	100%
28	100%
29	100%
30	100%
31	100%
32	100%
33	100%
34	100%
35	100%
36	100%
37	100%
38	100%
39	100%
40	100%
41	100%
42	100%
43	100%
44	100%
45	100%
46	100%
47	100%
48	100%
49	100%
50	100%
51	100%
52	100%
53	100%
54	100%
55	100%
56	100%
57	100%
58	100%
59	100%
60	100%
61	100%
62	100%
63	100%
64	100%
65	100%
66	100%
67	100%
68	100%
69	100%
70	100%
71	100%
72	100%
73	100%
74	100%
75	100%
76	100%
77	100%
78	100%
79	100%
80	100%
81	100%
82	100%
83	100%
84	100%
85	100%
86	100%
87	100%
88	100%
89	100%
90	100%
91	100%
92	100%
93	100%
94	100%
95	100%
96	100%
97	100%
98	100%
99	100%
100	100%

[illegible]

BROWSE CONDITION

[illegible]

Rock	3			
Tot. Dec.				
Tot. Inc.				
Tot. Inv.				
Hits All Plants				
Hits Dec. & Inc.				
Tot. Rock				2
Tot. Litter				
Bare Ground				87
Tot. Cool Season				



Pace Transect #1
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment TUL Date 4-6-82 Transect No. 9-28-2
 Aerial Photo No. 9-28 Place Interval 2 By Paul H. G. (S. 111.1)
 Game Mgmt. _____ Vegetative Type 9 Slope 15
 Key Area 175 Soil Supai Sandstone Aspect 15

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1"						X.001
2	1-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Supai

Comments: 150-250' Ponderosa
 Small pocket - 20%
 surrounded with bed
 rock! Plants pedistalled

Leaf Measurements (Vigor)

Species	Hit	
1	3	
2	3	
3	3.5	
4	3	
5	3.5	
6	2.5	
7	3	
8	3.5	
9	4	
10	3.5	
Tot	32.5	
Ave	3	

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	10	10	10	X2= 20
Inc.	8	26	34	34	X1/2= 8
Inv.	20	36	56	56	X-1= -2
Tot.			100		
Cool Seas.					-28

CONDITION AND TREND RATING

from Scorecard C TUL Dated 6-8
VEGETATION
 Forage Cover Index 11
 Composition 13
 Vigor 3
 Total 27
 Condition Class P
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 9
 Soil Disturbance 15
 Factor 24
 Total 24
 Condition Class P
 Current Trend →

P2-9 - Gusa, Hija, OPUN

P → 80% NC
 20% PC

Summary of Hits

Hits, all Plants 28
 Hits, all Rock 4
 Litter 2
 Bare Soil 66
 Total 100
 Hits, Dec. + Inc 8
 Hits, Cool Sea 28

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

LOOP MEASUREMENTS

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

☐ ☐ ☐ ☐ ☐

RANGE COMPOSITION

Class	Species	Hits	Tally	Total	Allowable
Dec.	Don		2	2	
10	Silky		8	3	
Inc.	Waco	4	14	14	
	LEVER	2	2	6	
	LEVER	2	2	2	
	LEVER	2	6	8	
	LEVER	2	2	2	
	SP41		2	2	
Inv.	Don	6	22	28	
	OPORD	6	4	10	
	Chvt	6	8	8	
	Chvt	2	2	2	
	Chvt	2	2	2	

BROWSE CONDITION

[illegible]



Pace Transect #2
Havasupai Traditional Use Lands



P-3

PACED TRANSECT

Range Allotment TUL Date 4-1-82 Transect No. 9-29-1
 Aerial Photo No. 9-29 Place Interval 1 By Shannon
 Game Mgmt. _____ Vegetative Type 9 Slope 4
 Key Area 176 Soil Talus Limestone Aspect NE-E

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1/4"		X.001
2 1/4-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Talus

Comments: Production 100-150 ACRE
on about 15 Acres. Timber
oil burn - prob up to 50% inc
Go up 40% talus slopes & prod
increases. but crown closed
increases. NC on talus slope

Leaf Measurements (Vigor)

Species	Spgr
1	5
2	6.5
3	7
4	6
5	6.5
6	4.5
7	4.5
8	5
9	4
10	5.5
Tot	54.5
Ave	5.5

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	2	12	14	14	X2=28
Inc.	6	24	30	30	X1/2=7.5
Inv.	36	20	56	56	X-1=56
Tot.	44	56	100		
Cool Seas.					-20.5

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
 VEGETATION TUL SOIL STABILITY
 Forage Cover Index 11 Bare Soil Index 22
 Composition 14 Soil Disturbance 23
 Vigor 4 Factor
 Total 29 Total 45
 Condition Class P Condition Class .. F
 Current Trend → Current Trend .. →
 Trend Indicators _____

P-39- Chvi, Spgr, OPUN
 P → NC

Summary of Hits

Hits, all Plants 44
 Hits, all Rock 8
 Litter 20
 Bare Soil 28
 Total 100
 Hits, Dec. + Inc 8
 Hits, Cool Sea . _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

LOOP MEASUREMENTS

[illegible]

COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

RANGE COMPOSITION

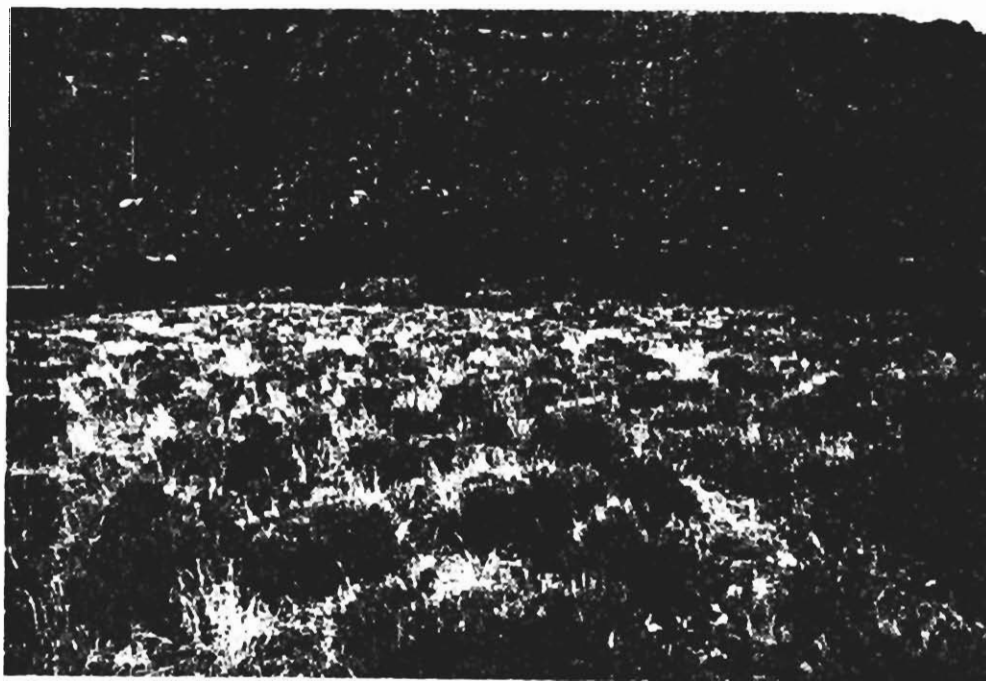
[illegible]

Chrys-
Chrysetharnus
viscidifolia

BROWSE CONDITION

[illegible]

Rock	8			
Tot. Dec.				
Tot. Inc.				
Tot. Inv.				
Hits All Plants				
Hits Dec. & Inc.	8			
Tot. Rock	8			
Tot. Litter	20			
Bare Ground	28			
Tot. Cool Season				



Pace Transect #3
Havasupai Traditional Use Lands

PACED TRANSECT

P4 (4)

Range Allotment TUL Date 4-7-82 Transect No. 9-29-3
 Aerial Photo No. 9-29 Place Interval 2 By Barton-Garrison
 Game Mgmt. _____ Vegetative Type 9 Slope 0-5%
 Key Area 175 Soil Supai Sandstone Aspect NE-E

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1/2"		X.001
2 1/2-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Supai

Comments: Prod-200* along transect
 but 1/2-1/3 of area will bring prod
 down to 100 #/ac

Leaf Measurements (Vigor)

Species	Spec
1	8
2	8.5
3	8
4	7
5	4
6	7
7	6 1/2
8	6
9	4 1/2
10	4
Tot	63.5
Ave	6.4

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Some Area

Approx 15 acres like this on this
 mesa

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	4	2	6	6	X2=12
Inc.	14	28	42	42	X1/2=10.5
Inv.	26	26	52	52	X-1=52
Tot.			100		
Cool Seas.					-29.5

CONDITION AND TREND RATING

from Scorecard C Dated 6-79

VEGETATION

Forage Cover Index 24
 Composition 13
 Vigor 4
 Total 41
 Condition Class F
 Current Trend →
 Trend Indicators

SOIL STABILITY

Bare Soil Index 15
 Soil Disturbance 15
 Factor 15
 Total 30
 Condition Class P
 Current Trend →

P4-9-Hija, Spec, Gusa

F → 80% NC
 20% PC

Summary of Hits

Hits, all Plants 44
 Hits, all Rock 0
 Litter 10
 Bare Soil 46
 Total 100
 Hits, Dec. + Inc 18
 Hits, Cool Sea

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., V-
 tation type, predominant vegetation, vegeta
 and soil score, and trend.

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

RANGE COMPOSITION

Class	Species	Hits	Tally	Total	Allowable
Dec.	Ac/a	114		4	
	Swamp		• 2	2	
Inc.	H/S	• 4	116	20	
	LPHS	• 2		2	
	Spr	• 8	112	20	
Inv.	GOSS	1112	• 8	20	
	OPUD	• 2	• 8	8	
	ALC	• 2	• 4	8	
	Chvt	• 6	• 6	12	
	Yusee	• 2		2	
	Yusee	• 2		2	

[illegible]

Rock	1		
Tot. Dec.			
Tot. Inc.			
Tot. Inv.			
Hills All Plants			
Hills Dec. & Inc.			
Tot. Rock			
Tot. Litter	1		10
Bare Ground	8 1/2		4 1/2
Tot. Cool Season			



Pace Transect #4
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment TUL Date 4-9-82 Transect No. 9-30-2
 Aerial Photo No. 9-30 Place Interval 2 By Baxter Sharrow
 Game Mgmt. _____ Vegetative Type 9 Slope 3
 Key Area 175 Soil Supai Sandstone Aspect E

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1/2"		X.001
2 1/2-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Supai Relic
Fossil Bay

NC

Comments: 300 #/AC

INACCESSIBLE AREA

Leaf Measurements (Vigor)

Species	Stco
1	11
2	9
3	11
4	11
5	8.5
6	10.5
7	10
8	9
9	11
10	7.5
Tot	98.5
Ave	9.8

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	2	54	56	56	X2=112
Inc.	2	20	22	22	X1/2=5.5
Inv.	6	16	22	22	X-1=-22
Tot.	10	90	100	100	
Cool Seas.					+95.5

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 5
 Composition 35
 Vigor 7
 Total 47
 Condition Class F
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 8
 Soil Disturbance 22
 Factor
 Total 30
 Condition Class P
 Current Trend →

P5-9- Stco, Hija, Gusa
F → NC

Summary of Hits

Hits, all Plants 10
 Hits, all Rock 2
 Litter 8
 Bare Soil 70
 Total 100
 Hits, Dec. + Inc. 4
 Hits, Cool Sea .

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., V-
 ation type, predominant vegetation, vegeta-
 and soil score, and trend.

[illegible]

	Sprout				Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

RANGE COMPOSITION

Class	Species	Hits	Tally	Total	Allowable
Dec.	Spruce	2	X X F E L	50	
	Fern		L	2	
Inc.	Hill	2	!! 10	10	
	E Pine		: : 6	8	
	StSP		:: 4	4	

Cohi
Atca
Eula
Opun
EPHE
Puer
Hidc
-ju.

[illegible][illegible]

	Guse	.. y	11: 10	16
	Ginc	.	y	y
	(UPUN)	2	2	y
Rock	{			
Tot. Dec.				
Tot. Inc.				
Tot. Inv.				
Hits All Plants				
Hits Dec. & Inc.				2
Tot. Rock				8
Tot. Litter		7		70
Bare Ground		X X X !:		
Tot. Cool Season				



Pace Transect #5
Havasupai Traditional Use Lands

PACED TRANSECT

P6

Range Allotment TUC Date 4-8-82 Transect No. 10-31-1
 Aerial Photo No. 10-31 Place Interval 2 By Shaw - Baxter
 Game Mgmt. _____ Vegetative Type 9 Slope 23
 Key Area 176 Soil _____ Aspect NE-E-NGO-E

Talus Slope

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1/2"		X.001
2 1/2-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Talus - southern portion of Fossil Bay

NC

Comments: INACCESSIBLE AREA

some forage on talus
Slopes - benches below are
about 50% rock to here from
camp.
Production 150-200%/acre

Leaf Measurements (Vigor)

Species	Polo
1	8
2	9
3	6
4	9
5	7
6	7
7	9
8	8
9	10
10	9
Tot	82
Ave	8.2

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits	Dots	Comp	ALLOW Comp	Comp Value
Dec.	12	60	72	72	X2=144
Inc.	2	8	10	10	X1/2=2
Inv.	10	3	13	15	X-1=-18
Tot.			100		
Cool Seas.					128

CONDITION AND TREND RATING

from Scorecard C Dated 6-79

VEGETATION

Forage Cover Index 19
 Composition 41
 Vigor 9
 Total 69
 Condition Class G
 Current Trend →
 Trend Indicators _____

SOIL STABILITY

Bare Soil Index 17
 Soil Disturbance _____
 Factor 18
 Total 35
 Condition Class P
 Current Trend →

P6 - 9 - Polo, Steo Boer
 G → NC

Summary of Hits

Hits, all Plants _____
 Hits, all Rock _____
 Litter _____
 Bare Soil _____
 Total _____
 Hits, Dec. + Inc. 14
 Hits, Cool Sea. _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., V, vegetation type, predominant vegetation, vegetation and soil score, and trend.

