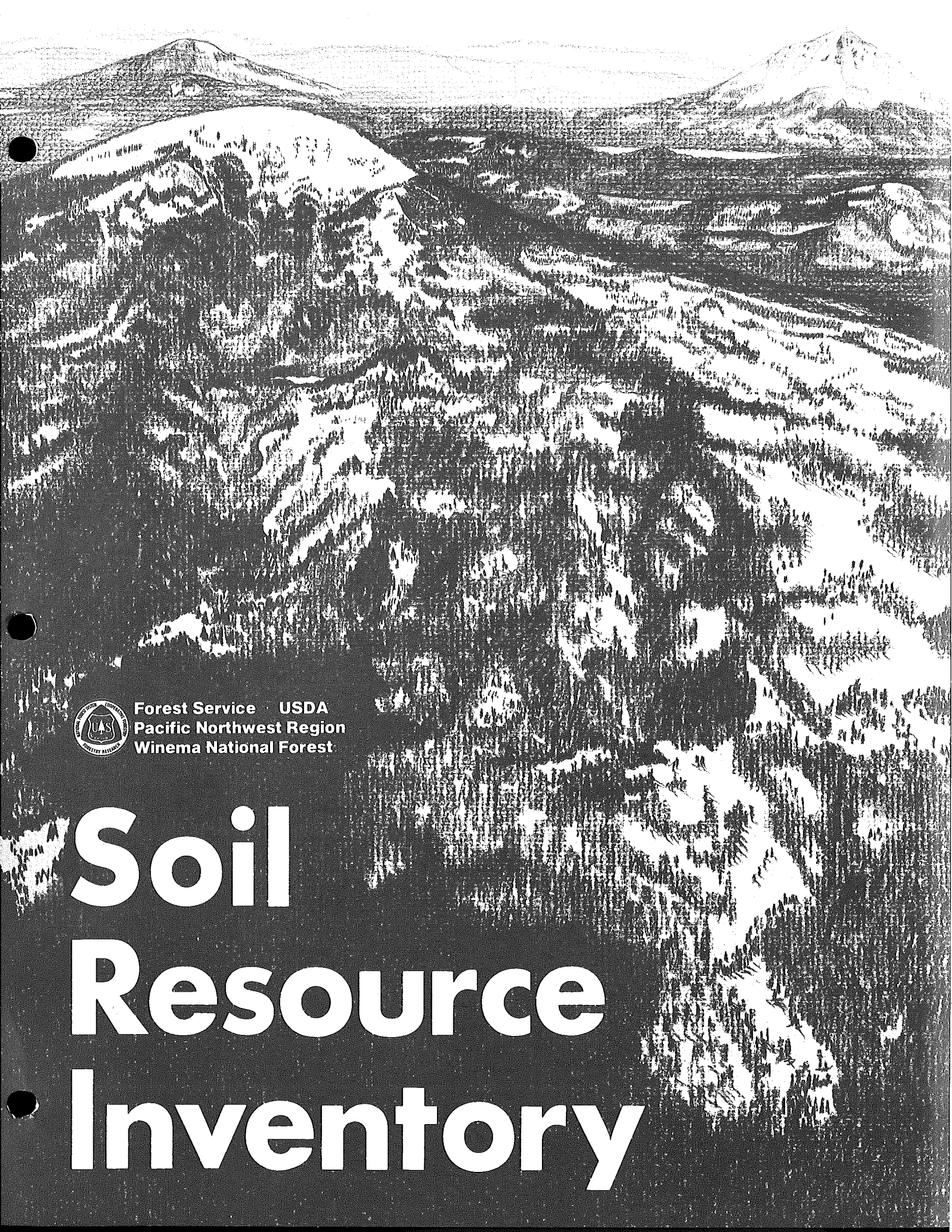
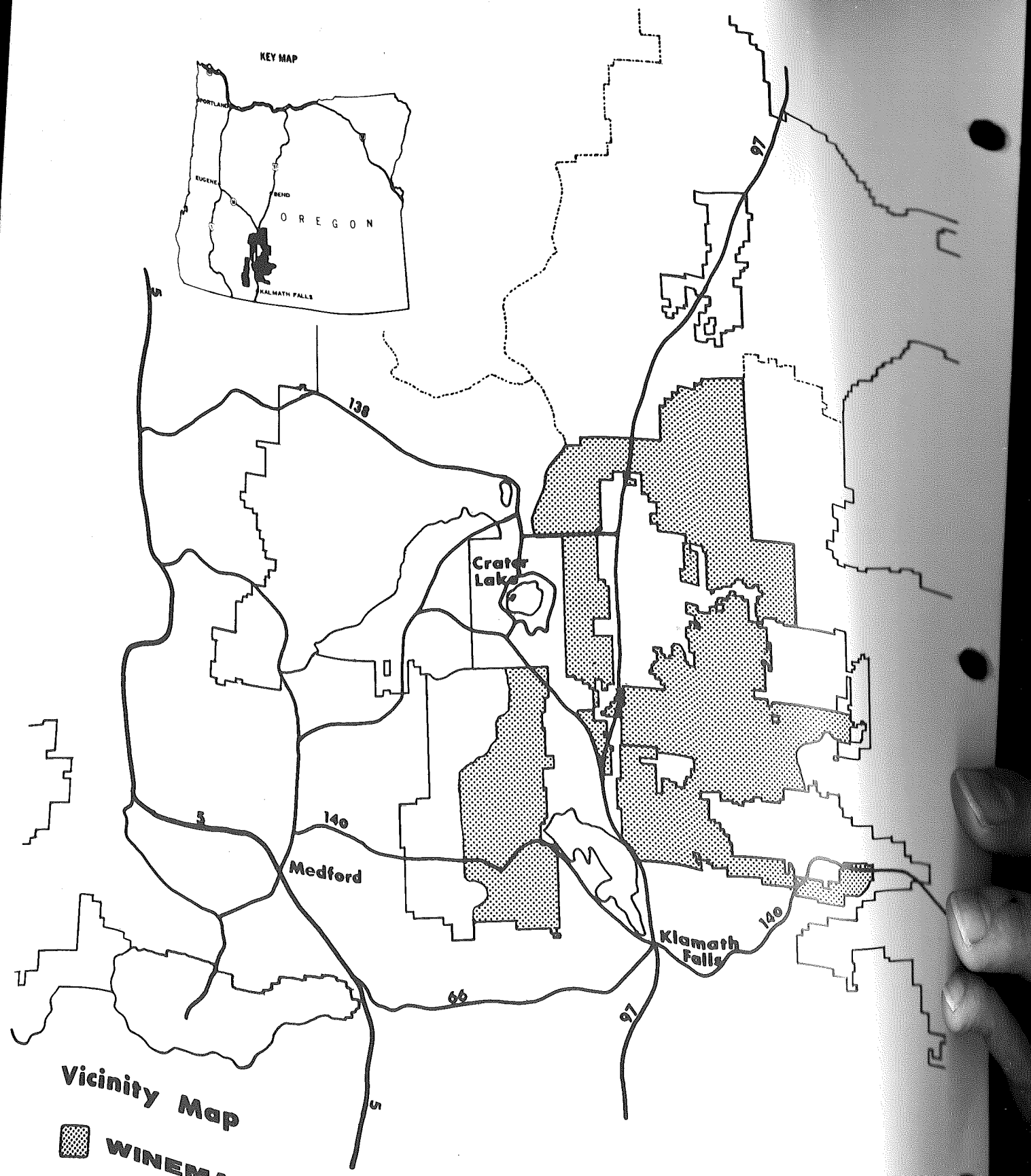
SOIL RESOURCE INVENTORY