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

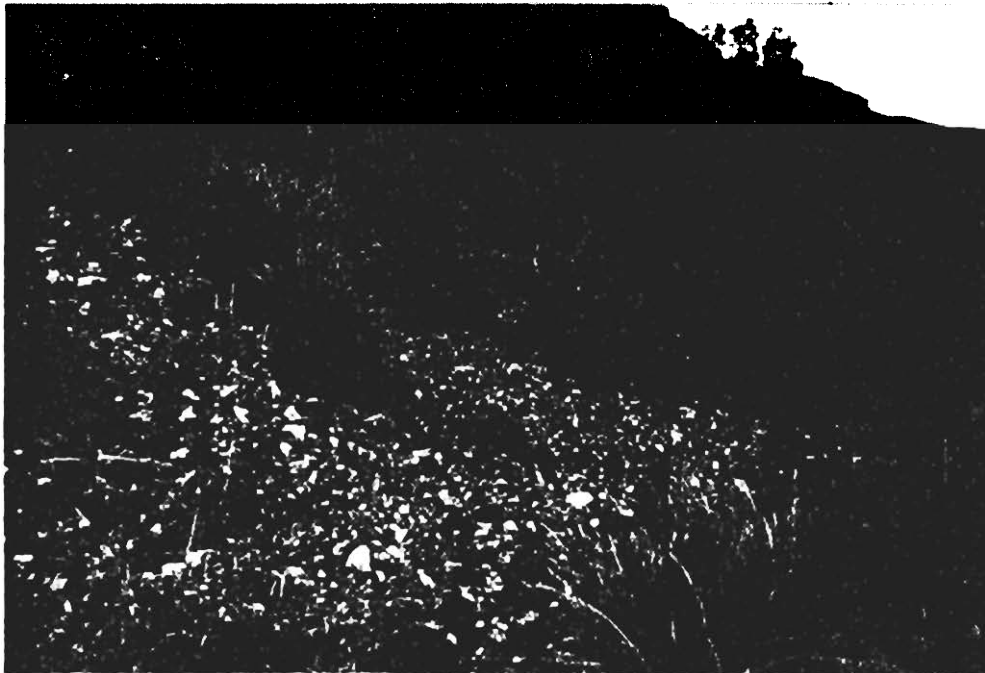
RANGE COMPOSITION

$$\begin{array}{l} \text{E} \\ \text{S} \\ \text{A} + \text{c} \end{array}$$

150⁺/acre

[illegible]

RANGE COMPOSITION					
Class	Species	Hits	Tally	Total	Allowable
Dec.	<i>Melospiza</i>	7	ME	7	
	<i>Sparo</i>	2	2	2	
	<i>Brewer</i>		11	12	
	<i>Sib.</i>		2	2	
Inc.	<i>Cohi</i>		2	2	
	<i>Flyc</i>		2	2	
	<i>Arc</i>		2	2	
	<i>Spgr</i>		2	2	
Inv.	<i>O'Hall</i>	2	2	4	
	<i>Gus.</i>	2	2	4	
	<i>Spgr</i>		2	2	
	<i>Alamo</i>	4		4	
	<i>Chwi</i>	2		2	
	<i>Rose</i>	2		2	
Rock					
Tot. Dec.		12	40	72	
Tot. Inc.		2	8	10	
Tot. Inv.		10	2	12	
Hits All Plants					
Hits Dec. & Inc.		14		50	
Tot. Rock		2		2	
Tot. Litter		12		12	
Bare Ground					
Tot. Cool Season					



Pace Transect #6
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment TUL Date 4-9-82 Transect No. 10-31-2
 Aerial Photo No. NPS-10-31 Place Interval 2 By Pat H. - S. M. J. W.
 Game Mgmt. _____ Vegetative Type 9 Slope 5-10%
 Key Area 175 Soil _____ Aspect NE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1/2"						X.001
2	1/2-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Supai S.S. Terrace

Southern portion of
Fossil BayNCComments: 350^{ft}/AC - 7Ac PatchHeavy WL Pellets on Moss

Leaf Measurements (Vigor)

Species	<u>170</u>	
1	<u>7</u>	
2	<u>17</u>	
3	<u>15</u>	
4	<u>14</u>	
5	<u>11</u>	
6	<u>11</u>	
7	<u>12</u>	
8	<u>12</u>	
9	<u>13</u>	
10	<u>10</u>	
Tot	<u>125</u>	
Ave	<u>12.5</u>	

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	<u>4</u>	<u>12</u>	<u>46</u>	<u>46</u>	<u>X2=92</u>
Inc.	<u>8</u>	<u>25</u>	<u>36</u>	<u>36</u>	<u>X1/2=9</u>
Inv.	<u>10</u>	<u>8</u>	<u>18</u>	<u>18</u>	<u>X-1=8</u>
Tot.	<u>22</u>	<u>78</u>	<u>100</u>		
Cool Seas.					<u>+83</u>

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 16
 Composition 33
 Vigor 10
 Total 59
 Condition Class F
 Current Trend →
 Trend Indicators _____

SOIL STABILITY

Bare Soil Index 12
 Soil Disturbance _____
 Factor 22
 Total 34
 Condition Class P
 Current Trend →

P7-9- Steo, Sper, Gusa
F → NC

Summary of Hits

Hits, all Plants 22
 Hits, all Rock 22
 Litter 0
 Bare Soil 56
 Total 120
 Hits, Dec. + Inc. 12
 Hits, Cool Sea. _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., V
 tation type, predominant vegetation, vegeta
 and soil score, and trend.

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

7.0
17.0
15.0
14.0
14.0
11.0
12.0
12.0
13.0
10.0

[illegible]

Class	Species	Hits	Tally	Total	Allowable
Dec.					
	stg	2	2	2	
	ceki			2	
	booy	2	2	2	
	orby			2	
Inc.					
	Hic	2	2	2	
	lsgr		2	2	
	sdg		1 12	12	
	FRPT	4	4	4	
	GRTE	2		2	
	W. 1				
Inv.					
	GRW	2	2	2	
	W. 2	2		2	
	W. 3				
	W. 4				
	W. 5				
	W. 6				
	W. 7				
	W. 8				
	W. 9				
	W. 10				
	W. 11				
	W. 12				
	W. 13				
	W. 14				
	W. 15				
	W. 16				
	W. 17				
	W. 18				
	W. 19				
	W. 20				
	W. 21				
	W. 22				
	W. 23				
	W. 24				
	W. 25				
	W. 26				
	W. 27				
	W. 28				
	W. 29				
	W. 30				
	W. 31				
	W. 32				
	W. 33				
	W. 34				
	W. 35				
	W. 36				
	W. 37				
	W. 38				
	W. 39				
	W. 40				
	W. 41				
	W. 42				
	W. 43				
	W. 44				
	W. 45				
	W. 46				
	W. 47				
	W. 48				
	W. 49				
	W. 50				
	W. 51				
	W. 52				
	W. 53				
	W. 54				
	W. 55				
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	W. 81				
	W. 82				
	W. 83				
	W. 84				
	W. 85				
	W. 86				
	W. 87				
	W. 88				
	W. 89				
	W. 90				
	W. 91				
	W. 92				
	W. 93				
	W. 94				
	W. 95				
	W. 96				
	W. 97				
	W. 98				
	W. 99				

PACED TRANSECT

Range Allotment _____ Date 4-12-82 Transect No. 11-305091
 Aerial Photo No. 11-30 Place Interval 2 By _____
 Game Mgmt. _____ Vegetative Type 12 Slope 27
 Key Area 178 Soil Coarsest in rocky down Aspect NE
Fossil Bay very little plot to west present

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class		Species						Tot
1	0-1/2"							X.001
2	1/2-2"							X.005
3	2-4"							X.049
4	4-6"							X.136
5	6-8"							X.267
6	8-10"							X.442
7	10-12"							X.600
8								
9								
10								
tot								
avg								

Limestone and sandstone talus slope
 mostly up Hornet shale and sandstone
 creek.

West side of Fossil Bay - NC

Shrub cover is sparse in area
 the slope dropping about 45° below
 Cora.

No perennial grasses present
 for a Vigor measurement.

Tortula only under shrub crown.

Comments: Some Poa bigelowii present
 and would have been a sample
 of dot taller were it not an
 annual. B. fr. in shade under Cora
Only perennial grass was 3
Sto. among a bulbar outcrop
20% Production

Leaf Measurements (Vigor)

Species		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

NOTHING
 TO MEASURE

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	0	0		X2=
Inc.	6	6	12		X1/2= 3
Inv.	46	48	88		X-1=-88
Tot.	46	54	100		
Cool Seas.					-85

CONDITION AND TREND RATING

from Scorecard C Dated 6-79

VEGETATION
 Forage Cover Index 8
 Composition 3
 Vigor 0
 Total 11
 Condition Class VP
 Current Trend →
 Trend Indicators

SOIL STABILITY
 Bare Soil Index 24
 Soil Disturbance 15
 Factor
 Total 39
 Condition Class P
 Current Trend →

P8-12 Cora EPHE

VP → NC

Summary of Hits

Hits, all Plants 46
 Hits, all Rock 20
 Litter 8
 Bare Soil 26
 Total 100
 Hits, Dec. + Inc. 6
 Hits, Cool Sea 1

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., V
 tation type, predominant vegetation, vegeta
 and soil score, and trend.

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

[illegible][illegible][illegible][illegible][illegible][illegible][illegible]



Pace Transect #8
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Date 3-82 Transect No. 11-29 5102
 Aerial Photo No. 11-29 Place Interval 2 By
 Game Mgmt. Vegetative Type 12 Blackbrush-Sper Slope 2°
 Key Area 174 Soil light gray, coarse sandy Aspect E
Fossil Bay Skating, No structure Location Map: Supai

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1"		X.001
2 1-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Leaf Measurements (Vigor)

Species	Vigor
1	3.5
2	7.0
3	4.5
4	4.0
5	7.0
6	5.5
7	7.5
8	5.5
9	7.5
10	6.0
Tot	56.0
Ave	5.5

Vigor on Sper species
good

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Some use of Atca shrubs.

Some wild life droppings pre-
the ground is dense as in the P.
area (Forster's).

Comments: Clouds and rain, 200% ave.
Thawed but not dropping zero,
in most of the area. Blackbrush.

Portula protecting most bare soil

Composition Summary

	Hits	Dots	Comp	ALLOW Comp	Comp Value
Dec.	6	8	14	14	X2=28
Inc.	2	46	48	48	X4=12
Inv.	12	26	38	38	X-1=35
Tot.	20	80	100	14	
Cool Seas.					+2

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 11
 Composition 18
 Vigor 4
 Total 33
 Condition Class P
 Current Trend →
 Trend Indicators
SOIL STABILITY
 Bare Soil Index 16
 Soil Disturbance
 Factor 22
 Total 38
 Condition Class P
 Current Trend →

P9-12 - Cora Sper Atca
P → NC

Summary of Hits

* Hits, all Plants 20
 Hits, all Rock 0
 Litter 36
 Bare Soil 44
 Total 100
 Hits, Dec. + Inc. 8
 Hits, Cool Sea.

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., ve-
 getation type, predominant vegetation, veget-
 and soil score, and trend.

[illegible]

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

FIRE RECORD					
Class	Species	Hits	Tally	Total	Allowable
Dec.	Orhy		2	2	
	Alca	6	6	12	
Inc.	Coccyz		12	12	10
	EPHF	2	8	10	
	H.L.		10	10	
	Spcc		16	16	
Inv.			12	25	28

[illegible][illegible]

Counts as knee ground-



Pace Transect #9
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Antelope Valley Date 4-13-82 Transect No. 1129-103
 Aerial Photo No. 11-24 Place Interval 2 By W.D. H. 11/82
 Game Mgmt. Vegetative Type 12 Riparian Slope 2°
 Key Area 174 Soil Aspect

Fossil Bay

BASAL AREA - Riparian or Aspen

Location Map:

Number or Size class	Species						Tot
1 0-1"							X.001
2 1-2"							X.005
3 2-4"							X.049
4 4-6"							X.136
5 6-8"							X.267
6 8-10"							X.442
7 10-12"							X.600
8							
9							
10							
tot							
avg							

Supai
 Erosion is slight where soils have tortula protection. There is litter protection under most Cora and most shrubs are on a 0-4" mound as opposed to a sharp pedestal. Soils without tortula show just faint erosion. Most drainages have intermittent gullies (about 1' deep), the lower ones in bedrock. Very few shrub pebbles.

Comments: 11-2-82 the Supai
 have been brown last year.
 The base of Cora

Leaf Measurements (Vigor)

Species	Vigor
1	7
2	6
3	5.5
4	4
5	5
6	8
7	7
8	5
9	5
10	5
Tot	60
Ave	5.1

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

The base of Cora
 is a ridge of about
 50-60 feet high. This is
 confined to small groups of trees.

Composition Summary

	Hits	Dots	Comp	ALLOW Comp	Comp Value
Dec.	0	4	4		X2= 8
Inc.	8	20	28		X1/2= 14
Inv.	22	70	92		X-1= -70
Tot.	30	94	100		
Cool Seas.					-53

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 11
 Composition 8
 Vigor 7
 Total 26
 Condition Class P
 Current Trend →
 Trend Indicators
SOIL STABILITY
 Bare Soil Index 11
 Soil Disturbance 23
 Factor
 Total 34
 Condition Class P
 Current Trend →

P10-12 - Cora, EPHE, Hija
 P→ NC

Summary of Hits

Hits, all Plants 30
 Hits, all Rock 10
 Litter 0
 Bare Soil 60
 Total 100
 Hits, Dec. + Inc. 8
 Hits, Cool Sea

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., vegetation type, predominant vegetation, veget and soil score, and trend.

[illegible]

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

Other species
infect:

- Gusta
- Atca
- Opau
- Yaba
- Agave
- Spradica

[illegible]

RANGE COMPOSITION					
Class	Species	Hits	Tally	Total	Allowable
Dec.					
	tree	()	.	7	
	cub			2-1-1	
Inc.	COTTONWOOD	.	:	0	
	PINE		:	: :	
	BIRCH		:	: : *	
	Spruce		:	: : *	
				1 -	
Inv.	L ELLIPTICAL CORN	X .	XX:	6*	
Rock					
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
	Hits All Plants				
	Hits Dec. & Inc.				
	Tot. Rock	I		" "	
	Tot. Litter				
	Bare Ground	□		18	
	Tot. Cool Season X's	XA:		49	

4 Courts As "Bad Ground"



Pace Transect #10
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Harrison Date 6-79 Transect No. 12-20-201
 Aerial Photo No. 11-29 Place Interval 2 By VP
 Game Mgmt. 178 Vegetative Type Coarse to medium, calcareous Slope 24%
 Key Area Fossil Bay Soil Coarse to medium, calcareous Aspect Talus

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1/2"		X.001
2 1/2-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Leaf Measurements (Vigor)

Species	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

This slope appears to be typical of the Coarse/Limestone talus slopes where black brush dominates. All grasses are fairly well killed from the top of the slope, and are not found in the rocky drainages. Only sparse but not there. The down slope of the talus is not so much as some steeper slopes.

Comments: To Coarse to medium, calcareous talus. Well developed. No talus.

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	0	0		X2=
Inc.	2	1	0		X1/2= 3
Inv.	20	20	20		X-1=
Tot.	22	21	100		
Cool Seas.					-77

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 8
 Composition 2
 Vigor 0
 Total 10
 Condition Class VP
 Current Trend →
 Trend Indicators →
SOIL STABILITY
 Bare Soil Index 17
 Soil Disturbance 15
 Factor 34
 Total 34
 Condition Class 10
 Current Trend →

P11-12 - Cora.
 VP → NC

Summary of Hits

Hits, all Plants 2
 Hits, all Rock 40
 Litter 0
 Bare Soil 34
 Total 100
 Hits, Dec. + Inc 2
 Hits, Cool Sea 1

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

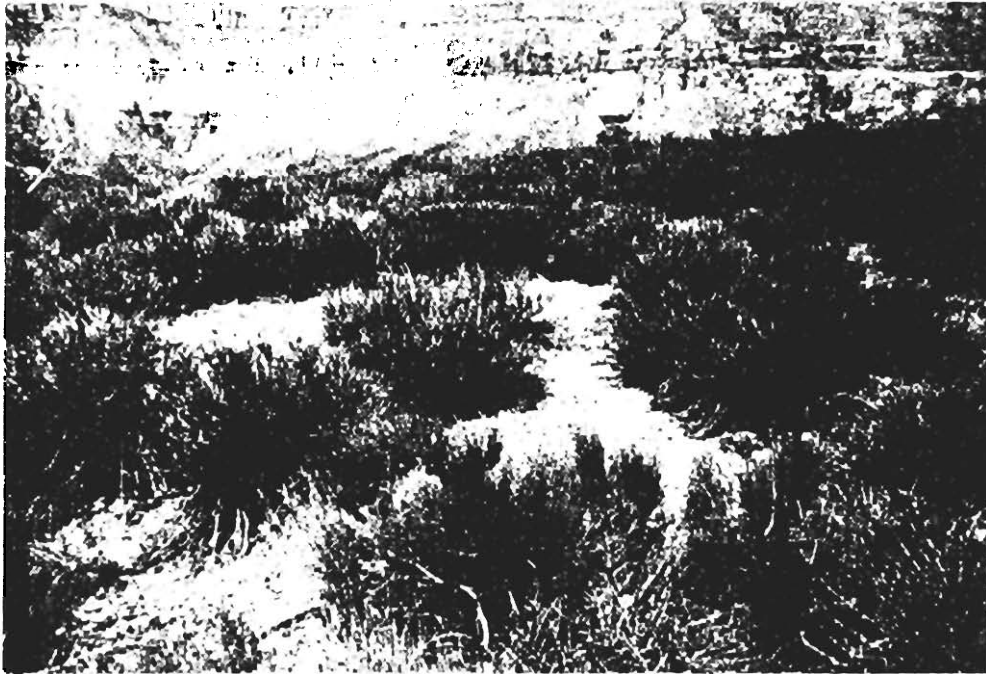
TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetative and soil score, and trend.