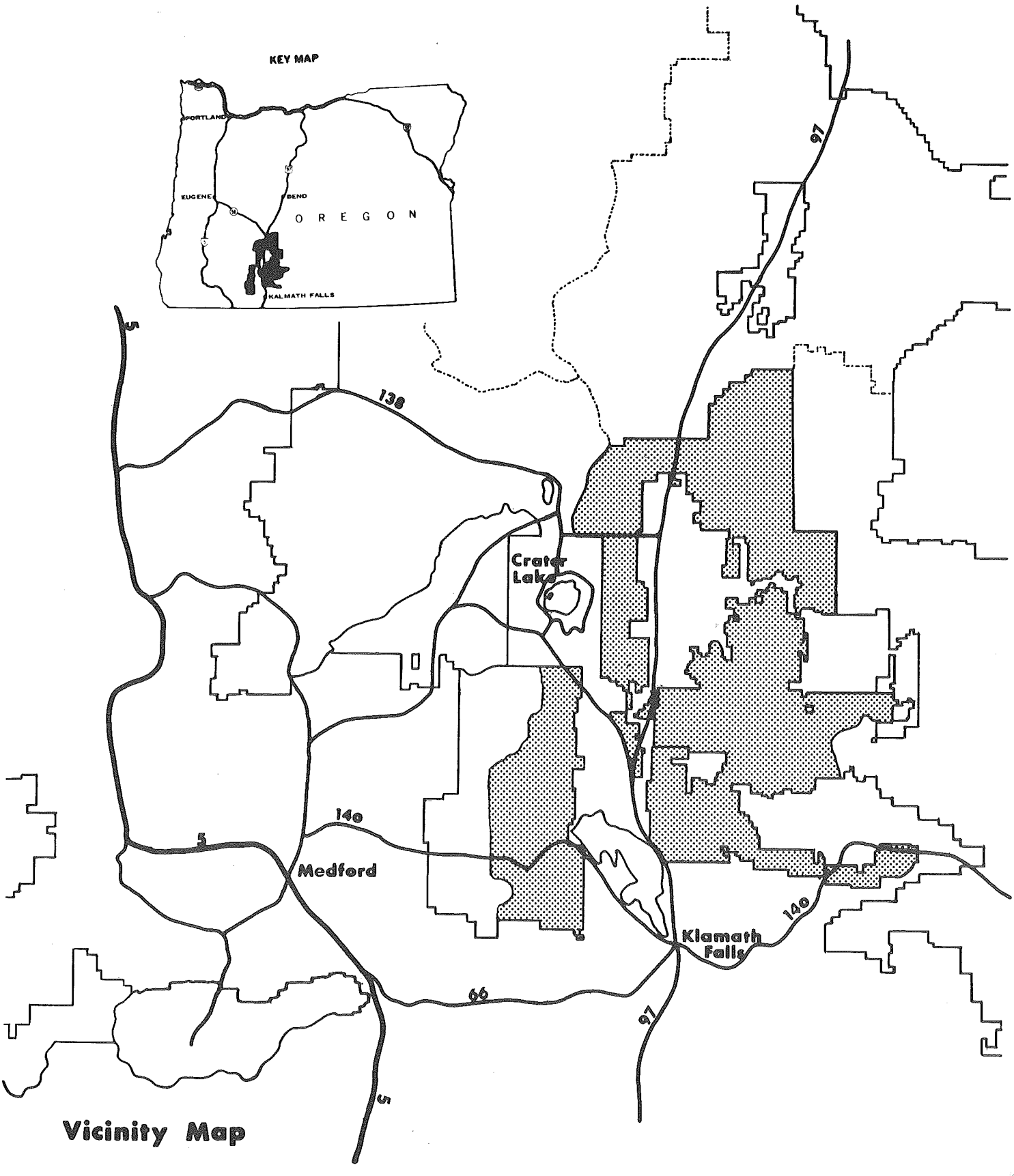
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Winema National Forest

Soil Resource Inventory


KEY MAP
PORTLAND
EUGENE
BEND
OREGON
KLAMATH FALLS
5
138
97
Crater Lake
5
140
Medford
Klamath Falls
140
66
97
5
Vicinity Map
WINEMA NATIONAL FOREST



Vicinity Map

WINEMA NATIONAL FOREST

SOIL
RESOURCE
INVENTORY

WINEMA NATIONAL FOREST



Forest Service · USDA
Pacific Northwest Region
Winema National Forest

SEPTEMBER 1979

PREPARED BY
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SOIL SCIENTIST

PREFACE

This Soil Resource Inventory for the Winema National Forest has been prepared to provide basic, fundamental facts about the soil and related resources. This general information will provide the land manager the necessary soil interpretations for extensive land management planning and resource planning. Information has been provided about soils, parent rock and plant community types. This report will serve as a permanent basic reference for many purposes. From this basic framework, future soil surveys and investigations can be conducted more efficiently to add detail and refinement needed for more intensive management.

Soil is a basic non-renewable forest resource. Future management options will be dictated by the way we manage it. Thus, maintenance or improvement of the soil resource is a primary goal of forest and related rangeland management. Meeting this goal allows the forest manager an opportunity to obtain optimum production of goods and services in a cost effective manner, while incurring minimal physical and social environmental impacts.

AUTHORITY (FSM 2550.1)

In discharging the responsibilities defined in the Multiple Use-Sustained Yield Act of 1960, Resource Planning Act of 1974, and National Forest Management Act of 1976, the Forest Service has a need for information on the nature and distribution of soils on National Forest System lands and a knowledge of their suitabilities for different uses and activities. Throughout these Acts there are references requiring that activities are to be conducted without impairment of the productivity of the land and where appropriate, should be enhanced. Basic soil information is necessary to determine how best to meet these requirements.

OBJECTIVE (FSM 2550.2)

"The broad objective is to secure correlated basic soil data applicable to intensive management of forest and rangelands. The soil program is designed to provide technical knowledge about soils in the form most usable for National Forest multiple use and resource planning, management and coordination."

POLICY (FSM 2550.3)

"Forest Service policy is to conduct soil resource inventories of National Forest lands as needed for proper development and management of all resources and activities. Soil resource inventories are made at varying orders of intensity tailored to specific National Forest management needs. These inventories will form the basis for interpretations about the soils to assist in the planning and management of forests and rangelands."

USE

The primary intended use of this Soil Resource Inventory is for the broad planning level. Major emphasis of this inventory is on interpretations and

behavior of the soil resource in response to land management activities. These interpretations are based on the interrelated factors of soil and its relative position, geology (parent rock and geomorphology) and plant community types. Interpretations are based on field observations, laboratory data, and anticipated response to management activities.

The reconnaissance nature of this soil inventory lacks scale and detail needed for intensive, small area projects. Such projects require additional on-site investigations to insure reliability of interpretations for various uses.

The user's responsibility is to recognize the limitation of scale and information accuracy. Often the user will over extend the SRI information by thinking it will answer all short term planning problems, that it is the ultimate and no more soil data or assistance is needed. The scope of this inventory is for broad planning purposes. Additional intensive inventories and interpretations will be needed for detailed planning and the project investigation. Interpretations should be continually updated and refined as better information becomes available through experience, research, field observations, and detailed mapping.