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

Also present
296 Lepidob.
at all stations.
Lepidob.
Terns
Nannodroma
Stern
Puffin

[illegible][illegible]



Pace Transect #11
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment _____ Date 10-7-79 Transect No. Tahuta Terrace Top #1
 Aerial Photo No. NO PHOTO Place Interval 2 By _____
 Game Mgmt. _____ Vegetative Type Open Oak Forest Slope 10%
 Key Area 174 Soil yellowish brown clay Aspect SE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1"						X.001
2	1-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Superior creek with shallow
 sand and rock. Deep.
 Some horse dung and trails
 present but not numerous
 This is very typical of the
 non-slickrock portion of
 Tahuta Terrace. Also
 present are not h. t. w. b.
 transects: Ptpa, Ltr, Yusa,
 Direct Palor, Shadler, p. 50/100

Comments: _____

The following were
 were _____

Below this ledge is about 1 acre of
 obvious sand dunes and shrubs

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	1	12	12	18	X2=36
Inc.	5	14	19	19	X1/2=5
Inv.	11	52	63	63	X-1=6
Tot.	22	78	100		
Cool Seas.					-22

Leaf Measurements (Vigor)

Species	_____	_____
1	3	
2	3	
3	3	
4	3	
5		
6	2	
7	2	
8		
9		
10		
Tot	425	
Ave	42.5	

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 15
 Composition 14
 Vigor 2
 Total 31
 Condition Class P
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 12
 Soil Disturbance _____
 Factor 15
 Total 27
 Condition Class P
 Current Trend →

P12-12-Cora, Agut Cemo
 P → 80% NC

Summary of Hits

Hits, all Plants 22
 Hits, all Rock 13
 Litter 4
 Bare Soil 58
 Total 100
 Hits, Dec. + Inc. 11
 Hits, Cool Sea. _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no.,
 tation type, predominant vegetation, vege
 and soil score, and trend.

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

Class	Species	Hrs.	Tally	Total	Allowable
Dec.	Cowbird	1	1	1	
	Robin	2	2	2	
	Flync	2	2	0	
Inc.	Thrush	2	2	2	
	Wren	2	2	10	
	1		1	2	
	Gato	1	4	5	
Inv.	Cardinal	1	4	5	
	Agout	6	7		
	Robin	2	4		
	Grackl	2	4		
	Indigo	2	4		

[illegible]

is (must) as bare given



Pace Transect #12
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment

Hawes Gulch

Date

4/27/82

Transect No.

14-9 Step 1

Aerial Photo No.

14-9

Place Interval

2

By

D. Sharrow

Game Mgmt.

Vegetative Type

Black brush-shrub

Slope

5%

Key Area

174

Soil

6" deep, gr. fine sandy loam, calcareous, very shallow

Aspect

N 40 E

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1 0-1"							X.001
2 1-2"							X.005
3 2-4"							X.049
4 4-6"							X.136
5 6-8"							X.267
6 8-10"							X.442
7 10-12"							X.600
8							
9							
10							
tot							
avg							

Tortula found mostly under the protection of shrubs. 1" plants pred. stated 4.6. Old horse dung and tracks present but not numerous. Grass plants, Stipa sp. and Stob. are found under shrubs, few are present and they're low in the grass. 70-80% Rock underfoot in the area.

Comments: Road cut near

2010 % A fine gravel road

crosses the road near

about 50% of the bare soil.

Trailing in the tortula

notable - the low accessible

ledges below this one.

Leaf Measurements (Vigor)

Species	St. asp.
1	2.5
2	8.5
3	5.0
4	3.0
5	6.0
6	3.5
7	9.0
8	8.0
9	6.5
10	4.5
Tot	56.5
Ave	5.6

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	4	10	14	14	X2=28
Inc.	3	16	19	19	X1/2=5
Inv.	19	43	67	67	X-1=-67
Tot.	26	74	100		
Cool Seas.					-34

CONDITION AND TREND RATING

from Scorecard

C

Dated

6-79

VEGETATION

Forage Cover Index

9

Composition

12

Vigor

3

Total

24

Condition Class

P

Current Trend

→

Trend Indicators

SOIL STABILITY

Bare Soil Index

8

Soil Disturbance

Factor

14

Total

22

Condition Class

P

Current Trend

→

P 13-12 - Cora LESQ Qutu

P →

20% PC

80% NC

Summary of Hits

Hits, all Plants

26

Hits, all Rock

4

Litter

0

Bare Soil

70

Total

100

Hits, Dec. + Inc

7

Hits, Cool Sea

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

[illegible]

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

Class	Species	Hits	Tally	Total	Allowable
Dec.	Csg	2	2	4	
	SLG		2	2	
	EPIC	2	2	4	
	Cume		4	4	
Inc.	Cum	2	2	10	
	Thon		4	4	
	casto	1	4	5	
Inv.	Guss		2	2	
LES	Ball		4	10	
	Csg	2	2	34	
	Rafa	6	4	10	
	Man				
	CABT		2		

[illegible]

CAST-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-1040-1041-1042-1043-10

Н. С. Савицкий



Pace Transect #13
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment TUL Date 4-29-82 Transect No. 2
 Aerial Photo No. 12-33 Place Interval 2 By D. S. Smith
 Game Mgmt. Vegetative Type Cora Gusg Ruten Slope 3%
 Key Area 174 Soil granitic, calcareous, shall 17" deep Aspect SE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1"						X.001
2	1-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Supraterrace Homilecyn

This is a somewhat protected pocket where wind blown soil accumulates. Shrub covered dunes 4' high are common. Gravel covered pits are common among the dunes and all drain out to beach. Rocks in this basin, much more on the surrounding terraces.

Comments: The...

Leaf Measurements (Vigor)

Species	Stem	
1	5	
2	7	
3	5	
4	5	
5	6	
6	3	
7	7	
8	3	
9	1	
10	1	
Tot	53	
Ave	5.3	

CROWN DENSITY (ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

There are... plants...
 These are...
 Forage...
 This area...
 Most...
 Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	4	11	15	15	X2=30
Inc.	7	12	19	19	X1/2=5
Inv.	22	44	66	66	X-1=66
Tot.	33	67	100		
Cool Seas.					-31

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
 VEGETATION Forage Cover Index 15 SOIL STABILITY Bare Soil Index 12
 Composition 12 Soil Disturbance
 Vigor 2 Factor 12
 Total 29 Total 24
 Condition Class P Condition Class P
 Current Trend → Current Trend →
 Trend Indicators

P14-12-Cora Gusg Ruten
 P → 20% PC
 80% NC

Summary of Hits

Hits, all Plants 33
 Hits, all Rock 8
 Litter 2
 Bare Soil 57
 Total 100
 Hits, Dec. + Inc 11
 Hits, Cool Sea

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com. position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

LOOP MEASUREMENTS

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

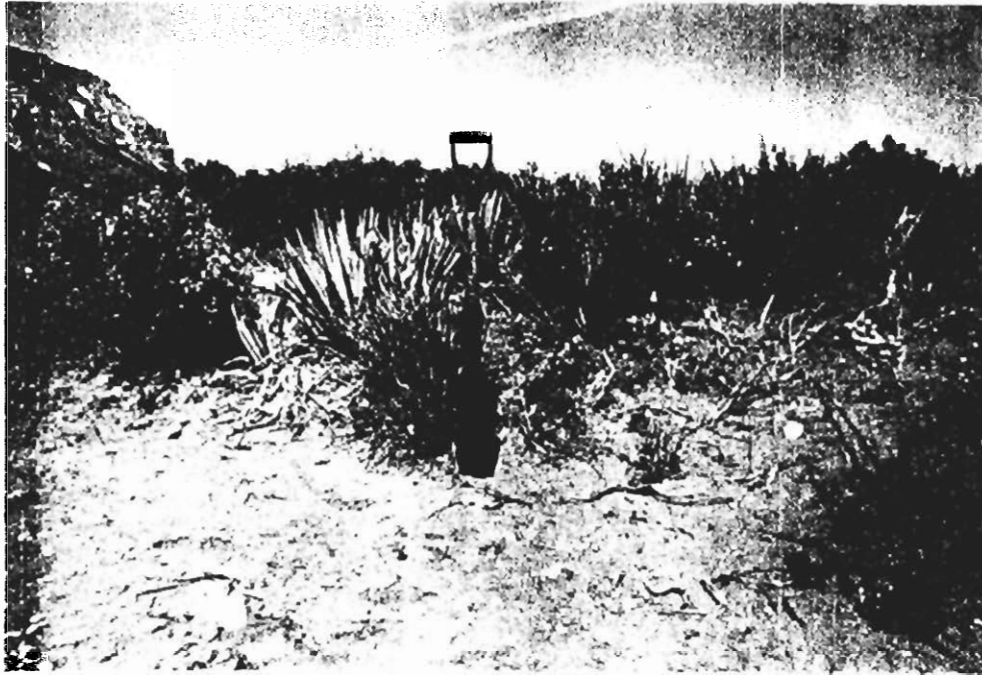
RANGE COMPOSITION

Class	Species	Hits	Tally	Total	Allowable
Dec.	Siberian	1	1	1	
	Foxglove	4	4	4	
	Gayl	4	7	10	
Inc.	Cornflower	3	3	16	
	Thyme	1	3	4	
	Rutabaga	3	2	5	
Inv.	Cornflower	Est: 15	SA: 126	11	
	Thyme	2	3	5	
	Rutabaga		1	8	
	Yarrow	2	2	2	
	Chamomile		1	1	
	Cornflower	1	3	4	
	Yarrow	1	2	3	
Rock	Aster			1	
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.					
Tot. Rock				8	
Tot. Litter				51	
Bare Ground					
Tot. Cool Season				6	

BROWSE CONDITION

[illegible]

crates as have given



Pace Transect #14
Havasupai Traditional Use Lands

2000



PACED TRANSECT

Range Allotment Haverdigh TUL Date 4-28-82 Transect No. 12-33-Sub 2
Aerial Photo No. 12-33 Place Interval 0 By STW
Game Mgmt. Vegetative Type Grass-Brush-Corn Slope 1-4%
Key Area 174 Soil Gravelly, Sand, sandy clay Aspect N
not calcareous Very shallow 5" Location Map

BASAL AREA - Riparian or Aspen

Number or Size class		Species						Tot
1	0-½"							X.001
2	½-2"							X.005
3	2-4"							X.049
4	4-6"							X.136
5	6-8"							X.267
6	8-10"							X.442
7	10-12"							X.600
8								
9								
10								
tot								
avg								

Leaf Measurements (Vigor)

Species		
1		
2		
3		10
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

CROWN DENSITY
(ASPEN AND RIPARIAN)

			Total
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Tot			
Ave			

CONDITION AND TREND RATING

from Scorecard C Dated 6-79

VEGETATION

Forage Cover Index	<u>8</u>
Composition	<u>5</u>
Vigor	<u>0</u>
Total	<u>13</u>
Condition Class	<u>VP</u>
Current Trend	<u>→</u>
Trend Indicators	

SOIL STABILITY

Bare Soil Index 8
Soil Disturbance
Factor 14
Total 22
Condition Class . . P
Current Trend . . →

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	0	0	0	$X2 = 0$
Inc.	5	18	24	24	$X\frac{1}{2} = 6$
Inv.	22	54	76	76	$X-1 = -76$
Tot.	27	72	100		
Cool Seas.					-70

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetative cover, and soil score, and trend.

R-3 2200-18
(Rev. 3/78)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	26	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

[illegible][illegible]

Countess de Beau-mont



Pace Transect #15
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Havasupai TNL Date 4-27-82 Transect No. 12-33 5403
 Aerial Photo No. 12-33 Place Interval 2 By D. Searles
 Game Mgmt. _____ Vegetative Type Conifer Slope _____
 Key Area 174 Soil fine, brown, calcareous, shallow, 10-15 cm Aspect SE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1/2"		X.001
2 1/2-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Super Bench 140m canyon.
 A very few grasses present
 in the bench. Some others, like
 P. sp. and S. sp. are
 present in the bench. They had
 been growing to the top of the
 bench and were visible
 from the bench. The bench
 was surrounded by the rock.

Comments:

Leaf Measurements (Vigor)

Species	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	12	12	12	X2=24
Inc.	4	14	18	18	X1/2=4.5
Inv.	12	58	70	70	X-1=-70
Tot.	16	64	100		
Cool Seas.					-41.5

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 5
 Composition 11
 Vigor 0
 Total 16
 Condition Class VP
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 7
 Soil Disturbance _____
 Factor 15
 Total 22
 Condition Class P
 Current Trend →

P16-12-Cora Gusa Cogr
 VP → 20% PC
 80% NC

Summary of Hits

Hits, all Plants 16
 Hits, all Rock 12
 Litter 0
 Bare Soil 72
 Total 100
 Hits, Dec. + Inc 4
 Hits, Cool Sea _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com. position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Ve-
 getation type, predominant vegetation, vegetati
 and soil score, and trend.

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

Class	Species	Hits	Tally	Total	Allowable
Dec.	Coot		6	6	
	Alma		6	6	
Inc.	Coot	2	8	10	10
	Alma		4	4	
	Auto	2	2	2	
Inv.	Coot	8	44	48	
	Alma	2	14	14	
		2	2	2	
		2	4	4	
		1	4	4	

[illegible]

* Count's as bare ground



Pace Transect #16
Havasupai Traditional Use Lands



PACED TRANSECT

Range Allotment TUL Date 1-15-72 Transect No. 12-1000
Aerial Photo No. _____ Place Interval 2 By 12-1000
Game Mgmt. _____ Vegetative Type 12 Slope 2
Key Area 178 ~~178~~ Soil _____ Aspect _____

BASAL AREA - Riparian or Aspen

Number or Size class		Species						Tot
1	0-½"							X.001
2	½-2"							X.005
3	2-4"							X.049
4	4-6"							X.136
5	6-8"							X.267
6	8-10"							X.442
7	10-12"							X.600
8								
9								
10								
tot								
avg								

Location Map:

lower 1/3 of the stone
is not available in determining
the true diameter of the
stone. The contact the
top of the metal is year round.
The stone is not a perfect
circle. The surface is not
smooth to be a perfect circle.
The surface is disturbed by

Leaf Measurements (Vigor)

Species	Ratio	
1	3	
2	2.5	
3	3	
4	3	
5	2.5	
6	1.5	
7	2.0	
8	2.5	
9	2.5	
10	3.5	
Tot	25.0	
Ave	2.5	

**CROWN DENSITY
(ASPEN AND RIPARIAN)**

			Total
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Tot			
Ave			

Comments:

[illegible]

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	2	6	0	10	X2=
Inc.	5	12	15	25	X½=
Inv.	15	25	75	75	X-1=
Tot.	20	25	100	100	
Cool Seas.					-50

CONDITION AND TREND RATING

from Scorecard C Dated 6-79

VEGETATION

Forage Cover Index	<u>11</u>
Composition	<u>7</u>
Vigor	<u>1</u>
Total	<u>21</u>
Condition Class	<u>0</u>
Current Trend	<u>→</u>
Trend Indicators	

SOIL STABILITY

Bare Soil Index 17
Soil Disturbance _____
Factor 19
Total 36
Condition Class . . P
Current Trend . . →

Summary of Hits

Hits, all Plants	_____
Hits, all Rock	_____
Litter	_____
Bare Soil	_____
Total	_____
Hits, Dec. + Inc	_____
Hits, Cool Sea .	_____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

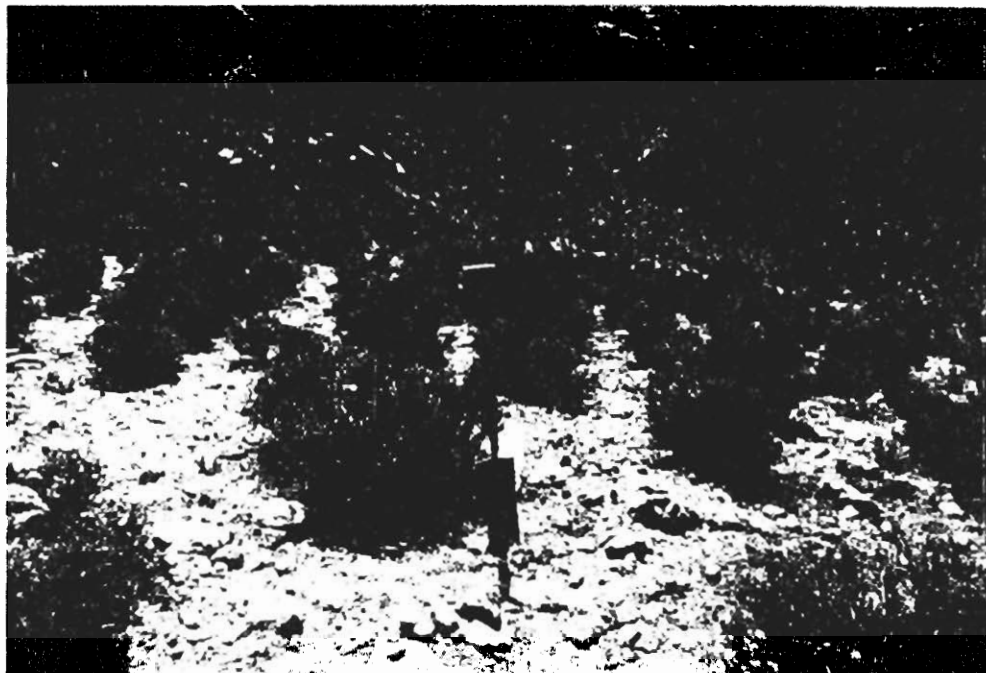
R-3 2200-18
(Rev. 3/78)

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

[illegible][illegible]

Rock	2					
Tot. Dec.						
Tot. Inc.						
Tot. Inv.						
Hits All Plants						
Hits Dec. & Inc.						
Tot. Rock						
Tot. Litter						
Bare Ground						
Tot. Cool Season						



Pace Transect #17
Havasupai Traditional Use Lands



Pace Transect #13
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Havasupai TUL Date 5-3-82 Transect No. 7-022 Stn 1
 Aerial Photo No. 7-022 Place Interval 2 By D. Shavran
 Game Mgmt. _____ Vegetative Type Cora-Guth Slope 2%
 Key Area 174 Soil sandy compact - brown Aspect SW

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1 0-1"							X.001
2 1-2"							X.005
3 2-4"							X.049
4 4-6"							X.136
5 6-8"							X.267
6 8-10"							X.442
7 10-12"							X.600
8							
9							
10							
tot							
avg							

Leaf Measurements (Vigor)

Species	Sihy	Stco
1	8	6.5
2	6.5	8.5
3	8	8.5
4	5	6.5
5	3.5	
6	3	
7		
8		
9		
10		
Tot	34	30
Ave	5.7	7.5

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

CONDITION AND TREND RATING

from Scorecard C Dated 6-79

VEGETATION

Forage Cover Index 3
 Composition 3
 Vigor 3
 Total 9
 Condition Class VP
 Current Trend →
 Trend Indicators _____

SOIL STABILITY

Bare Soil Index 8
 Soil Disturbance _____
 Factor 19
 Total 27
 Condition Class P
 Current Trend →

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

Location Map:

Super Bench W. of 1-0 mile
 To few grasses in good vigor
 measurements. Those that
 were found were growing among
 Ruba or Cora plants. Three
 Steo plants with slight
 loss protection have grazed
 off at a height of 3/4. As
 usual there were a greater
 variety of shrubs growing
 edge of the terrace. There
 were also more grass plants
 under the trees.

Comments: Mounds oval

Shrubs 6"-7" poor

Tortula procreta - but

gentle slope so soil erosion

is not as prevalent as other

sites. Production estimated 500

turf traffic, during soil disturbance
is evident here but less than Tabata Tr.

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	0	0	0	X2= 0
Inc.	2	10	12	12	X1/2= 3
Inv.	24	64	88	88	X-1= 11
Tot.	26	74	100	100	
Cool Seas.					-85

P 19 Many young Glue plants are
 growing among the rock ledges

12-Cora Agut Yuba
VP → 20% PC
80% NC

Summary of Hits

Includes Tortula
 Hits, all Plants 26
 Hits, all Rock 0
 Litter 0
 Bare Soil 74
 Total 100
 Hits, Dec. + Inc 2
 Hits, Cool Sea _____

This Soil Disturbance Index is
 applicable to the primary level 1
 on most of the terrace sites. The only
 TYPING DESIGNATION: Transect no., Ve-
 getation type, predominant vegetation, vegeta-
 tion and soil score, and trend. Soil
 movement is more evident.

LOOP MEASUREMENTS

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

RANGE COMPOSITION

Class	Species	Hits	Tally	Total	Allowable
Dec.					
Inc.	Corn 10 Eggs	2 1	2 1	3	
Inv.	Agave St. Alba Corns Guns Mullein	1 1 1 1 1	1 1 1 1 1	5	
Rock					
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.					
Tot. Flock					
Tot. Litter					
Bare Ground					
Tot. Cool Season					
Totals					

BROWSE CONDITION

[illegible]

* Court's AS Base Money



Pace Transect #19
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment TUL Date 5-4-82 Transect No. 7-022 Tran. A
 Aerial Photo No. 7-022 Place Interval 2 By D. Sharrow
 Game Mgmt. _____ Vegetative Type Cora-Hija-ohy Slope 0-10°
 Key Area 104 Soil gravelly sandy loam Aspect NW
Shallow ~4"

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1 0-1/2"							X.001
2 1/2-2"							X.005
3 2-4"							X.049
4 4-6"							X.136
5 6-8"							X.267
6 8-10"							X.442
7 10-12"							X.600
8							
9							
10							
tot							
avg							

Leaf Measurements (Vigor)

Species	1-12	Orch
1	40	121
2	4	11.5
3	5	17
4	3	11.5
5	3.5	14
6	3	17
7	5	15
8	4	15
9	5	11
10	3	9
Tot	38.5	132
Ave	3.9	13.2

CROWN DENSITY (ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Gatagama Terrace
 Relic - aspen - Hermit Shale
 Similar to grazed aspen
 Shale site except for the presence
 of grasses and tortula and grass
 sward. Erosion is nearly as
 apparent as other hermit sites
 But a typical density of mon.
 Plants are present. Small gravel
 (mostly < 3/4") covering most of the
 surface seems to be ineffective
 Comments: 1. Browse is present
 There is about 10% tortula cover.
 Grasses are more numerous in the
 tortula. Some use of processor
 forage is apparent. This transect
 poses higher on area with better
 than average plant cover. 50% area

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	4	1	1	X2= 2
Inc.	4	44	57	57	X4= 12
Inv.	10	28	48	48	X-1= 48
Tot.	14	86	100	100	
Cool Seas.					-28

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 5
 Composition 13
 Vigor 7
 Total 25
 Condition Class P
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 7
 Soil Disturbance _____
 Factor 14
 Total 21
 Condition Class P
 Current Trend →

P20 Forage production with unit
 averages about 20 #/acre,
 as only with Hija

Summary of Hits

✱ Hits, all Plants 14
 Hits, all Rock 11
 Litter 0
 Bare Soil 72
 Total 120
 Hits, Dec. + Inc 4
 Hits, Cool Sea . _____

12 - Cora-Hija-OPUN
 P →
 NC

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., V.
 tation type, predominant vegetation, vegeta
 and soil score, and trend.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

[illegible]

St 20
Maricola
Sger
Yuba
Art,
China

[illegible]

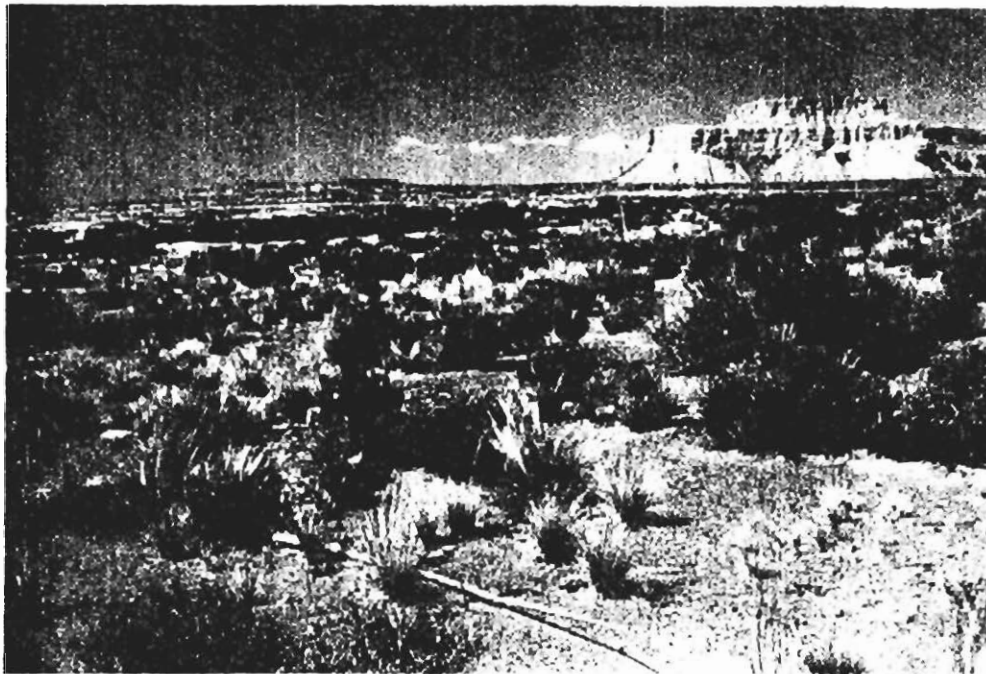
Class	Species	Hits	Tally	Total	Allowable
Dec.	Clay		4	4	
Inc.	Core	2	10	10	
	Ward			2	
	Asst		2	2	
	Ward		30	30	
	Ward	2	2	4	
Inv.	Core	4		4	
	Ward	6	30	36	
	Ward		9	9	
	Ward		4	4	
	Ward		2	2	
Rock					
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.					
Tot. Rock					
Tot. Litter					
Bare Ground					
Tot. Cool Season.					

count as
the group

Tot. Cool Season.	12				
12					

← count and use ground

Comp A = 120000 lbs of organic leaves & basal/blanketed flowers & stems, large



Pace Transect #20
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Havenside TUL Date 5-4-82 Transect No. 7-022 Trans. 13
 Aerial Photo No. 7-022 Place Interval 2 By D. Sharvin
 Game Mgmt. Vegetative Type Cora-Stee Slope 0-8%
 Key Area 174 Soil Sandy loam, shallow, calcareous Aspect SSW

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1 0-1/2"							X.001
2 1/2-2"							X.005
3 2-4"							X.049
4 4-6"							X.136
5 6-8"							X.267
6 8-10"							X.442
7 10-12"							X.600
8							
9							
10							
tot							
avg							

Location Map:

Gatagana Terrace Relic Area
 Supa. Sandstone

Active erosion not as prevalent as
 mother Supa. areas. Small
 soil mounds around plants and dunes occur.
 Much of the ground surface is covered by
 tortoise and rock outcrop.
 Most of last year's seed heads have
 been grazed. Some sheep/deer dung
 is present but very little soil disturber
 on tracks and no trails is apparent.

Comments: Mistakenly though
pedicelled 1-2" as vigorous
and have many seed heads.

Leaf Measurements (Vigor)

Species	Stee	
1	13	
2	6.5	
3	10	
4	11	
5	12	
6	13	
7	15	
8	13	
9	10	
10	12	
Tot	116.5	
Ave	11.7	

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	28	28	28	X2=56
Inc.	2	18	20	20	X4=5
Inv.	6	46	52	52	X-1=-52
Tot.	8	92	100	100	
Cool Seas.					+9

CONDITION AND TREND RATING

from Scorecard C Dated 6-79

VEGETATION

Forage Cover Index 3
 Composition 20
 Vigor 8
 Total 31
 Condition Class P
 Current Trend →
 Trend Indicators

SOIL STABILITY

Bare Soil Index 12
 Soil Disturbance
 Factor 28
 Total 40
 Condition Class P
 Current Trend →

Summary of Hits

Hits, all Plants 8
 Hits, all Rock 30
 Litter 11
 Bare Soil 58
 Total 100
 Hits, Dec. + Inc. 2
 Hits, Cool Sea.

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Ve-
 getation type, predominant vegetation, vegetati-
 on and soil score, and trend.

[illegible]

COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN							
	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

Office	
Specimen	1-168
Dye	2-0
Specimen	3-0
	4-0
	5-0
	6-0
	7-0
	8-0
	9-0
	10-2
	87

Class	Species	Hits	Tally	Total	Allowable
Dec.	Cowbird		2 18	18	
	Baird	1	2 1	3	
	Anser		2	2	
	Pinn-1		2 28	2	
Inc.	Cowbird	2	2 8	10	
	Acted 10		2 10	10	

[illegible]

Inw.	Acacia	: c	.	2		2
	Schin	:	7	1/1	18	
	Cinch	:	.	4	1	
	Clusia	:	.	2	2	
	Gins	:	.	2	2	
	Guaia	:	.	8	8	
	Chama	:	.	4	4	
	Quercus	:	.	2	c	
Rock	Bryonia	:	.	2	2	
	Hesperis	:	.	2	2	
Tot. Dec.	Alcornoque	:	.	4	4	
Tot. Inc.						
Tot. Inw.						
Hitts All Plants						
Hitts Dec. & Inc.						
Tot. Rock		X:1			30	
Tot. Litter		:			4	
Bare Ground		X:0			36	
Tot. Cool Season						
Total		X:			32	

Choi = Caldonia
Hypodonia
Hypodonia
Hypodonia
Hypodonia

PACED TRANSECT

Range Allotment Havasupai TUL Date 5-5-82 Transect No. 7-022 Stop 2
 Aerial Photo No. 7-022 Place Interval 2 By D. Sharrow
 Game Mgmt. _____ Vegetative Type Cora 12 Slope 2-15%
 Key Area 104 Soil skatatal, shallow calcareous Aspect W
coarse loamy,

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1 0-1"							X.001
2 1-2"							X.005
3 2-4"							X.049
4 4-6"							X.136
5 6-8"							X.267
6 8-10"							X.442
7 10-12"							X.600
8							
9							
10							
tot							
avg							

Leaf Measurements (Vigor)

Species	Area	Count
1	1.5	6
2	2	4
3	2	5.5
4	3	5.5
5	3	4
6	2.5	4
7	2	6
8	2.5	3
9	4	6
10	6	3
Tot	28.5	48
Ave	2.9	4.8

CROWN DENSITY (ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Hermit shale

Gatagoma trees
 Distinct and numerous rills on all slopes > 8%. Most surface gravels less than 3/4". Larger rocks on the surface do not form a protective layer.

All of last years grass growth has been grazed to 3/4 inch or less.

Dung, trails and dust wallows are numerous.

The few grass plants in this area were found in rills where limestone rocks had accumulated.

Comments: Many Hija plants

week of early pulled up.

Side cuts with 50-60 road base.

but many dead rhizomes exposed
because in ground each has 10-15

Tartula rare, confined to south a few shr.

This is typical of Hermit shale outcrops on these large terraces. Production 0-10%
 Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	0	0	0	X2=0
Inc.	0	14	14	14	X4=3
Inv.	6	80	86	86	X-1=86
Tot.	6	94	100	100	
Cool Seas.					-83

CONDITION AND TREND RATING

from Scorecard C Dated 6-79

VEGETATION

Forage Cover Index 0
 Composition 3
 Vigor 2
 Total 5
 Condition Class VP
 Current Trend →
 Trend Indicators _____

SOIL STABILITY

Bare Soil Index 8
 Soil Disturbance _____
 Factor 8
 Total 16
 Condition Class .. VP
 Current Trend .. →

0-22 Despite a few grasses in some of the rills, production for the unit is near zero.