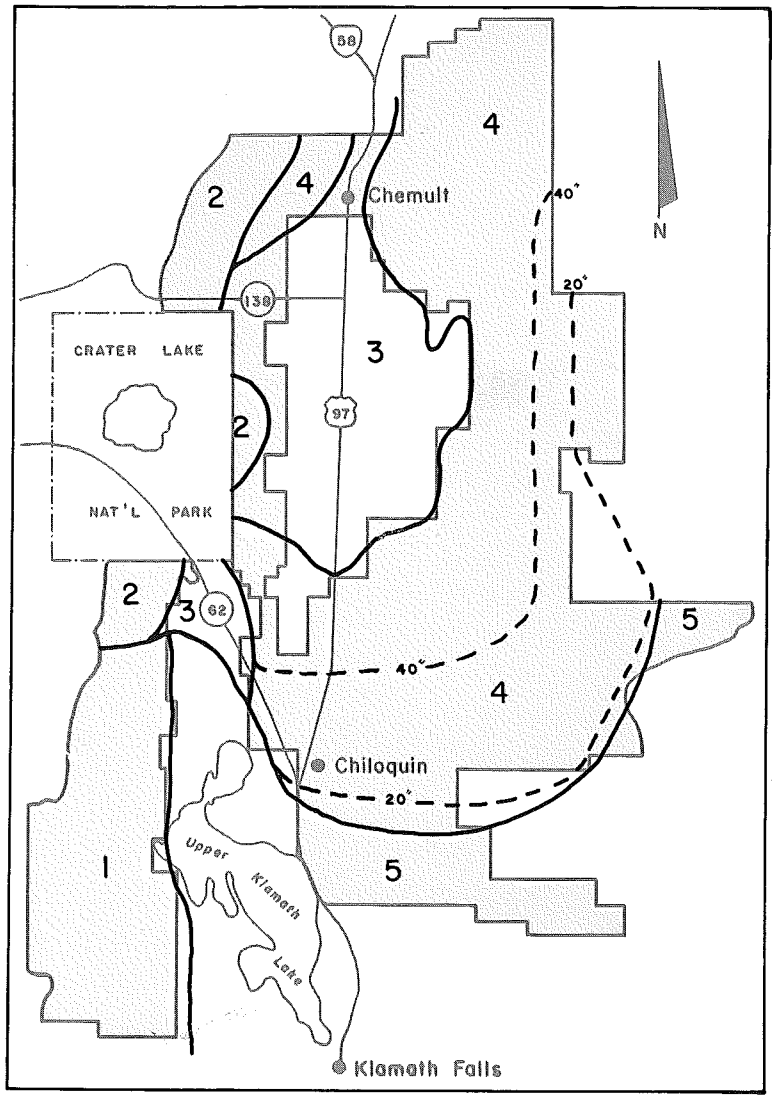
To aid the resource planner, this report was prepared in one book. Reproductions of the aerial photos are used to give visual detail of the complex soil-plant community relationships.

Soil Scientist, Garwin Carlson, conducted the field mapping from 1975 to 1977 and also prepared this report. Supervision was provided by Loren Herman from the Division of Watershed in the Regional Office.

The author would like to thank the Winema Geometronics Unit, Jane M. Cissell, Eve M. Gmirkin, Jerry J. Tighe, Charles D. Cooper, and Katherine Bushey; and the Typist, Deanna L. Vest, for their valuable assistance and participation in the preparation of this report.

TABLE OF CONTENTS

	Page
Geology	1
Climate	5
General Soil Groups and Landtypes	9
Special Features of the Pumice and Ash Soils of the Winema National Forest	13
Soil Group A	23
Soil Group B	33
Soil Group C	43
Soil Group D	53
Soil Group E	63
Soil Group G	73
Special Features of the Non-Pumice and Ash Soils of the Winema National Forest	80
Soil Group H	83
Soil Group R	93
Soil Group X	103
Miscellaneous Landtypes	113
Appendix I - Soil Chemical Analysis Data	123
Appendix II - Temperature, Precipitation, and Water Balance Data for Selected Locations	135
Appendix III - Definitions of Soil Interpretations	138
Appendix IV - Landtype Features and Qualities Definitions	146
Appendix V - Soil Characteristics Definitions	148
Appendix VI - Glossary	152
Soil Maps	157



1 Glaciated high cascades, basalts, and andesites.

2 Cascade basalts and andesites with pumice and ash mantle.

3 Scoria, pumice, and ash glowing avalanche flows.

4 Airlaid pumice and ash with 20 and 40 inch depth lines (---)[1/]

5 Pliacene and Pleistocene volcanics and sedimentaries.

GENERALIZED GEOLOGY MAP

Winema National Forest

[1/] Pumice and ash depth adapted from Howel Williams, U.S.G.S. with refinement from field observations.

GEOLOGY [1/] - Sources of Soil Material

The geologic history of the Winema N.F. began to unfold approximately 10 to 15 million years ago during the early stages of the Pliocene Epoch. Rivers that drained the region were blocked by basalt flows, creating large shallow lakes over much of what is now the present day Forest area except for the western edge of the Forest. This was the beginning of the Basin and Range Province for the eastern three-quarters of the Forest.

Large quantities of volcanic ejecta from the Cascade Mountains and nearby eruptive centers were deposited into these shallow waters. These deposits consisted of lapilli tuff stratified with layers of andesite and basalt from local eruptive centers. Examples of local eruptive centers within these shallow lakes are the Badlands and Devil's Garden on the Chiloquin Ranger District.

The shallow lakes were heavily populated by diatoms whose siliceous skeletons were deposited in great numbers on the lake bottoms. The white diatomaceous bedrock exposures are common in roadcuts in the southeast part of the Chiloquin Ranger District.

The high Cascades Geologic Province also began to form during the early Pliocene Epoch in the western part of the Forest. Great outpourings of lava and newly forming mountains were beginning to build up a barrier to eastward movement of moisture into the present day Forest area.

Towards the end of the Pliocene Epoch faulting began to take place and reshape the large shallow lakes. The faults caused large blocks of land to shift and form north to south trending ridges and valleys throughout the Chiloquin and eastern part of the Chemult Ranger District. Faulting continued into the Pleistocene Epoch.

The Pleistocene Epoch began with a change in climatic conditions approximately 1 million years ago. The climate turned colder and wetter as the ice age began. Much of the western portions of the Forest and Yamsay Mountain and Swan Lake Point were covered with alpine glaciers.

With faulting continuing into this period, fault derived basins filled with melt from the glaciers and increased precipitation. Diatomite and pyroclastic materials continued to fill the water filled basins.

Volcanic activity also continued throughout the Pleistocene Epoch. Scattered north and south in the High Cascades were large volcanos such as Mt. Hood, Shasta, Adams, Mazama, and Rainier.

Mt. Mazama standing on the site where Crater Lake now exists rose to an estimated 12,000 feet with glaciers active on its summit and flanks. "An interval of quiet followed. The glaciers retreated farther up the mountainsides, until only three tongues extended below the present rim of Crater Lake for a mile or so. As the glaciers retreated, forests spread upward in their wake. Trees three feet or more in diameter grew along what is now the south rim of the lake.

During this long spell of calm, the liquid magma in the feeding chamber of Mount Mazama, perhaps 2 or 3 miles underground, was slowly crystallizing. Heavy crystals sank in the liquid while gases rose toward the top of the chamber. In this way a relatively light, gas-rich liquid containing only a few crystals came to overlie a heavier liquid containing less gas but charged with abundant crystals. In brief, gas-rich dacite magma, poor in crystals, came to overlie gas-poor basaltic magma crowded with iron-rich minerals. The stage was set 7,000 years ago for the climactic outbursts that were to destroy the top of Mount Mazama and in doing so produce the colossal basin that holds Crater Lake.

Characteristically, the gas pressure was at its greatest during the initial stages of these culminating eruptions. Hence, the dacite magma that was first discharged, was blown high above the mountaintop as a fine incandescent spray that fell to earth as fragments of frothy white pumice, mostly of gravel size or finer. As the eruptions continued and the gas pressure diminished, the size of most of the falling fragments of pumice increased, and the winds changed from the northwest to the southwest. Some of the fine pumice has recently been identified as far away as Alberta, Canada. The total area covered by falling pumice was more than 350,000 square miles, and no less than 5,000 square miles were buried to a depth of more than 6 inches. All of eastern Oregon and eastern Washington, blanketed by white pumice, must have had a wintry aspect, as if covered by a heavy fall of snow. How long these high-pressure initial eruptions lasted cannot be told with certainty, but by comparison with the famous eruptions of Krakatoa in Indonesia in 1883, perhaps they lasted no more than a few months or years.

The eruptions then changed radically in character. When the upper, gas-rich layers of the feeding chamber had been discharged, the lower layers of dacite liquid foamed to the surface. Part of the liquid continued to be blown high above the volcano producing showers of pumice, but most of it rose only a short distance, foaming over the rims of the craters and then avalanching down the mountainsides as glowing pumice fragments, often moving at speeds of more than 50 miles an hour. Some of the avalanches rushed down the old U-shaped glacial valleys; those that emptied into the valley of the Rogue River did not stop until they had traveled 35 miles, even though much of their path lay through dense forests. North and east of the volcano where there were no deep canyons to confine the avalanches, they spread in wide sheets, some pouring into Upper Klamath Marsh while others swept by the present site of Chemult with such speed that they traveled 25 miles from their source, across a plateau, and even uphill. Such was the mobility of these incandescent, turbulent avalanches that lumps of pumice 14 feet in diameter were carried for a distance of 20 miles.