7-12-Cora-PSOR-Agust

VP →
 NC

Summary of Hits

Hits, all Plants 6
 Hits, all Rock 26
 Litter 0
 Bare Soil 68
 Total 100
 Hits, Dec. + Inc 0
 Hits, Cool Sea . _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

[illegible][illegible]

Legume - large Spout leaf
Purple Clover like flower - 25/6/1958

Hylas
Hymenopappus
lugens
Perennial
Comp

PACED TRANSECT

Range Allotment Havasupai TUL Date 5-5-82 Transect No. 7-022 Stop 3
 Aerial Photo No. 7-022 Place Interval 2 By 1) Sharrow
 Game Mgmt. _____ Vegetative Type Cora-Stco 12 Slope 2%
 Key Area 174 Soil gravelly, sandy, loamy, calcareous, Shallow Aspect W.S.W.

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1"		X.001
2 1-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Leaf Measurements (Vigor)

Species	Dec
1	11.5
2	16
3	10
4	12
5	16
6	9.5
7	12
8	12
9	18
10	17
Tot	134.0
Ave	13.4

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Relic Mesa Supai Sands

This mesa is apparently inaccessible to live stock and wildlife. No signs of either were found. Product on one side of the protected soils rivets that found in Fossil bay, about 350%/acre. The average production for the part of this mesa with soil is 150-200%/acre. So figuring in 50-60% bedrock the average for the terrace is 70-100%/acre.

Gross vigor is good with many hands being produced. Grass plants are generally slightly post-staked but there is only minor

Comments: evidence of sheet erosion Wind erosion - noticeable in the

form of dune slopes to a protected across. Tortula edwardsii good in suitable spot Many areas are losing or gaining soil due wind erosion to rapidly for tortula develop.

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	4	20	24	24	X2=48
Inc.	16	26	42	42	X1/2=10.5
Inv.	4	30	34	34	X-1=-34
Tot.	24	76	100		
Cool Seas.					+24.5

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
 VEGETATION SOIL STABILITY
 Forage Cover Index 27 Bare Soil Index 18
 Composition 23 Soil Disturbance 26
 Vigor 8 Factor
 Total 58 Total 44
 Condition Class F Condition Class F
 Current Trend → Current Trend →
 Trend Indicators _____

23-12- Cora Point Cele
F → NC

Summary of Hits

Hits, all Plants 24
 Hits, all Rock 36
 Litter 4
 Bare Soil 36
 Total 100
 Hits, Dec. + Inc 20
 Hits, Cool Sea .

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

10
12
16
9.5
12
12
18
17

Other Species

Madam	Arty
Yuba	Speed
Yuan	Sperr
Boer	
Polo	
Kutr	
Ba Bluestem	
Redney	
Numerous Mangro	
Lilies	
Boca	

$$\begin{array}{r} 1-1 \\ 2-0 \\ 3-0 \\ 4-4 \\ 5-0 \\ 6-0 \\ 7-1.5 \\ 8-0 \\ 9-0 \\ 10-0 \\ \hline 6.5 \end{array}$$

RANGE COMPOSITION

things as they are

[illegible]

PACED TRANSECT

Range Allotment Havasupai TUL Date 5-18-82 Transect No. 3-011 5up1
 Aerial Photo No. 3-011 Place Interval 2 By D. Sharrow
 Game Mgmt. 178 Vegetative Type Cora 12 Slope 25%
 Key Area 178 Soil skeletal, coarse loamy, moderately deep, calcareous, no profile development Aspect 11W
 Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1/2"		X.001
2 1/2-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Leaf Measurements (Vigor)

Species	Star
1	6.5
2	10.0
3	11.5
4	13
5	9
6	8.5
7	8
8	12.5
9	7.5
10	9
Tot	95.5
Ave	9.6

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Talus

Similar to other talus slopes. Veg dominated by Black brush with a few other shrub species and an occasional grass. Though armored with coarse gravel the soil is unstable. Down slope creep is evidenced by prominent stair stepping. Sheet erosion is less apparent as rock and Tortula protect most of the soil surf. There is little or no evidence of wind or livestock on this slope.

Comments: Grown on sparse and production near 20%

Vigor fairly good, leaves are long but there are fewer seed heads than would be expected.

Stipa and de found here for the first time in the survey.

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	4	8	12	12	X2= .1
Inc.	4	6	10	10	X4= .2
Inv.	28	50	78	78	X-1= .78
Tot.	36	64	100	100	
Cool Seas.					-52

CONDITION AND TREND RATING

from Scorecard C Dated 6-79

VEGETATION

Forage Cover Index 11
 Composition 9
 Vigor 8
 Total 28
 Condition Class P
 Current Trend →
 Trend Indicators

SOIL STABILITY

Bare Soil Index 40
 Soil Disturbance 18
 Factor 58
 Total 58
 Condition Class F
 Current Trend →

P24-12 - Cora, Opec, Chna
 P → 80% PC
 20% NC

Summary of Hits

Includes Tortula * Hits, all Plants 60
 Hits, all Rock 34
 Litter 0
 Bare Soil 6
 Total 100
 Hits, Dec. + Inc 8
 Hits, Cool Sea

$$EGC = \frac{60}{66} = .92$$

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

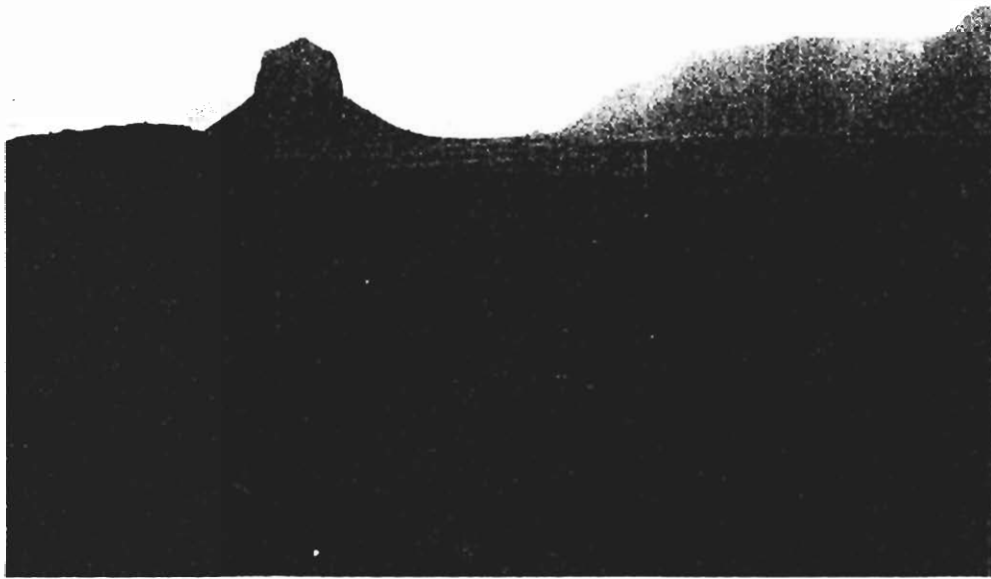
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COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN							
	Sprout		Seedling		Pole,	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

11/11/11
P/Lu

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Class	Species	Hits	Tally	Total	Allowable
Dec.	Boer	3	1	4	
	Eula	2	2	4	
	Star	2	2	2	
	Siby	2	2	2	
Inc.	Cora-10	4	10	10	
Inv.	Cora	22	11	66	
	Chas	4	4	4	
	Yiba	2	2	2	
	Spec	2	2	2	
Rock					
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.				31	
Tot. Rock					
Tot. Litter					
Bare Ground				6	
Tot. Cool Season					
Tot. All				24	



Pace Transect #24
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Havasupai TUL Date 5-18-82 Transect No. 3-011 Shp2
 Aerial Photo No. 6-011 Place Interval 2 By D. Sherrin
 Game Mgmt. _____ Vegetative Type Cora-China-Sp. 100% Slope 3%
 Key Area 174 Soil Supai Aspect 4/1E

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1 0-1"							X.001
2 1-2"							X.005
3 2-4"							X.049
4 4-6"							X.136
5 6-8"							X.267
6 8-10"							X.442
7 10-12"							X.600
8							
9							
10							
tot							
avg							

Leaf Measurements (Vigor)

Species	Spec	Hits
1	8	
2	4.5	
3	4	
4	6.5	
5	6.5	
6	2.5	
7	4	
8	5	
9	4.5	
10	5	
Tot	48.5	
Ave	4.9	

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Supai
 More grass here than on other grazed
 Supai Terraces. Productivity by
 several grass species is 60-80%
 There is more utilization on this
 terrace than on the terrace
 where 3-001-T1 was run. About
 1/2 the grasses were utilized on
 last years growth and 20%
 on this years growth. Wildlife
 and livestock sign is numerous
 though not as common as on the
 terrace.

Comments: as the grass is thick
Tarula protecta is abundant
Dunes and Supai terraces are
well established

Composition Summary

	Hits	Dots	Comp	ALLOW Comp	Comp Value
Dec.	2	0	2	2	X2=4
Inc.	6	12	18	18	X4=72
Inv.	18	42	60	60	X-1=58
Tot.	26	54	80	80	
Cool Seas.					

CONDITION AND TREND RATING

from Scorecard 6 Dated 6/59
VEGETATION
 Forage Cover Index 11
 Composition 4
 Vigor 4
 Total 19
 Condition Class VP
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 12
 Soil Disturbance _____
 Factor 14
 Total 26
 Condition Class P
 Current Trend →

P25-12-Cora-OPUN-SPHE
 VP → 20% PC
 80% NC

Summary of Hits

Hits, all Plants 36
 Hits, all Rock 0
 Litter 6
 Bare Soil 58
 Total 100
 Hits, Dec. + Inc 8
 Hits, Cool Sea . _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., V
 tation type, predominant vegetation, vegeta
 and soil score, and trend.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

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Inv.	Clina	2	14	28
	Van	1	22	30
	Core-2	1	22	30
	Yuba	1	2	3
	Spice	1	2	3
	Thoma	2	2	2
Rock				
Tot. Dec.				
Tot. Inc.				
Tot. Inv.				
Hits All Plants				
Hits Dec. & Inc.				
Tot. Rock				
Tot. Litter				
Bare Ground				
Tot. Cool Season				
Tot. Total				10



Pace Transect #25
Havasupai Traditional Use Lands



PACED TRANSECT

Range Allotment Havasupai TUL Date 5-18-82 Transect No. 3-011-Stop3
 Aerial Photo No. 3-011 Place Interval By 12. Sharrow
 Game Mgmt. 174 Vegetative Type Cora-SPHE-4-ba-Atca Slope 5%
 Key Area 174 Soil Supai Aspect N

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1"						X.001
2	1-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Supai

Sparsely vegetated with much bare ground and tortula. Wind erosion evident as small dunes and mounds around plants. More tortula protection than at 3-011-Stop 2 but this is not totally effective. Shallow rills cut to bedrock are evident. Production is about 50% a, mostly of Spcr, Spco, Spfb, Orly, Boer.

Comments: About equal numbers of horse and wild horse tracks and pellet groups. Little forage utilization.

Leaf Measurements (Vigor)

Species	Spcr	Spfb
1	3	8
2	3.5	6
3	3.5	5
4	4	6
5	3	5.5
6	4	5
7	5	8
8	4	5
9	6.5	6
10	4.5	7.5
Tot	41.0	62.0
Ave	4.1	6.2

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	2	4	6		X2=
Inc.	6	25	32	52	X4=
Inv.	8	54	62		X-1=
Tot.	16	81	100		
Cool Seas.					-42

CONDITION AND TREND RATING

from Scorecard C Dated 5/79
 VEGETATION SOIL STABILITY
 Forage Cover Index 11 Bare Soil Index 15
 Composition 10 Soil Disturbance
 Vigor 5 Factor 17
 Total 20 Total 32
 Condition Class P Condition Class P
 Current Trend → Current Trend →
 Trend Indicators

P26-12-SPHE Cora OPUN
 P → 20% PC
 80% NC

Summary of Hits

Hits, all Plants 48 including tortula
 Hits, all Rock 2
 Litter 2
 Bare Soil 117
 Total 107
 Hits, Dec. + Inc. 8
 Hits, Cool Sea

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

Class	Species	Hits	Tally	Total	Allowable
Dec.	Atca	2	2	1	
	Orh		1	2	
Inc.	Spc		11	10	
	Green 10		11	10	
	Spc 0-1		1	2	
	Green 1		1	1	
	Spc 1		1	1	
	Epi	1	1	1	
Inv.	Gusa		1	1	
	Oban		1	1	
	Splle		1	1	
	Cura				
	Erid				
	Asterog.				
	Yuba				
Rock					
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.					
Tot. Rock				2	
Tot. Litter				2	
Bare Ground				48	
Tot. Cool Season				52	

PACED TRANSECT

Range Allotment TUL Date 5-22-82 Transect No. 1 522
 Aerial Photo No. NO PHOTO Place Interval 3 By Baxter
 Game Mgmt. _____ Vegetative Type Blackbrush Slope 0-5%
 Key Area 104 Soil CLAY Aspect S

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1"		X.001
2 1-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Matcamba Mesa
 Hermit Lake
 Some prod of grasses but >2i
 Brush predistated - 100% - 6-1
 Hi.
 Stosion pavement everywhere
 fills & small gullies prevail

Comments: NC - will probably
 be a bit more open due to
 inherent erosion

Leaf Measurements (Vigor)

Species	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	-	-	-	-	X2= 0
Inc.	2	10	12	12	X4= 3
Inv.	8	80	88	88	X-1=-88
Tot.	10	90	100		
Cool Seas.					-85

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION **SOIL STABILITY**
 Forage Cover Index 3 Bare Soil Index 8
 Composition 3 Soil Disturbance 10
 Vigor 0 Factor
 Total 6 Total 18
 Condition Class VP Condition Class .. VP
 Current Trend → Current Trend .. ↓
 Trend Indicators _____

P27-12-Cora Agut OPPD

VP→

NC

Summary of Hits

Hits, all Plants 10
 Hits, all Rock 18
 Litter 2
 Bare Soil 70
 Total 100
 Hits, Dec. + Inc 2
 Hits, Cool Sea .

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no.,
 tation type, predominant vegetation, veget
 and soil score, and trend.

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	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

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	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

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	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

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Pace Transect #27
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment TUL Date 5-22-82 Transect No. 2-522
 Aerial Photo No. NO PHOTO Place Interval 3 By Barnes
 Game Mgmt. _____ Vegetative Type _____ Slope 2-50
 Key Area 174 Soil Super Sandstone Aspect W

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1"						X.001
2	1-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

OLD Horse droppings here
Pedistalced Plants

thin and 1/4-acre here
numerous dead or dry
in 10-15 acre patch of 22"
deep soil - surrounded by
bedrock!

Comments: 100-150 #/Ac with
red decreasing to 50 #/Ac
in the case of deeper and
10 production beyond

Leaf Measurements (Vigor)

Species	Spot	Color
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot	60	50
Ave	6"	5"

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	4	4	4	X2=8
Inc.	8	34	42	42	X1/2=10.5
Inv.	20	34	54	54	X-1=-54
Tot.	28	72	100		
Cool Seas.					-35.5

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 11
 Composition 12
 Vigor 3
 Total 26
 Condition Class P
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 8
 Soil Disturbance 10
 Factor 18
 Total _____
 Condition Class VP
 Current Trend ↓

P28-12-Cora Hiri Gutu
P → 20% PC
80% NC

Summary of Hits

Hits, all Plants 28
 Hits, all Rock 0
 Litter 4
 Bare Soil 68
 Total 100
 Hits, Dec. + Inc 8
 Hits, Cool Sea _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Ve-
 getation type, predominant vegetation, vegetati
 and soil score, and trend.