Shortly before the discharge of glowing avalanches ended, the lower levels of the feeding chamber were tapped, so that the white sheets of dacite pumice were buried in places by avalanches of darker basaltic scoria, very rich in crystals still visible on the walls of the canyon of Annie Creek, or, even more clearly, at the Pinnacles on Sand Creek. Finally, after a few weak, dying, explosions, the great eruptions ceased. All of the

wooded glacial canyons on the slopes of Mount Mazama had been utterly devastated, choked to depths of 300 feet or so by deposits of hot pumice and scoria which continued to give off acid fumes for many years." (Howell Williams U.S. Geologic Survey).

Scoria, pumice, and ash from Mt. Mazama covers the northern two-thirds of the Forest with depths varying from 75 to 100 feet near Crater Lake to less than 12 inches in some places on the eastern edge of the Forest.

Soils on the Forest have formed in both the air laid pumice and ash and the avalanche types. The airlaid pumice is less than 3 inches in diameter and are the parent material for Soil Groups A and B. The avalanche types are the parent material for Soil Group C and D. The last portion of the avalanche flows contained a high proportion of crystalline plagioclase sands which developed into Soil Group E. The different types are shown on the geologic map.

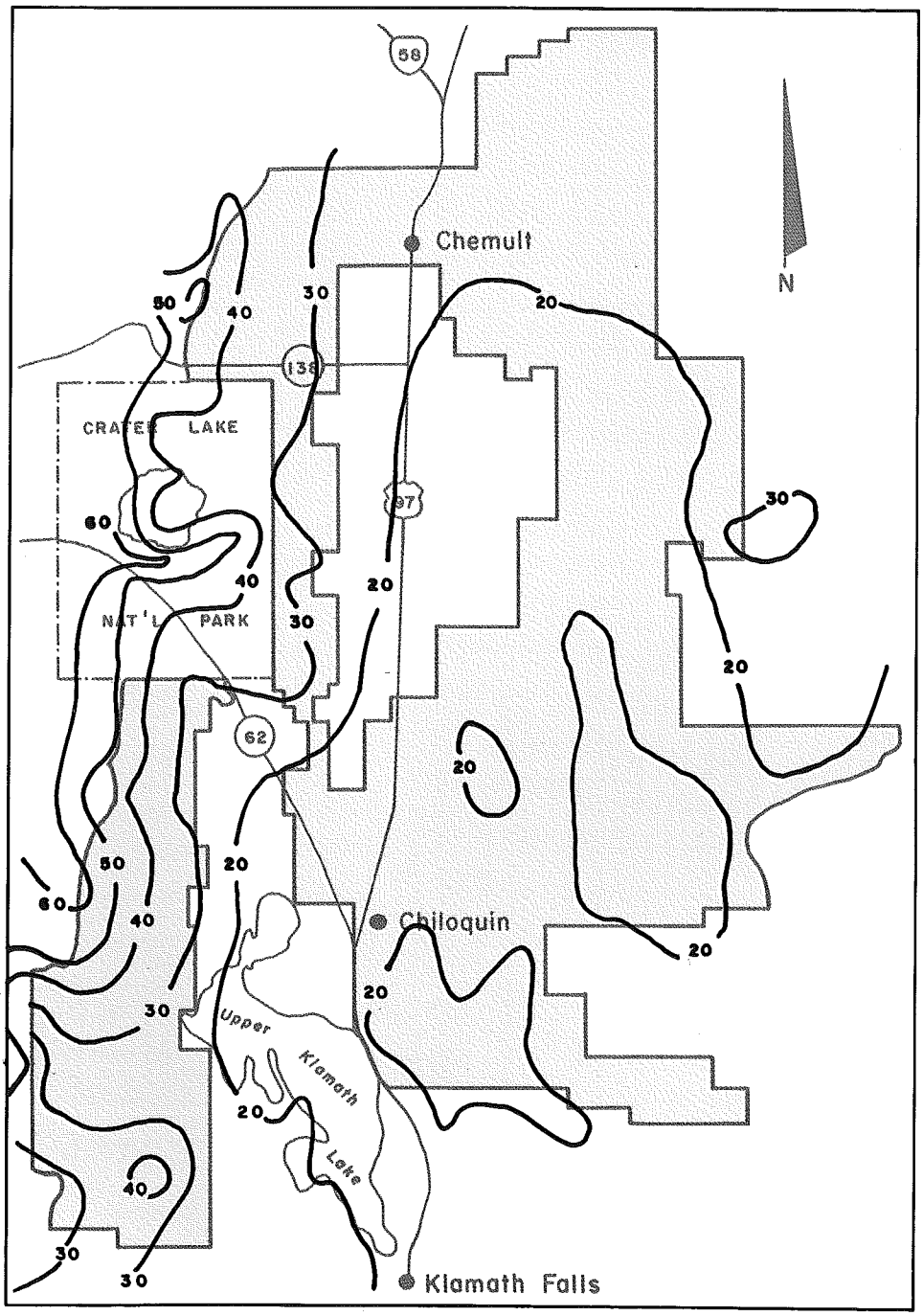
From late pleistocene into recent time, many basaltic cinder cones have erupted scoriaceous cinders. Examples are Lookout and Boundary Butte on the Chemult, Applegate on the Chiloquin District and Goosenest on the Klamath District. Numerous small cinder cones are used as road rock sources.

The author has identified the possibility of an additional windshift to the south during the airfall stage. Softer, airlaid pumice with different characteristics overlies the more common hard, airlaid pumice and can be observed in deep roadcuts generally to the north and northeast of Mt. Mazama.

REFERENCES 1/

The Reconnaissance Geology and Mineral Resources of Eastern Klamath County and Western Lake County, Oregon. Bulletin 66 -State of Oregon Dept. of Geology and Mineral Industries - 1970.

U.S.G.S. Quad Sheet - Crater Lake Park and Vicinity, Oregon. Dissertation on reverse side by Howell Williams. 1956.



PRECIPITATION MAP

Winema National Forest

—20— Precipitation expressed in Inches per Year[1]

1/ Klamath Basin State Water Resources Board, June 1971

CLIMATE [1/]

The climate of the Klamath Basin, which the Winema N.F., is a part of, is generally characterized by dry summers with high temperatures and wet winters with moderately low temperatures.

The basin, due to its location just east of the Cascade Mountain Range between the Pacific Coast and the inland plateaus, is in the path of many cyclonic storms originating in the north Pacific. Practically all winter precipitation is derived from these storms traversing the basin in a easterly direction from the west and southwest. Precipitation amounts in the basin are greatest along the eastern slope of the Cascades. The area is subject to residual precipitation from primary uplifting of storms passing over the Cascade Range. The Klamath Ranger District and the western part of the Chemult Ranger District receive 25 to 50 inches of precipitation. The remainder of Chemult and Chiloquin Ranger Districts receive 15 to 30 inches.

Most winter precipitation falls as snow, particularly at higher elevations. Total average annual snowfall at Klamath Falls weather station is approximately 41 inches and at Crater Lake National Park Service headquarters approximately 521 inches. Midwinter rains are frequent in the lower elevation areas. Maximum precipitation and minimum temperatures generally occur in December and January. Minimum precipitation and maximum temperatures generally occur in July, August, and September.

Seasonal variation of temperature in the Klamath Basin is large. At Klamath Falls, the average temperature over the year is approximately 48 degrees, with extremes ranging from 105 degrees to minus 24 degrees. The diurnal variance in temperatures is appriximately 20 degrees in the month of minimum temperatures (January) as compared to approximately 40 degrees in the month of maximum temperatures (July). The annual mean variance in temperature from maximum to minimum is approximately 65 degrees.

Killing frosts, temperatures of 32 degrees or less, have been recorded throughout the basin in every month of the year. Because of the thermal properties of pumice and ash soil materials, which are explained later in the pumice and ash section, low humidities and clear nights, frosts commonly occur. The likelihood of frost is greater than 50 percent on any summer night at Chemult.