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Class	Species	Hits	Tally	Total	Allowable
Dec.	Arcg		'	2	
	Ochug		'	2	
Inc.	SPEI		:::	8	
	Geri	'	II	16	
	Eura	:::	:::	10	10
	Spar		:::	8	
Inv.	Rocky	'		2	
	Rocky	:::	□	22	
	Rocky	:::	:::	12	
	Rocky	'		2	
	Rocky				

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Rock	0.002			
Tot. Dec.				
Tot. Inc.				
Tot. Inv.				
Hits All Plants				
Hits Dec. & Inc.				
Tot. Rock				
Tot. Litter				
Bare Ground				
Tot. Cool Season				



Pace Transect #28
Havasupai Traditional Use Lands



PACED TRANSECT

Range Allotment Havasupai TUL Date 5-23-82 Transect No. 5-013 T-2
 Aerial Photo No. CS-013 Place Interval 2 By Sharon Baxter
 Game Mgmt. Vegetative Type 12 Cora-Atea-Epi Slope 20-30
 Key Area 174 178 Soil Aspect NW

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1 0-1/2"							X.001
2 1/2-2"							X.005
3 2-4"							X.049
4 4-6"							X.136
5 6-8"							X.267
6 8-10"							X.442
7 10-12"							X.600
8							
9							
10							
tot							
avg							

Location Map:

Talus Toiyango Pt.
 Sheep use on Ariz, trees on
 some down slope creep and rock
 lined rills.

Comments: Production 50th

Leaf Measurements (Vigor)

Species	Orly	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave	5"	

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	2	2	1	4	X2=8
Inc.	6	14	20	20	X1/2=5
Inv.	34	42	76	76	X-1=76
Tot.	42	56	100	100	
Cool Seas.					-63

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 11
 Composition 7
 Vigor 5
 Total 23
 Condition Class P
 Current Trend →
 Trend Indicators
SOIL STABILITY
 Bare Soil Index 29
 Soil Disturbance 14
 Factor 6
 Total 43
 Condition Class F
 Current Trend →

P29-12-Cora, Epi
 P→ 80% PC
 20% KC

Summary of Hits

Hits, all Plants 102
 Hits, all Rock 35
 Litter 4
 Bare Soil 18
 Total 100
 Hits, Dec. + Inc. 8
 Hits, Cool Sea

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

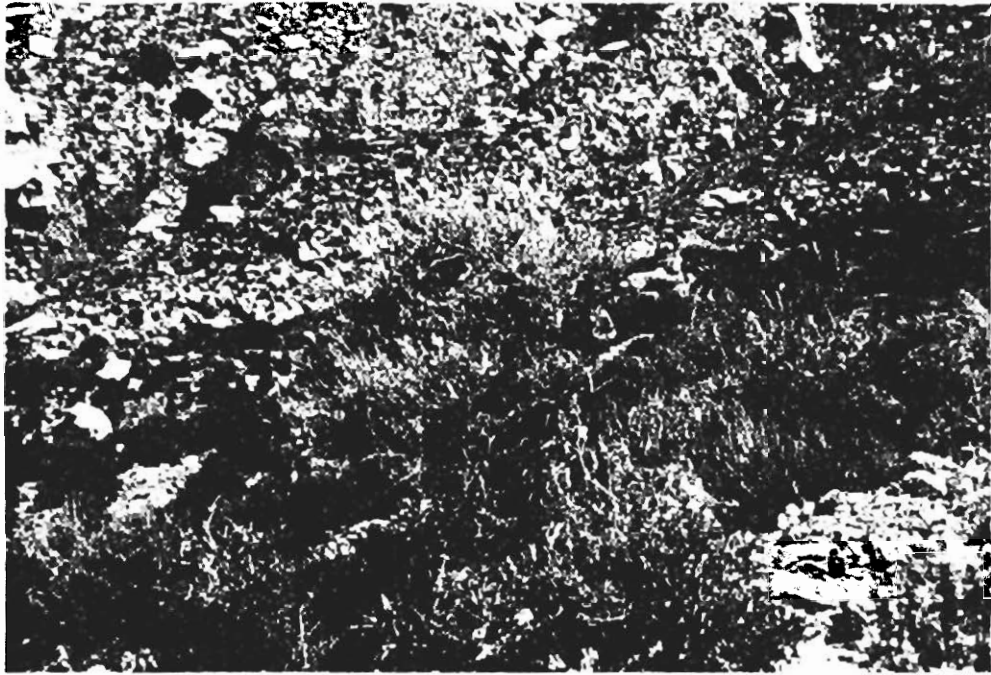
TYPING DESIGNATION: Transect no., \
 tation type, predominant vegetation, veget
 and soil score, and trend.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

BROWSE CONDITION

[illegible][illegible]



Pace Transect #29
Havasupai Traditional Use Lands



PACED TRANSECT

Range Allotment TUL Date 5-23-82 Transect No. 3-5013-
 Aerial Photo No. 5-13 Place Interval 3 By Baxter
 Game Mgmt. _____ Vegetative Type _____ Slope 0-5%
 Key Area 174 Soil Supai Sandstone Aspect S

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1/2"						X.001
2	1/2-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Comments: Prod 50# + less/AcGuts is hummocked w some soil1/2 of bare soil hits are on 1/2-2" of soil

Leaf Measurements (Vigor)

Species	Step	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave	<u>6"</u>	

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	<u>0</u>	<u>30</u>	<u>30</u>	<u>30</u>	X2=60
Inc.	<u>1</u>	<u>33</u>	<u>34</u>	<u>34</u>	X1/2=8.5
Inv.	<u>1</u>	<u>35</u>	<u>36</u>	<u>36</u>	X-1=-36
Tot.	<u>2</u>	<u>98</u>	<u>100</u>		
Cool Seas.					+32.5

CONDITION AND TREND RATING

from Scorecard C Dated 6-83
 VEGETATION SOIL STABILITY
 Forage Cover Index 1 Bare Soil Index 12
 Composition 24 Soil Disturbance 10
 Vigor 3 Factor
 Total 28 Total 22
 Condition Class P Condition Class P
 Current Trend → Current Trend ↓
 Trend Indicators

P30-12-Step Cora Guts

VP → 20% PC
80% NC

Summary of Hits

Hits, all Plants 2
 Hits, all Rock 64
 Litter
 Bare Soil 34
 Total 100
 Hits, Dec. + Inc 1
 Hits, Cool Sea ..

Soil is almost gone to bedrock!
Mapping Classification changed to VP - Plants are
all in between. Very little soil!

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vege-
 tation type, predominant vegetation, vegetation
 and soil score, and trend.

LOOP MEASUREMENTS

[illegible]

COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

RANGE COMPOSITION

Class	Species	Hits	Tally	Total	Allowable
Dec.	Antelope		1	3	
	Bird		1	2	
	Bird		1	3	
	Bird		1	1	
	Bird		1	5	
Inc.	Rate		1	3	
	Spec		1	4	
	Cora		1	10	10
	Aluminum		1	2	
	Spel		1	7	
	Hill		1	8	
	Ther		1	1	
Inv.	Agut		1	5	
	Sted		1	21	Dressage
	Cora		1	12	
	Cora		1	10	
	ARKS		1	3	
	CHRY		1	2	
	Yuba		1	3	
Rock	OPUD		1	1	
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.					
Tot. Rock			1	64	
Tot. Litter					
Bare Ground				34	
Tot. Cool Season					

BROWSE CONDITION

[illegible]



Pace Transect #30
Havasupai Traditional Use Lands



PACED TRANSECT

Range Allotment

Aerial Photo No.

Game Mgmt.

Key Area

TUL

Date

5/24/82

Transect No.

1-524

Place Interval

3

By

Baker

Vegetative Type

Blackbrush

Slope 0-5

Soil

Hermit SHALE

Aspect Flat → N

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1/2"						X.001
2	1/2-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Leaf Measurements (Vigor)

Species	Sp	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave	2"	

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Comments: PRODUCTION 0-20%
 Patisalant plants -

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	0	0	0	X2= 0
Inc.	6	30	36	36	X1/2= 9
Inv.	16	48	64	64	X-1= -64
Tot.	22	78	100		
Cool Seas.					-55

CONDITION AND TREND RATING

from Scorecard

C

Dated

6-79

VEGETATION

Forage Cover Index

8

Composition

8

Vigor

2

Total

18

Condition Class

VP

Current Trend

→

Trend Indicators

SOIL STABILITY

Bare Soil Index

9

Soil Disturbance

Factor

10

Total

19

Condition Class

VP

Current Trend

↓

P 31

12-Cora-Spfi-GUTI

VP→

NC

Summary of Hits

Hits, all Plants

22

Hits, all Rock

14

Litter

1

Bare Soil

64

Total

100

Hits, Dec. + Inc

6

Hits, Cool Sea

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Veg-
 etation type, predominant vegetation, vegetati-
 on and soil score, and trend.

LOOP MEASUREMENTS

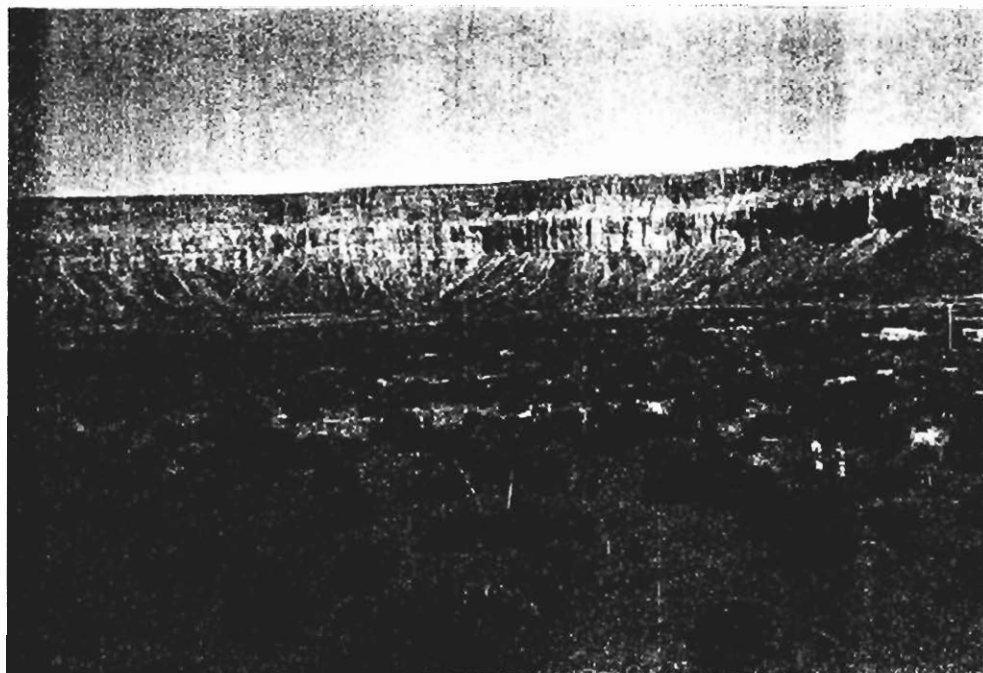
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COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

☒ ☒ ☒ ☒ ☒

Class	Species	Hits	Tally	Total	Allowable
Dec.	Rock				
	Ortho				
	Spect		.	2	
	Sofl		:::	8	
Inc.	Hirt		.	2	
	Eppes	"	:::	6	
	Kora	"	:::	10	10
	Unk. Spurs	"	.	2	
	Thru		:::	6	
	Inv.		:::	8	
	Inv.	IT	M:::	44	
	Spurs		.	2	
	Oppo		:::	4	
	Chey		:::	4	
Rock		IT		14	
	Tot. Dec.				
	Tot. Inc.				
	Tot. Inv.				
	Hits All Plants				
	Hits Dec. & Inc.				
	Tot. Rock				
	Tot. Litter				
	Bare Ground	44		64	
	Tot. Cool Season				



Pace Transect #31
Havasupai Traditional Use Lands



PACED TRANSECT

Range Allotment Tull Havanipai Date 5-24-82 Transect No. 05-012 - top 1
 Aerial Photo No. 05-012 Place Interval 2 By D. Sharrow
 Game Mgmt. _____ Vegetative Type Cora-Eula Slope 35%
 Key Area 178 Soil _____ Aspect NNE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1"		X.001
2 1-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Talus

A few sheep tracks and beds.
 Use noticable on some grasses
 but none of the Eula appears
 to be hedged by foot use now
 does it show any recent use.
 The Eula is small and not very
 vigorous.

Comments: Down slope movement
 is evident on soil but grasses
 back up behind each shrub.

Leaf Measurements (Vigor)

Species	Star
1	10
2	10
3	11
4	7
5	11
6	9
7	9
8	6.5
9	7.5
10	8
Tot	89
Ave	8.9

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	4	24	28	28	X2=56
Inc.	2	8	10	10	X1/2=2
Inv.	16	46	62	62	X-1=-52
Tot.	22	78	100		
Cool Seas.					-4

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION **SOIL STABILITY**
 Forage Cover Index 8 Bare Soil Index 40
 Composition 17 Soil Disturbance _____
 Vigor 7 Factor 10
 Total 32 Total 50
 Condition Class P Condition Class F
 Current Trend → Current Trend →
 Trend Indicators _____

P32 12 - Cora Eula Gusa
 P → 80% PC
 20% KC

Summary of Hits

Hits, all Plants 24
 Hits, all Rock 54
 Litter 16
 Bare Soil 8
 Total 100
 Hits, Dec. + Inc. 6
 Hits, Cool Sea. _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., v
 tation type, predominant vegetation, veget.
 and soil score, and trend.

[illegible]

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

10
10
11
7
11
9
9
6.5
7.5
8

[illegible][illegible][illegible]

PACED TRANSECT

Range Allotment Hansup TUL Date 5-24-82 Transect No. 05-012-54p2
 Aerial Photo No. 05-012 Place Interval 2 By D. Stanger
 Game Mgmt. _____ Vegetative Type 12-Cora-Equi-Yuba Slope 25%
 Key Area 178 Soil Shallow, rocky, calcareous Aspect NE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1"						X.001
2	1-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Talus

Unstable, with clams and terraces
 formed by shrubs & rocks.
 Gravel cover is not as complete
 as on other talus slopes.

Comments: Vigor fair

with only a few trees of each
species. Most grasses have
been used. Much shrub & grass
traces & dung.

Leaf Measurements (Vigor)

Species	Orch.	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave	<u>7"</u>	

CROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits	Dots	Comp	ALLOW Comp	Comp Value
Dec.	11	10	11	11	X2=2
Inc.	11	10	11	11	X1/2=?
Inv.	16	53	72	72	X-1=?
Tot.	28	73	100	100	
Cool Seas.					-41

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 11
 Composition 11
 Vigor 6
 Total 28
 Condition Class P
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 18
 Soil Disturbance _____
 Factor 15
 Total 33
 Condition Class P
 Current Trend .. →

P33 12 - Cora Atea Yuba
 P → 80% PC
 20% NC

Summary of Hits

Hits, all Plants 24
 Hits, all Rock 34
 Litter 6
 Bare Soil 33
 Total 100
 Hits, Dec. + Inc. 8
 Hits, Cool Sea. _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no.,
 tation type, predominant vegetation, veg
 and soil score, and trend.

[illegible]

COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN							
	Sprout		Seedling		Pole,	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

[illegible][illegible]

Class	Species	Hits	Tally	Total	Allowable
Dec.	Ateca	4	2	4	
	Bocr		2	2	
	Ory		2	2	
	Sisb		2	2	
	Fula		2	2	
	Sper		2	2	
Inc.	Cora 2nd	2	8	10	
	Eprv	2 / 11	2	4	
Inv.	Cora	14	16	30	
	Tuba	2		2	
	Gusa		2	2	
Rock					
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.					
Tot. Rock				34	
Tot. Litter				6	
Bare Ground				32	
Tot. Cool Season				72	



Pace Transect #33
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Harrison TUL Date 01-07-87 Transect No. 01-006 stop 2
 Aerial Photo No. 01-006 Place Interval 2 By Shannon
 Game Mgmt. Vegetative Type Cora-Burr Slope 15%
 Key Area 178 Soil Aspect NE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1"						X.001
2	1-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Talus

lower end of slope.