Prevailing winds in the basin are from the west and southwest. Average recorded wind velocity in the basin is approximately 6 miles per hour on a long-term basis, but localized surface wind patterns vary throughout the basin, due to the irregular topography. Severe wind storms are not uncommon.

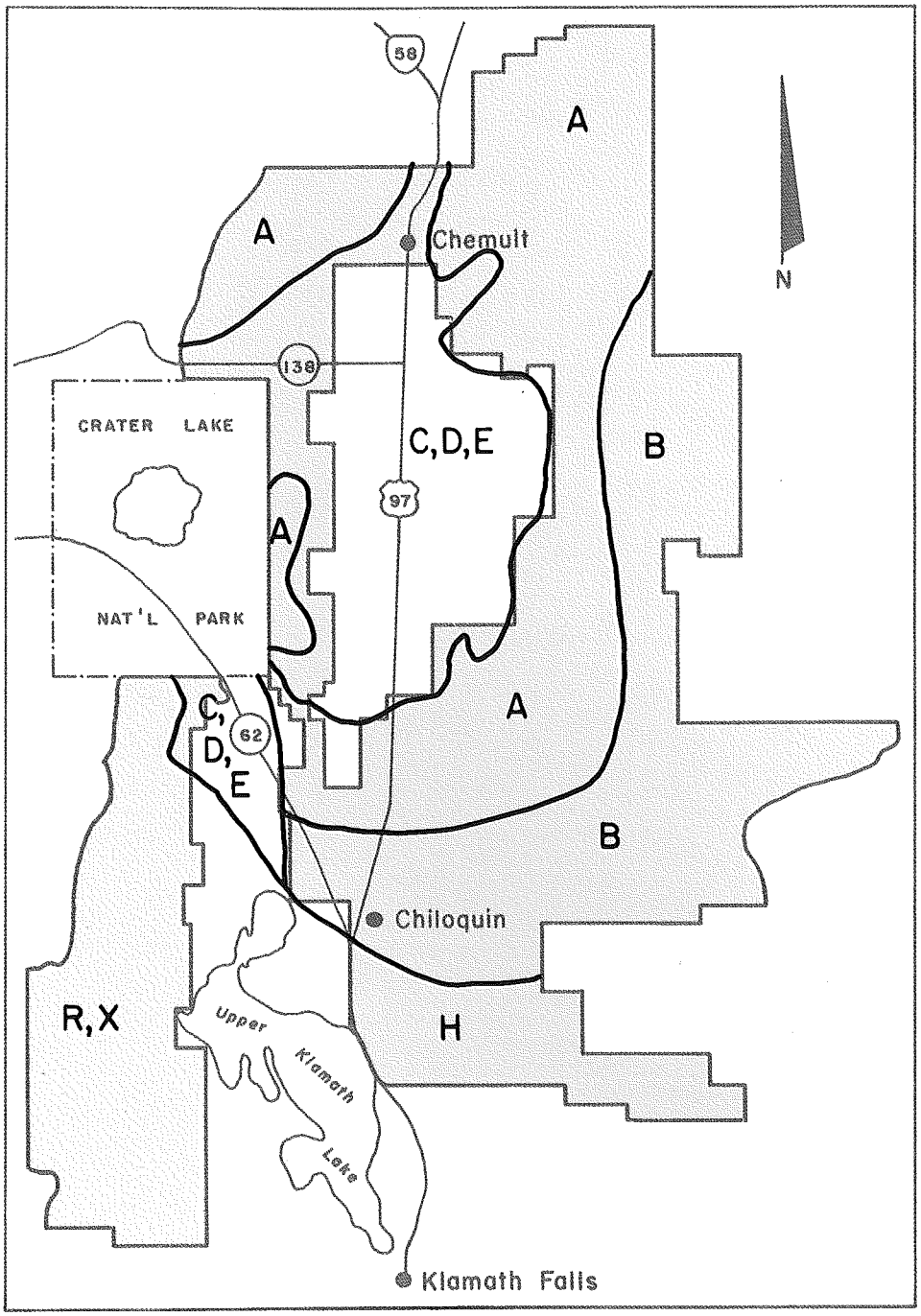
Both temperature and wind conditions have a significant effect on evaporation rates from exposed water surfaces as well as total evapo-transpiration from vegetated areas. Evaporation losses from water surfaces in the basin vary from over 4 feet per year to as little as 1.5 feet per year, being

greatest in the low-lying areas of the basin. Upper Klamath Lake has an evaporation rate of between 3.5 to 5 feet per year on the average. High mountain lakes in the basin have much lower evaporation rates.

Evapotranspiration data on vegetated areas in the basin have been estimated from 1.5 feet per year for large stands of pine to less than 1 foot per year for noncommercial vegetation, such as sagebrush and the low-lying prairie lands.

Temperature, precipitation, and water balance data for selected locations is shown in the appendix II.

1/ Temperature and the water balance for Oregon Weather Stations. Special Report 150, May 1963. Agricultural Experiment Station, Oregon State University, Corvallis, Oregon.



GENERAL SOIL GROUP MAP

Winema National Forest

A-X Soil Group Areas

Soil Group Area Boundaries

GENERAL SOIL GROUPS AND LANDTYPES

of the Winema National Forest

There are two distinct, basic soil materials on the Forest. About 75 percent of the soils are derived from pumice and ash from the eruption of Mt. Mazama approximately 7,000 years ago. The other 25 percent of the Forest has had minimal influence from the recent pumice and ash and resemble typical mineral soils. This is the first stratification of the soils on the Forest - pumice and ash soils and non-pumice and ash soils. Because of the distinct differences between the two basic soil materials the report will be in two sections so as to cover the two distinct soil materials more fully.

SOIL GROUPS

The next stratification of the soils on the Forest is within each of the two major soil areas. Six soil groups have been identified within the pumice and ash soils and three within the nonpumice and ash soils. These groups differ in soil characteristics and interpretations. These divisions are called soil groups with a different letter identifying each group. Each group may or may not have a U.S.D.A. soil series name. Since, at the present time, the series name has not been correlated on the Forest, the term Lapine-like is used. Examples are: Soil Group A -(Lapine-like soils), Soil Group C (Makalak-like soils), and Soil Group G - (Wickiup-like and other unnamed soils). The General Soil Group Map shows where the user can generally expect each soil group to occur.

LANDTYPES

Within each soil group, differences in topography, vegetation, and climate are described as landtypes. Each soil group may have up to seventeen different landtypes. Each landtype has a symbol such as A1 and A2 for landtypes within Soil Group A and R1 and R2 for landtypes within Soil Group R.

The landtype is the basic unit of mapping. Landtype delineations on the soil maps will represent at least 70 percent of the identifying landtype. The other 30 percent can be other landtypes which occur as inclusions.

MISCELLANEOUS LANDTYPES

In addition to the landtypes within each soil group, there are twenty-one other landtypes that occur anywhere on the Forest. These are called miscellaneous landtypes. They relate generally to a specific landform or vegetative area. Examples are: miscellaneous landtype 1, wet meadows, and miscellaneous landtype 14, scab rock flats with low sagebrush.

LANDTYPE LEGEND

Miscellaneous Landtypes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 17, 18, 19, 20, 21.

Soil Group A Landtypes: A1, A2, A3, A4, A5, A6, A8, A10, A11, A12, A13, A14, A15, A16, A17, A18, A19.

Soil Group B Landtypes: B1, B2, B3, B4, B5, B6, B7, B8.

Soil Group C Landtypes: C1, C2, C3, C4.

Soil Group D Landtypes: D1, D2, D3, D4, D5.

Soil Group E Landtypes: E1, E2, E3, E4, E5, E6, E7, E8, E9, E10.

Soil Group G Landtypes: G1, G2, G3.

Soil Group H Landtypes: H1, H2, H3, H4, H5, H6, H7.

Soil Group R Landtypes: R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11.

Soil Group X Landtypes: X1, X2, X3, X4, X5, X6, X7.