Burr is the most common grass,
 with most plants having been
 grazed in the last year.
 Production is low, about
 30-40% a. Some horse
 dung.

Comments: Soil is fairly stable
 due to gentle slope and
 rocky ground cover.

Leaf Measurements (Vigor)

Species		
1		5.50
2		7
3		14
4		8
5		12
6		13
7		13
8		9
9		10
10		11
Tot		101
Ave		10.1

CROWN DENSITY
(ASPEN AND RIPARIAN)

			Total
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Tot			
Ave			

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	4	12	18	18	X2=36
Inc.	4	2	16	16	X1/2=8
Inv.	14	52	66	66	X-1=66
Tot.	22	78	100		
Cool Seas.					-26

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 11
 Composition 13
 Vigor 6
 Total 30
 Condition Class D
 Current Trend →
 Trend Indicators
SOIL STABILITY
 Bare Soil Index 22
 Soil Disturbance 24
 Factor
 Total 46
 Condition Class F
 Current Trend →

P34 12 - Cora, SPHA, St sp

P → 80% PC
 20% NC

Summary of Hits

Hits, all Plants 30 Includes
 Hits, all Rock 42 Terrestrial
 Litter 0
 Bare Soil 28
 Total 100
 Hits, Dec. + Inc 8
 Hits, Cool Sea

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vege-
 tation type, predominant vegetation, vegetation
 and soil score, and trend.

LOOP MEASUREMENTS

[illegible]

COMPOSITION BY SIZE CLASS · RIPARIAN · ASPEN

	Sprout			Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed				
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
Tot.								
Ave.								

RANGE COMPOSITION

[illegible]

BROWSE CONDITION

[illegible]



Pace Transect #34
Havasupai Traditional Use Lands



PACED TRANSECT

Range Allotment Aspen TUL Date 6-7-82 Transect No. 01-006 Step 3
 Aerial Photo No. 1-6 Place Interval 2 By D. Sherrill
 Game Mgmt. _____ Vegetative Type Cora-Epvi 12 Slope 40%
 Key Area 177 Soil _____ Aspect NE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1"		X.001
2 1-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Talus

Mid way up the Talus.
 Soils are unstable with signs
 down slope movement. Numerous
 gravels are not protecting the
 surface. Distinct stair steps.
 A very few Star are present.
 Production in near zero.

Comments: _____

Leaf Measurements (Vigor)

Species	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

NOTHING
to MeasureCROWN DENSITY
(ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Shrubs are
 dominated by Cora with about 2%
 of Epvi, Yuba, and 1% Atca, Eula
 Chna. Some Bghen/D. on the

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	2	2	2	X2=4
Inc.	2	10	12	12	X1/2=3
Inv.	6	80	86	86	X-1=-86
Tot.			100		
Cool Seas.					-79

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
 VEGETATION SOIL STABILITY
 Forage Cover Index 3 Bare Soil Index 26
 Composition 4 Soil Disturbance _____
 Vigor 2 Factor 10
 Total 9 Total 36
 Condition Class VP Condition Class P
 Current Trend → Current Trend →
 Trend Indicators _____

P35

12 - Cora, Yuba, Epvi
 VP → NC

Summary of Hits

Hits, all Plants 8
 Hits, all Rock 68
 Litter 2
 Bare Soil 22
 Total 100
 Hits, Dec. + Inc. 2
 Hits, Cool Sea. _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

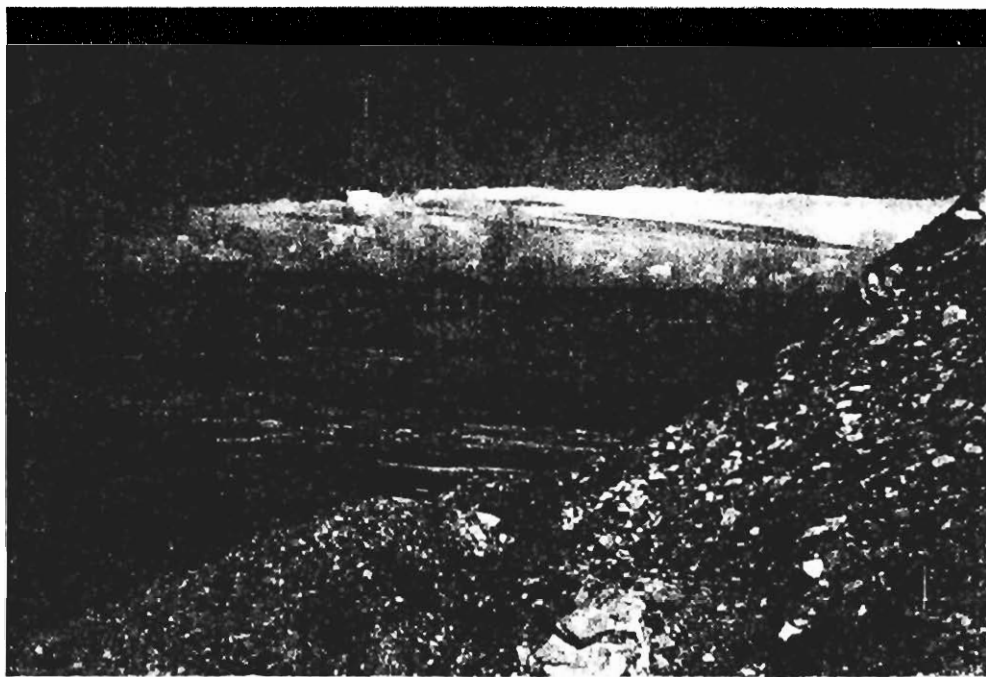
Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., V
 tation type, predominant vegetation, vegeta-
 and soil score, and trend.

[illegible]

Sprout		Seedling		Pole.	Mature	Dead
Browsed	Unbrowsed	Browsed	Unbrowsed			
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
Tot.						
Ave.						

[illegible][illegible]



Pace Transect #35
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Havasupai TUL Date 6-8-82 Transect No. 01-006 St094
 Aerial Photo No. 01-006 Place Interval 3 By D. Shaw
 Game Mgmt. _____ Vegetative Type Cora - Hija Slope 8%
 Key Area 174 Soil _____ Aspect ENE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1"		X.001
2 1-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Supai N. of Flatiron Butte
 Dune sands. Accumulations of up to 3' ground some shrubs. Small pits cut to bedrock. Some turtle protection but this not vigorous or extensive. All grass plants, particularly Orhy and Sporobolus sp. are pedistled 1-3".

Comments: Production is

about 100²/acre mostly by Hija and Orhy. This type of production makes up about 15% of this terrace. Rock outcrop covers about 50% with the remainder being less productive shallow soils.

Leaf Measurements (Vigor)

Species	Hija
1	5.5
2	5.5
3	5
4	4
5	6.5
6	3.5
7	6
8	5
9	5.5
10	4.5
Tot	
Ave	5.1

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits	Dots	Comp	ALLOW Comp	Comp Value
Dec.	0	2	2	2	X2= 4
Inc.	14	38	52	52	X4= 3
Inv.	12	32	44	44	X-1= -1
Tot.	28	74	100	100	
Cool Seas.					-29

CONDITION AND TREND RATING

from Scorecard C Dated 6/79
VEGETATION
 Forage Cover Index 19
 Composition 13
 Vigor 7
 Total 39
 Condition Class P
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 14
 Soil Disturbance _____
 Factor 11
 Total 25
 Condition Class P
 Current Trend →

P36-12-Hija Cora OPUN
P→ 20% PC
80% NC

Summary of Hits

Hits, all Plants 16 *Include turtle*
 Hits, all Rock 0
 Litter 2
 Bare Soil 50
 Total 100
 Hits, Dec. + Inc. 14
 Hits, Cool Sea. _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., V tation type, predominant vegetation, vegeta and soil score, and trend.

LOOP MEASUREMENTS

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

COMPOSITION BY SIZE CLASS - RIPARIAN - ASPEN

	Sprout		Seedling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

04 Leontopos
Orhy
Sper
Spec
male

RANGE COMPOSITION

[illegible]

BROWSE CONDITION

[illegible]

Rock	✓						
Tot. Dec.							
Tot. Inc.							
Tot. Inv.							
Hits All Plants							
Hits Dec. & Inc.							
Tot. Rock							
Tot. Litter							2
Bare Ground							50
Tot. Cool Season							
Tot. Warm							20



Pace Transect #36
Havasupai Traditional Use Lands

PACED TRANSECT

Range Allotment Hawesipai TUL Date 6-8-82 Transect No. 01-0065 top 5
 Aerial Photo No. 1-006 Place Interval 2 By D. Starnan
 Game Mgmt. Vegetative Type Cora Slope 3-8%
 Key Area 174 Soil Aspect NE

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1	0-1"						X.001
2	1-2"						X.005
3	2-4"						X.049
4	4-6"						X.136
5	6-8"						X.267
6	8-10"						X.442
7	10-12"						X.600
8							
9							
10							
tot							
avg							

Supai
 very similar to 01-006-5 top 4.
 less evidence of wind erosion,
 dunes only 6"-1' high. Water
 erosion is still very evident.
 All grasses are pedistaled and
 only moderately vigorous

Comments: Production is
60% acre of High and dispersed
species.

Leaf Measurements (Vigor)

Species	Hits	
1	4.0	
2	4	
3	3.5	
4	5.5	
5	5	
6	3	
7	3.5	
8	4.5	
9	3	
10	2.5	
Tot	38.5	
Ave	3.9	

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	2	6	8	8	X2= 16
Inc.	6	48	54	24	X1/2= 12
Inv.	20	18	38	22	X-1= -12
Tot.	28	72	100		
Cool Seas.					-10

CONDITION AND TREND RATING

from Scorecard C Dated 6-29
VEGETATION
 Forage Cover Index 11
 Composition 16
 Vigor 5
 Total 32
 Condition Class P
 Current Trend →
 Trend Indicators
SOIL STABILITY
 Bare Soil Index 16
 Soil Disturbance
 Factor 14
 Total 30
 Condition Class P
 Current Trend →

P 37-12- Hija Cora OPUN
 P- 20% PC
 80% NC

Summary of Hits

Hits, all Plants 56 Includes
 Hits, all Rock 0 Tortoise
 Litter 0
 Bare Soil 44
 Total 0
 Hits, Dec. + Inc 8
 Hits, Cool Sea

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no.,
 vegetation type, predominant vegetation, veget
 and soil score, and trend.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

Class	Species	Hits	Tally	Total	Allowable
Dec.	Asa			2	
	Orch	2		2	
	Bdr			4	
Inc.	Hya		1731	51	
	Corv	6		10	
	Spe		2	2	
	Spe		2	6	
	Arad		207	2	
Inv.	Gua			8	
	Pop	6		10	
	Co	8		18	
	Yaba			2	
	Yaba			2	
	Mallow		2/1	2	
Rock					
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.					
Tot. Rock					
Tot. Litter					
Bare Ground				4-1	
Tot. Cool Season					
Tot. All				28	

0
0
0
5
5
5
1

[illegible]

005500-1-47/Ch



Pace Transect #37
Havasupai Traditional Use Lands



PACED TRANSECT

Range Allotment Havasu TUL Date 6-9-82 Transect No. 02-007-Stop 2
 Aerial Photo No. 02-007 Place Interval 2 By Shawar
 Game Mgmt. _____ Vegetative Type 12 - Cora Slope 15%
 Key Area 178 Soil Lithic Ustic Turbenthal Aspect NW

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species						Tot
1 0-1/2"							X.001
2 1/2-2"							X.005
3 2-4"							X.049
4 4-6"							X.136
5 6-8"							X.267
6 8-10"							X.442
7 10-12"							X.600
8							
9							
10							
tot							
avg							

Talus 10-40% slope

Leaf Measurements (Vigor)

Species		
1		
2		
3		
4		
5	NOTHING	
6		
7	TO	
8		
9	Heard well	
10		
Tot		
Ave		

CROWN DENSITY
(ASPEN AND RIPARIAN)

		Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Tot		
Ave		

Comments: No grasses present
for vigor measurements. Moderate
downslope soil movement present.
A moderate amount of house dung
and tracks present.

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	0	2	2	2	X2=4
Inc.	0	12	12	12	X1/2=3
Inv.	26	60	86	86	X-1=86
Tot.	26	74	100	100	
Cool Seas.					-79

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 0
 Composition 4
 Vigor 0?
 Total 4
 Condition Class VP
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 18
 Soil Disturbance _____
 Factor 14
 Total 32
 Condition Class P
 Current Trend →

P38- 12 - Cora Eula Yuba
 VP → 80% PC
 20% RIC

Summary of Hits

Hits, all Plants 26
 Hits, all Rock 36
 Litter —
 Bare Soil 38
 Total 100
 Hits, Dec. + Inc —
 Hits, Cool Sea —

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com- position	Density	Vigor	Avail- ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Ve-
 getation type, predominant vegetation, vegetat
 and soil score, and trend.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

[illegible][illegible]

Class	Species	Hits	Tally	Total	Allowable
Dec.	Eula	.	. 2	2	
Inc.	Cora Egri	16	:1 . 2	10 2	
Inv.	Cora ~~Qqda~~ Yaba	22 . 2	X X X X X X X X .	82 2 2	
Rock					
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.					
Tot. Rock				36 0	
Tot. Litter					
Bare Ground				36	
Tot. Cool Season					
Trade				2	



Pace Transect #38
Havasupai Traditional Use Lands

PACED TRANSECT

★ 02-007 stop 1 is the same, with a slight increase in production to about 30% among large boulders.

P-39

Range Allotment Haverhill TUL Date 6-9-82 Transect No. 01-006-Stop 6
 Aerial Photo No. 01-008 Place Interval 2 By Sharrow
 Game Mgmt. _____ Vegetative Type Cora-Atca 12 Slope 15-25
 Key Area 178 Soil Very rocky, calcareous, deep Aspect N

Location Map:

BASAL AREA - Riparian or Aspen

Number or Size class	Species	Tot
1 0-1/2"		X.001
2 1/2-2"		X.005
3 2-4"		X.049
4 4-6"		X.136
5 6-8"		X.267
6 8-10"		X.442
7 10-12"		X.600
8		
9		
10		
tot		
avg		

Talus - lower slope.
 Soil is fairly stable due to extensive rock cover and tortula. Stair step is only slightly noticeable.

Some horse dung and tracks present

Comments: Most of the grasses present show some signs of use.
The grasses present are in small pockets. Production for the slope is 1200-2000.

Leaf Measurements (Vigor)

Species	Spfl
1	3
2	2
3	6
4	6
5	6
6	4
7	3.5
8	6.5
9	5
10	3.5
Tot	45.5
Ave	4.6

CROWN DENSITY (ASPEN AND RIPARIAN)

	Total
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Tot	
Ave	

Composition Summary

	Hits.	Dots.	Comp	ALLOW Comp	Comp Value
Dec.	4	2	6	6	X2=12
Inc.	6	14	20	20	X1/2=5
Inv.	16	58	74	74	X1=74
Tot.	26	74	100	100	
Cool Seas.					-57

CONDITION AND TREND RATING

from Scorecard C Dated 6-79
VEGETATION
 Forage Cover Index 13
 Composition 8
 Vigor 4
 Total 25
 Condition Class P
 Current Trend →
 Trend Indicators _____
SOIL STABILITY
 Bare Soil Index 35
 Soil Disturbance _____
 Factor 19
 Total 54
 Condition Class F
 Current Trend →

P39-12 - Cora Spfl Atca
 P → 80% PC
 20% NC

Summary of Hits

Includes Tortula

Hits, all Plants 48
 Hits, all Rock 30
 Litter 6
 Bare Soil 12
 Total 100
 Hits, Dec. + Inc 10
 Hits, Cool Sea . _____

SCORE - BROWSE, RIPARIAN, OR ASPEN

Com-position	Density	Vigor	Avail-ability	Stand Structure	Basal Area	Cool Season

TYPING DESIGNATION: Transect no., Vegetation type, predominant vegetation, vegetation and soil score, and trend.