LANDTYPE COMPLEXES

At times, because of localized landforms or vegetation, two landtypes occur in an arrangement too complex or too small to seperate at the one inch scale used in this survey. The delineation on the soil map will have two landtypes to identify the area and are called landtype complexes. Usually, one landtype will be dominant, but sometimes occur in approximately equal distribution. In any one delineation, the relative proportion may be different from another delineation.

Examples of landtype complexes are A1A3, A2B4, 5B4, and A17I8. If one of the miscellaneous landtypes is part of the complex, it is the first unit of the complex as in 5B4. Refer to each landtype for desired information.

LANDTYPE COMPLEX LEGEND

Complex	Landtypes		Complex	Landtypes	
214	2	14	B1B8	B1	B8
419	4	19	B2B4	B2	B4
4B4	4	B4	B2G1	B2	G1
4E10	4	E10	B2H5	B2	H5
4H3	4	H3	B3B4	B3	B4
4R5	4	R5	B3B5	B3	B5
4R8	4	R8	B4B7	B4	B7
4R9	4	R9	B4G1	B4	G1
4R11	4	R11	B4G2	B4	G2
4X2	4	X2	B4H2	B4	H2
4X3	4	X3	B4H5	B4	H5
4X6	4	X6	B4H6	B4	H6
5H3	5	H3	B5H2	B5	H2
6A8	6	A8	B5H3	B5	H3
1213	12	13	B6H6	B6	H6
1214	12	14	B7B8	B7	B8
12H1	12	H1	B7G1	B7	G1
12H2	12	H2	B8G1	B8	G1
12H5	12	H5	C1C2	C1	C2
13H3	13	H3	C1E2	C1	E2
13H4	13	H4	C2D1	C2	D1
13H5	13	H5	C2E3	C2	E3
A1A8	A1	A8	C3E8	C3	E8
A2A4	A2	A4	D1D2	D1	D2
A3A5	A3	A5	D1G2	D1	G2
A4A6	A4	A6	D1H4	D1	H4
A4A8	A4	A8	D4X6	D4	X6
A4B4	A4	B4	E6E8	E6	E8
A4B5	A4	B5	G1G3	G1	G3
A4G2	A4	G2	G2G3	G2	G3
A5A6	A5	A6	H1H3	H1	H3
A5B5	A5	B5	H1H4	H1	H4
A6A8	A6	A8	H1H5	H1	H5
A6G2	A6	G2	H1H7	H1	H7
A8A10	A8	A10	H2H3	H2	H3
A8D1	A8	D1	H3H7	H3	H7
A8G1	A8	G1	H5H6	H5	H6
A8G2	A8	G2	H5H7	H5	H7
A8G3	A8	G3	R1R2	R1	R2
A10B8	A10	B8	R1R3	R1	R3
A1116	A11	A16	R4R5	R4	R5
A1216	A12	A16	R4R6	R4	R6
A12E4	A12	E4	R4R7	R4	R7
A1314	A13	A14	R5X3	R5	X3
A16E8	A16	E8	R8R9	R8	R9
A1718	A17	A18	R8R10	R8	R10
			X3X4	X3	X4

This report is designed so that the user starts at the soil group level for characteristics and interpretations which are common to landtypes in pumice and ash soils or non-pumice and ash soils. There is increasing specificity of descriptive information and interpretations at each decending level of stratification. Each lower level becomes more specific to the actual soil delineated on the soil map. If the desired information is not available it may be necessary for the Forest Soil Scientist to map the area at a higher intensity (for some project level needs).

SPECIAL FEATURES OF PUMICE AND ASH SOILS

Approximately 75 percent of the soils on the Winema National Forest are derived from pumice and ash from the eruption of Mt. Mazama approximately 7,000 years ago. Pumice and ash are excessively cellular or frothy rocks which developed into soils with low bulk densities and high water holding capacities. In order to more fully understand how these soils react under management, it is important that an overall understanding of the unique features of these soils and how they differ from other mineral soils.

THERMAL PROPERTIES

Pumice and ash soils have unique thermal properties which more closely resemble peat soils than mineral soils (Cochran 1969) they are:

1. Low heat storage within the soil.

2. Slow heat transfer within the soil.

3. Large temperature response at the soil surface to added heat.

4. Shallow penetration of significant temperature variation.

5. Lack of heat radiation from the soil at night.

All of these properties are interrelated and have an effect on the management of these soils.

These unique properties are characteristic of good insulators like styrofoam or fiberglass, except to a lesser extent. When these insulators become wet, their effectiveness is decreased. The soils react the same way. Water increases the heat storage in the soil, increases the heat transfer rates, and increases the heat penetration within the soil. It decreases the large temperature response from added heat at the soil surface until the soil surface becomes dry.

Other effects of these thermal properties are a lack of available heat at night for radiation back into the atmosphere. With limited incoming radiation and very little radiation from the soil the air can become very cold. Dense, cold air moves downslope and accumulates in flats and openings. This results in lower minimum temperatures and frost pockets. The likelihood of freezing temperatures at Chemult is greater than 50% for any summer night. Some of our timber cutting practices create openings that react like basins or frost pockets. Summer frost damage to ponderosa pine seedlings has been observed on both the Chemult and Chiloquin Ranger Districts. The damage was observed on convex slopes less than 6 percent and along the edges of basins.

Pumice and ash soils are slow to warm in the spring due to their insulating properties. The soil surface dries and then heat is reradiated back into the atmosphere. Soil temperatures at 6 to 12 inch tree planting

depth probably stay in the 35 to 45 degree range until around the first of June except for exceptionally warm springs. It is not known at this time what effect this has on root elongation of planted stock.

In open areas during the summer, surface soil temperatures above 160 degrees have been recorded. This is due to the large temperature response to added heat, and the shallow penetration of the added heat. Temperatures in this range are lethal to new seedlings. In experimental plots with seedlings planted in the open and under slash, only those planted under slash survived. (Cochran 1969b).

Another problem associated with the thermal properties of pumice and ash soils is frost heave. The high water holding capacity of these soils, in combination with its thermal properties, create ideal conditions for frost heave.

Frost heaving is most pronounced when the soil is wet to the surface, is initially free of frost, and when the air temperature drops below freezing at night after being above freezing during the day. At night when water freezes in a thin layer of surface soil, additional water moves upward in response to the water potential gradient created by freezing. This water then freezes and forms ice crystals. The upper ends of these ice crystals are attached to the frozen soil layer and the lower ends are in contact with water in the unfrozen soil. As water freezes, these ice crystals elongate, forcing the frozen soil layer next to the surface, upward. Ice crystal columns have been observed that were 4 to 8 inches high. Seedling and other plants with bases solidly encased in the frozen surface layer are pushed upward. When the surface layer thaws and the ice columns melt, these seedlings and other plants are left on the surface with portions of their roots either broken or exposed on the soil surface.

Late fall rains or spring snow melt are sufficient to wet the soil. The wet soils combined with the same factors which cause a high frequency of radiation frost (high altitude, relatively dry air mass, clear nights, and the thermal properties of pumice and ash soils) also cause severe frost heaving. (Cochran 1973).

WATER REPELLENCY

There is very little research about water repellency of pumice and ash soils in central Oregon except for some of the high elevation plant communities. Voland (Voland 1976) in his plant community work, observed water repellency in some of the mountain hemlock and shasta red fir communities after slash burning. Based on observations and measurements during the Soil Resource Inventory, the author has concluded that all of the pumice and ash soils are water repellant during the driest part of the summer regardless of plant community. The repellency is stronger under the litter layer. Research in California (Debano 1969) shows that there are different types of water repellency. One type is caused by fire and the other is associated with fungal micelia. It is the author's opinion that the repellency in the pumice and ash soils is caused by fungal mice-

lia due to the stronger repellency under litter and the lack of fire for 50 to 60 years. Research could probably determine the real cause of the repellency.

The effects of the repellency is rapid water runoff during high intensity summer storms while the soils are dry. Some surface soil erosion and sometimes severe erosion on roads and fills occur during these storms. Management activities that stir up the litter layer and surface 3 or 4 inches break up this repellant layer. This is an example of management decreasing the erosion hazard.