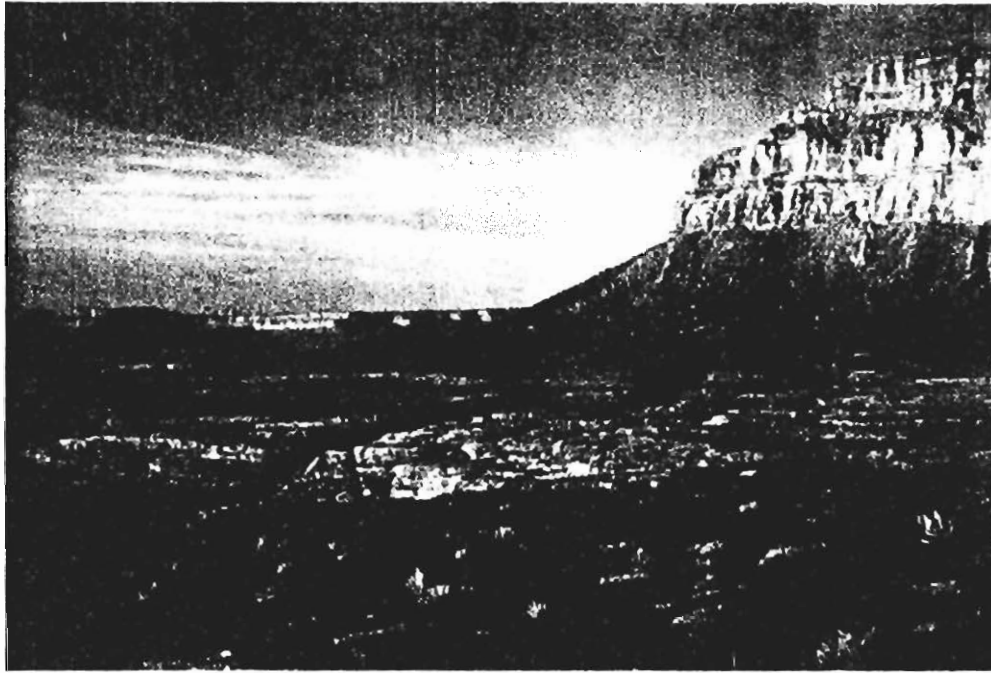
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
		/							

	Sprout		Sapling		Pole.	Mature	Dead
	Browsed	Unbrowsed	Browsed	Unbrowsed			
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Tot.							
Ave.							

RANGE COMPOSITION					
Class	Species	Hits	Tally	Total	Allowable
Dec.	<i>Mica</i>	4	2	4	
	<i>Mica-1</i>			2	
Inc.	Covered	4	6	10	
	Spl		6	6	
	TEP		2	2	
	spl	2		2	

[illegible]

Class	Species	Hits	Tally	Total	Allowable
Dec.	Atca	4		4	
	Mape-1		2	2	
Inc.	Cover 2 nd	4	6	10	
	Spfl		6	6	
	Spfl		2	2	
	Spfl	2		2	
Inv.	Cover	16	58	74	
Rock					
Tot. Dec.					
Tot. Inc.					
Tot. Inv.					
Hits All Plants					
Hits Dec. & Inc.		11		34	
Tot. Rock				2	
Tot. Litter				12	
Bare Ground					
Tot. Cool Season				42	
Tot. All					



Pace Transect #39
Havasupai Traditional Use Lands



APPENDIX F

LIST OF PLANT SPECIES FOUND ON THE HTUL



LIST OF SPECIES FOUND ON THE HAVASUPAI
TRADITIONAL USE LANDS

SPECIES

COMMON NAME

TREES

<i>Cercis occidentalis</i>	Western Redbud
<i>Fraxinus anomala</i>	Singleleaf Ash
<i>Juniperus monosperma</i>	One-seed Juniper
<i>Juniperus osteosperma</i>	Utah Juniper
<i>Pinus edulis</i>	Pinyon Pine
<i>Populus fremontii</i>	Fremont Cottonwood

SHRUBS AND HALF SHRUBS

<i>Acacia greggii</i>	Catclaw Acacia
<i>Agave utahensis</i>	Utah Agave
<i>Amelanchier utahensis</i>	Utah Serviceberry
<i>Arctostaphylos pungens</i>	Pointleaf Manzanita
<i>Artemesia tridentata</i>	Big Sagebrush
<i>Atriplex canescens</i>	Fourwing Saltbush
<i>Berberis fremontii</i>	Fremont Barberry
<i>Bernardia incana</i>	Bernardia
<i>Ceanothus greggii</i>	Desert Ceanothus
<i>Cercocarpus intricatus</i>	Littleleaf Mountain-Mahogany
<i>Cercocarpus montanus</i>	Alderleaf Mountain-Mahogany
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush
<i>Chrysothamnus viscidiflorus</i>	Douglas Rabbitbrush
<i>Coldenia hispidissima</i>	Hispid Coldenia
<i>Coleogyne ramosissima</i>	Blackbrush
<i>Cowania mexicana</i>	Cliffrose
<i>Dyssodia thurberi</i>	Thurber Dyssodia
<i>Echinocactus polycephalus</i>	Barrel Cactus
<i>Echinocereus englemanni</i>	Hedgehog Cactus
<i>Echinocereus triglochidiatus</i>	Hedgehog Cactus
<i>Ephedra viridis</i>	Mormon Tea
<i>Eurotia lanata</i>	Winterfat
<i>Fallugia paradoxa</i>	Apache Plume
<i>Fendlera rupicola</i>	Cliff Fendlerbush
<i>Glossopetalon nevadense</i>	Nevada Greasebush



Gutierrezia sarothrae
Laphamia congesta
Mortonia scabrella
Nolina microcarpa
Opuntia echinocarpa

Opuntia erinacea
Opuntia phaeantha
Parthenium incanum
Ptelea trifoliata
Quercus turbinella

Quercus turbinella x gambellii
Quercus turbinella x undulata
Rhus trilobata
Shepherdia rotundifolia
Thamnosma montana

Yucca angustissima
Yucca baccata

Broomsnakeweed

Scurfy Mortonia
Beargrass
Cholla

Grizzly Bear Prickly Pear
Prickly Pear
Mariola
Pale Hoptree
Shrub Live Oak

Hybrid Oak
Hybrid Oak
Squawberry
Roundleaf Buffaloberry
Turpentine Broom

Fineleaf Yucca
Datil Yucca

FORBS

Abronia nana
Aster abatus
Astragalus sp.
Calochortus sp.
Castilleja sp.
Crypthantha capitata
Erigeron concinnus
Eriogonum alatum
Eriogonum inflatum
Hymenopappus lugens

Hymenoxys acaulis
Linum lewisii
Mirabilis multiflora
Oenothera hookeri
Penstemon sp.

Penstemon utahensis
Phlox austromontana
Psilostrophe sparsiflora
Plantago sp.
Psoralea mephitica

Sand Verbena
Mohave Aster
Locoweed
Mariposa Lily
Paintbrush
Hiddenflower
Hairy Fleabane
Winged Wild-buckwheat
Desert Trumpet

Nostem Rubberweed
Blue Flax
Colorado Four O'Clock
Late Primrose
Beardtongue

Utah Beardtongue
Desert Phlox
Green Paperflower
Indian-Wheat
Scurf Pea



Sarcostemma sp.
Sphaeralcea sp.
Sphaeralcea parviflora
Verbena macdougalii

Milkweed
Globemallow
Globemallow
Tall Verbena

GRASSES

Agrostis semiverticillata
Andropogon (Schizachyrium) scoparius
Aristida sp.
Aristida glauca
Bouteloua curtipendula

Bouteloua eriopoda
Bouteloua gracilis
Bromus rubens
Elymus salinas
Enneapogon desvauxii

Hilaria jamesii
Hilaria rigida
Muhlenbergia porteri
Oryzopsis hymenoides
Poa bigelovii

Poa interior
Poa longiligula
Scleropogon brevifolius
Sitanion hystrix
Sporobolus airoides

Sporobolus contractus
Sporobolus cryptandrus
Sporobolus flexuosus
Stipa arida
Stipa comata

Stipa coronata
Stipa speciosa
Tridens pulchella

Water Bentgrass
Little Bluestem
Three-awn
Blue Three-awn
Sideoats Grama

Black Grama
Blue Grama
Red Brome
Salina Wildrye
Pappus Grass

Galleta
Big Galleta
Bush Muhly
Indian Ricegrass
Biglow Bluegrass

Inland Bluegrass
Longtongue Bluegrass
Burrograss
Bottlebrush Squirreltail
Alkali Saciton

Spike Dropseed
Sand Dropseed
Mesa Dropseed
Funeral Needlegrass
Needle and Thread

Desert Needlegrass
Fluffgrass



APPENDIX G

RANGE GLOSSARY



GLOSSARY OF RANGE MANAGEMENT TERMINOLOGY

1. No Allowable Capacity (NC). Terrain incapable of being grazed by domestic livestock under reasonable management goals. These areas consist of land under natural conditions that are not capable of producing vegetation or are inaccessible to livestock. This classification also includes soils that are not capable of producing more vegetation than is needed to prevent erosion rates that exceed the allowable soil loss.
2. Allowable Capacity. Terrain which is or has the potential to be grazed by domestic livestock on a sustained-yield basis under reasonable management goals. There are two categories as follows:
 - A. Potential Capacity (PC). Areas where current on-site soil loss exceed allowable soil loss because it does not have sufficient effective ground cover to protect the soil. These soils have the potential to recover. This category is not given grazing capacity until it becomes full capacity terrain. For example, an area has 20% ground cover when 40% is needed to hold the soil in place. When ground cover exceeds 40%, the area is reclassified as full capacity.
 - B. Full Capacity (FC). Terrain which is presently stable because effective ground cover is holding soil loss to an acceptable level. These are the areas used to compute estimated grazing capacity.
3. Condition. Condition is a subjective expression of the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community. Soundness and stability are evaluated relative to a standard that encompasses the composition, density, and vigor of the vegetation and the physical characteristics of the soil.
4. Trend. Trend expresses the direction of change, if any, in condition, in response to past and existing livestock management practices, combined with other environmental factors.
5. Animal Unit Month (AUM). An AUM is the grazing capacity for a pasture or grazing unit. Unless otherwise noted, it usually means the number of grown cattle (adults weighing 850-1,000 pounds) that can graze an area for one month. Lighter or younger animals generally require less forage so a conversion to yearlings will allow for more animals. Horses generally require more forage so a conversion to horses will allow for fewer horses.

6. Trick Tank. A trick tank is a range improvement designed to catch, collect, store, and distribute water. An apron is used to catch water from precipitation. A pipe is used to move water from the apron into a storage tank. A pipeline then connects the storage tank to a water trough for livestock and wildlife consumption. They are dependable sources of water if properly designed.
7. Decreaser Plants. These plants are desirable forage plants characteristic of pristine or well managed ranges. These species normally are the most palatable and will decrease with over grazing.
8. Increaser Plants. These plants are less desirable plants which may thrive at the expense of the decreaser species. Under continued over grazing, these plants also will decrease, being replaced by less productive annual plants and by the less palatable invader species.
9. Invader Plants. These are the least desirable species. They normally increase, or invade, the range as the more desirable species disappear.
10. Pace Transects. A pace transect is not permanent. It is used to assist in estimating condition and trend of rangeland; used to delineate vegetation condition classes; used to determine changes in condition; and used to gather composition, vigor, cover, and soil condition data.



APPENDIX H

TERRESTRIAL ECOSYSTEM AND RANGE MAPS



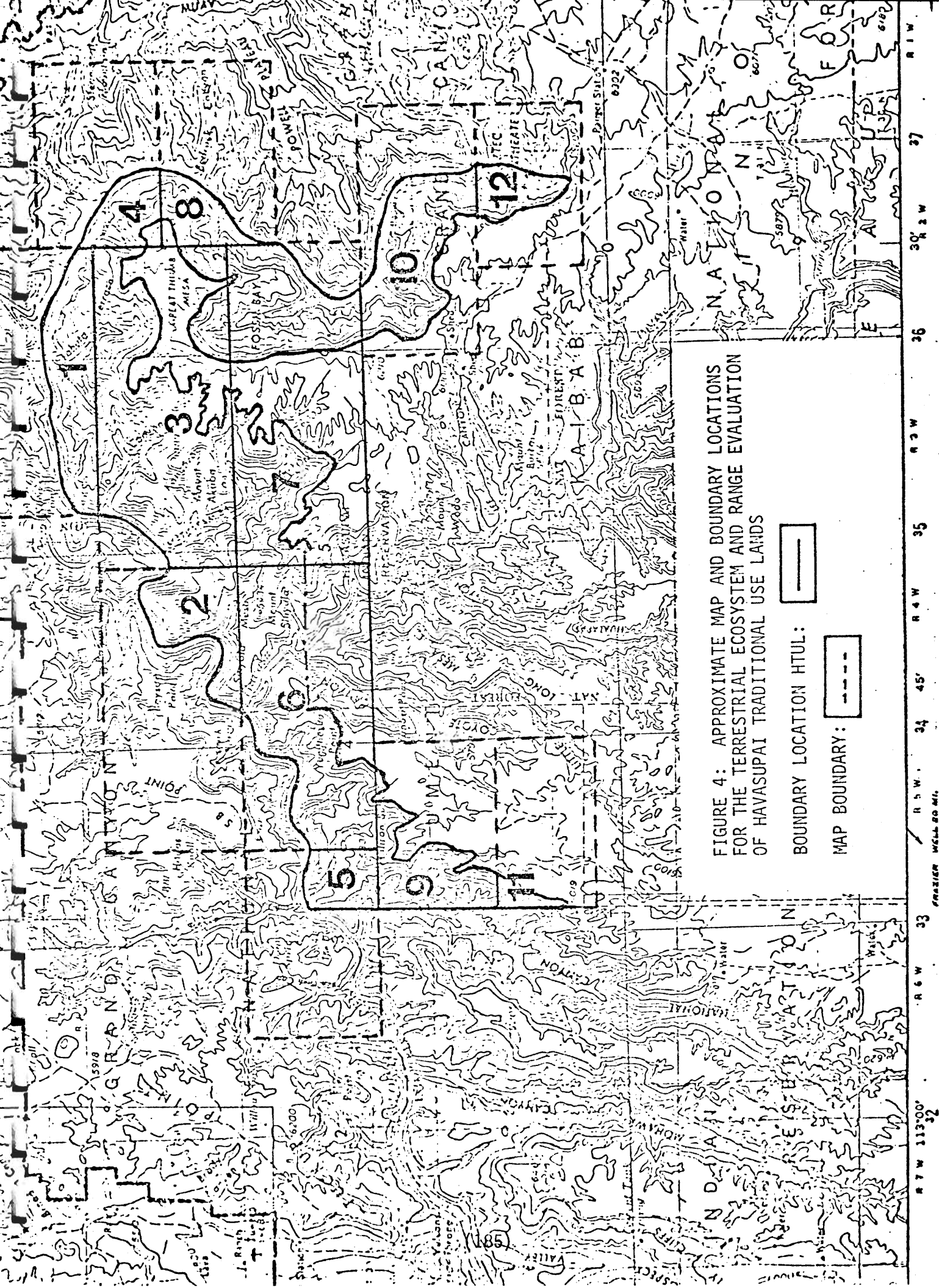


FIGURE 4: APPROXIMATE MAP AND BOUNDARY LOCATIONS
FOR THE TERRESTRIAL ECOSYSTEM AND RANGE EVALUATION
OF HAVASUPAI TRADITIONAL USE LANDS

BOUNDARY LOCATION HTUL: —

MAP BOUNDARY: - - - -