Wildfire and hot prescribed burns may also cause water repellency in pumice and ash soil. The intensity of burn determines the depth and thickness of repellency. This type differs from the fungal mycelia type in that it can be 2 or 3 inches below the surface while the dry mycelia type is strongest at the mineral soil - litter layer contact. It also may be that fire has removed the fungal mycelia type from the surface few inches. Until more is known about repellency in pumice and ash soils, prescribed burns should be designed to maintain 1/2 inch of litter duff. This should keep fire induced repellency to a minimum.

BULK DENSITY AND AGGREGATE STABILITY

Bulk density, which is a comparison of how heavy something is in relationship to water for a set volume, is quite low for pumice and ash soils. It ranges from 0.50 to 0.75 while most common forest soils range from 0.8 to 1.2 with some being even higher.

Aggregate stability relates to the arrangement of the soil particles into aggregates and the relative strength of the aggregate. Clay and organic matter are cementing agents that hold the particles together. Pumice and ash soils have very low clay contents and low organic matter contents except in the A1 horizon. Due to these factors these soils have very low aggregate stability. When these soils are dry, they are easily displaced or moved under logging traffic. Displacement also becomes more pronounced as slopes become steeper. Moist soils are much more resistant to displacement. On steep (over 40%) slopes when the soils are dry, dry ravel can become a severe problem. Dust also becomes a severe problem while operating on these soils when dry. From a displacement and safety standpoint, it is much better to log on these soils when moist.

These soils are usually difficult to compact even when wet due to low clay contents and the structure of the pumice particles. On the most heavily used skid trails and landings there may be some detrimental compaction if the soils are sufficiently moist. These areas can be easily rennovated by ripping or discing on the gentler slopes. In pumice and ash soils it is difficult to get optimum compaction for road construction.

EROSION

Pumice and ash soils have rapid infiltration rates and very rapid permeability rates except when dry and water repellant. These charac-

teristics decrease the water erosion hazard to a very low level except as discussed under water repellency. The major water erosion problems are associated with roads. Many roads are in troughs that do not let water spread out or get off the roadways. As water moves down the roads, the velocity and volume increases, causing erosion on road surfaces. Erosion can be reduced and water properly dispersed by removing the outer berms, cross-draining, outsloping, and other procedures.

Wind erosion may potentially become a problem in large bared areas (more than 100 to 200 acres) that are exposed to the predominant winds. It is doubtful that openings generally less than 100 acres will cause severe wind erosion.

SOIL WATER STORAGE

Pumice and ash soils are capable of storing large amounts of water. Much of this water is stored at very low tensions. Tensiometer readings a week after precipitation in May are generally less than 10 centibars. This equates to 3.5 to 5 inches of water per foot of soil depth. Wilting point or 15 bar moisture is 1/2 inch of water per foot of soil depth. Dyrness (1960) studied water movement in pumice soils. He found that the rate decreases rapidly at tensions greater than 50 centibars and can limit the length of time during the day when photosynthesis can take place. Moisture tensions drop back or recover to lower levels at night. The slow water movement rate is caused by the limited contact points between the soil particles and the water within the porous pumice and ash particles. During the 30 day establishment period for planted stock, the soil moisture tension should not exceed 30 to 50 centibars.

FERTILITY

Fertility levels are considered low compared with most mineral soils. This may be due to their immature nature (less than 7,000 years old.) For example, the soils have weak profile development and do not have developed B horizons. Significant organic matter enrichment is confined to only a few inches of surface soil and nitrogen, phosphorus, and sulfer levels are low.

It is estimated that 75 to 80 percent of the soil nutrients are concentrated in the upper 6 inches of soil. The nutrient levels do not seem low based on soil test results but when bulk density is taken into consideration the total quantities are low. These soils only weigh 1/2 to 2/3 as much as a normal mineral soil, so the amounts on an acre basis is low. Management activities that remove part of the upper 6 inches of soil can degrade soil productivity. Selected pumice and ash soils chemical analysis are in appendix 1, together with data from other soils on the Forest.

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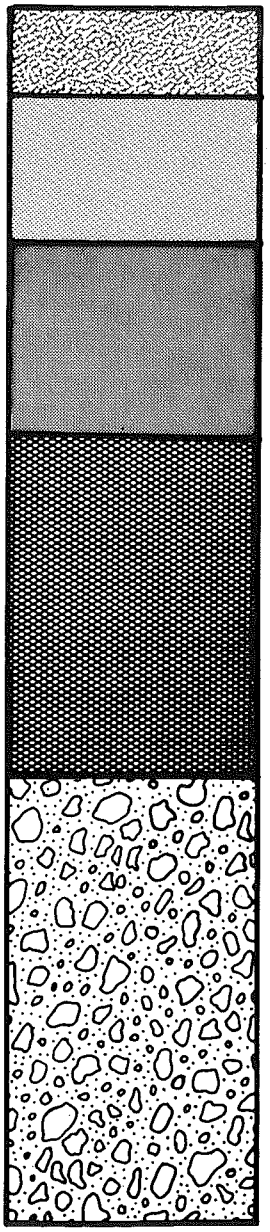
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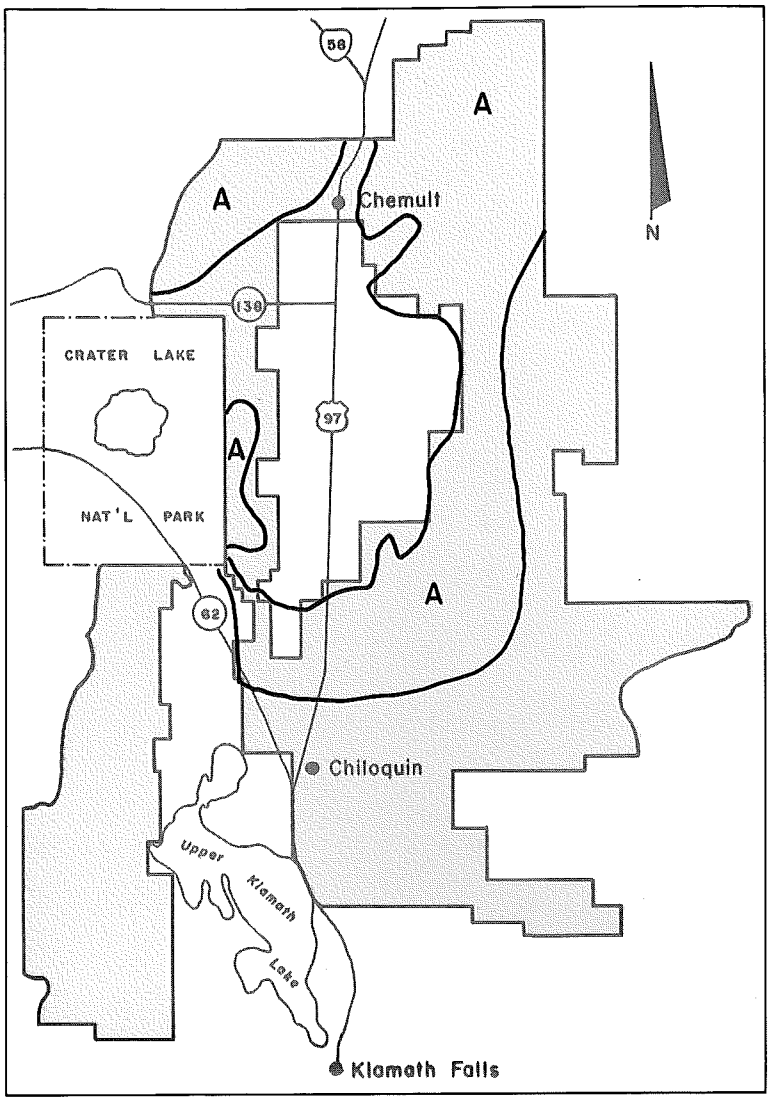
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GENERAL SOIL PROFILE OF SOIL GROUP A

Soil horizon	Soil texture and horizon thickness
Litter layer	½ to 3 inches thick
A1	Gravelly loamy sand — 2 to 6 inches thick
AC	Very gravelly loamy coarse sand — 6 to 12 inches thick
C	Very gravelly coarse sand — greater than 30 inches thick
IIB	Buried soil at depths greater than 40 inches — very gravelly and cobbly loams





SOIL GROUP A (LAPINE LIKE SOILS)

Soil Group A consists of deep soils that have formed in the air-laid mantle of coarse pumice and ash. A1 horizon textures are gravelly loamy coarse sands with very gravelly coarse sand C horizons. Pumice gravel content ranges from 15 to 50 percent in the A1 and AC, and 50 to 85 percent in the C horizon. Depth to buried soil or bedrock is greater than 40 inches. Slope gradients range from 0 to 70 percent with most of the slopes less than 35 percent.

SOIL GROUP A LANDTYPES

A1, A2, A3, A4, A5, A6, A8, A10, A11, A12, A13, A14, A15, A16, A17, A18, A19.

Complexes: A1A8, A2A4, A3A5, A4A6, A4A8, A4B4, A4B5, A4G2, A5A6, A5B5, A6A8, A6G2, A8A10, A8D1, A8G1, A8G2, A8G3, A10B8, A1116, A1216, A12E8, A1314, A16E8 A1718, 6A8.

DOMINANT SOIL GROUP A PLANT COMMUNITIES 1/

Ponderosa/bitterbrush/needlegrass CP S2 12
Mixed conifer/snowbrush-manzanita CW S1 12
Mixed conifer/manzanita CR S1 11
Mountain hemlock/grouse huckleberry CM S1 11
Lodgepole/bitterbrush/needlegrass CL S2 11
Lodgepole/manzanita CL S3 11
Lodgepole/needlegrass basins CL G3 11

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/

R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

SOIL GROUP A FEATURES AND QUALITIES

Drainage class - Excessively drained.

Infiltration class - Rapid except when soil surface is dry and has water repellent chacteristics.

Permeability - Very Rapid (greater than 20 inches per hour).

Slope range - 0 to 70 percent.

Bulk density - 0 to 15 inches — 0.6 to 0.7 grams per cubic centimeter
15 to 30 inches — 0.5 to 0.65 grams per cubic centimeter

Natural fertility - low

Elevation range - 4,000 to 7,500 feet.

SOIL GROUP A INTERPRETATION

Sediment yield - Low.

Sediment size - A horizon - pumice, gravel, sand, and silt.
C horizon - pumice, gravel, and sand.

Mixing and displacement hazard - high.

Dustiness hazard - high.

Mudiness hazard - low.

Dry ravel hazard - Road cutbanks and fills - high.
Natural slopes - low, except for high on landtype A19 and moderate to high for landtype A14.

Detrimental compaction hazard - low

Potential for high surface soil temperatures - high

Natural stability - very stable

Unified Engineering Classification - A1 and AC horizon - SM, SW, SP
C horizon - GP

Soil-water relationships - inches of water in surface foot of soil at selected tensions.

Moisture tension (Bars)	0.1	0.5	1.0	15.0
Inches of water per foot of soil	3.5 to 5.0	1.0 to 2.0	0.75 to 1.0	0.5

Readily available water - 0.1 minus 0.5 bar water - 2.5 to 3.0 inches. During the 30 day establishment period for reforestation planting, tensions should not exceed 0.5 bars.

Less available water - 0.5 minus 15 bar water - 0.5 to 1.5 inches.

MAJOR SOIL MANAGEMENT CONSIDERATIONS FOR SOIL GROUP A

1. Low natural fertility - 70 to 80 percent of the total soil nutrients are in the upper 6 inches of soil.

2. Effective rooting zone is generally limited to A1 and AC horizons for landtypes A1, A2, A3, A4, A5, A6, A8, and A10. Most of the available water for growth comes from these two horizons (8 to 24 inches thick).

3. The C horizon, which begins at 8 to 24 inches, of landtypes A1, A2, A3, A4, A5, A6, A8, and A10 generally impedes root extension. Lodgepole pine is affected more than other tree species. There is stronger impedence in the northeast portion of the Forest.

4. Slow water transfer rates for tree growth in the C horizon.

5. Low productivities of the high elevation landtypes A11, A12, A13, A14, and A16.

6. Careful manipulations of natural openings and created openings to manage cold air drainage.

SOIL GROUP A MANAGEMENT DIRECTION

Timber Mgt.: Avoid removal or excessive displacement of the A1 horizon. Areas with displacement or removal including roads, skidtrails, and landings should not exceed 10 percent on an area basis. Less soil displacement takes place when soils are moist.

Detrimental compaction is not a problem with these soils except in the main skidtrails and landings. These areas should be ripped or loosened to 18 inches if these areas are to be put back into full production. Nitrogen fertilizer may be advantageous when planting trees if grass competition is controlled.

Some site prep methods involve manipulating the soil in some manner. The preferred method for Soil Group A is vertical mixing such as discing to a depth of 6 to 12 inches except where long stolon sedge is present. Methods that decrease the total thickness of the A1 and AC horizons should be avoided. When this happens a higher percentage of the roots of planted stock are planted in the gravelly and sterile C horizon. Areas that have long stolen sedge should be checked by the Forest Soil Scien tist for alternative methods of site prep.

Fuels Management: On slopes less than 35%, maintain 1/2 inch of litter duff after a burn. On slopes over 35% and special problem areas (old brush fields), consult the Forest Soil Scientist for further on-site interpretations.

Estimated Taxonomic Classification: Cindery typic cryorthent.

Modal Location: SW1/4, SW1/4, Sec. 24, T33S., R7 1/2E.

Modal Description: (Landtype A4)

A1 -- 0 to 4 inches (range - 2 to 6 inches thick); very dark grayish brown (10 YR 3/2) moist, gravelly loamy coarse sand, grayish brown (10 YR 5/2) dry; weak fine granular structure; soft, very friable; about 20 percent cinders (gravel size); slightly acid (pH 6.5); clear wavy boundary.

AC -- 4 to 18 inches (range - 6 to 18 inches thick) dark brown (10 YR 3/3 and 4/3) moist, very gravelly loamy coarse sand; massive; soft, very friable; about 40 percent cinders (gravel size); slightly acid (pH 6.5); clear wavy boundary.

C -- 18 to 60 inches (range - more than 30 inches thick; brown (10 YR 5/3) to white (N8/) moist colors; very gravelly coarse sand; single grained; loose; 50 to 75 percent cinders (gravel size); neutral (pH 7.0).

IIB - 60 inches - Cobbly loam.

INTERPRETATIONS FOR LANDTYPES WITHIN SOIL GROUP A

Landtype	Erosion Hazard			Frost Heave Hazard	Cold Air Drainage Hazard
	Sheet	Gully	Wind		
A1	Low	Low	Low to Mod.	Mod. to High	Mod.
A2	Low	Low to Mod.	Low	Mod. to High	Mod.
A3	Low	Low to Mod.	Low	Mod. to High	Mod.
A4	Low to Mod.	Low	Low to Mod.	Mod. to High	Low
A5	Low to Mod	Low	Low to Mod.	Mod. to High	Low
A6	Low	Low	Low to Mod.	Mod. to High	Low
A8	Low	Low	Mod.	High	High
A10	Low	Low	Mod.	High	High
A11	Low to Mod.	Low	Low	Low to Mod.	Low
A12	Low to Mod.	Low	Low	Low to Mod.	Low
A13	Low	Low	Low	Low to Mod.	Low
A14	Mod. to High	Low	Low	Low to Mod.	Low
A15	Low to Mod.	Low	Low	Low to Mod.	Low
A16	Low	Low to Mod.	Low	Low to Mod.	Low to Mod.
A17	Low to Mod.	Low	Low	Low to Mod.	Low
A18	Low	Low	Low	Low to Mod.	Low to Mod.
A19	High	Low	Low	Low to Mod.	Low

Land-Type	Landform	% Slope Range	Aspect	Elevation Range in Feet	Effective Rooting Depth Inches	Common Landtype Inclusions within Mapped Delineation
A1	Upland flats	0 to 10	Variable	4000 to 5500	10 to 20	A2, A4, A8, A9
A2	Concave toeslopes and valley bottoms	0 to 15	Variable	4000 to 5500	12 to 24	A1, A4, A8, A9, G2, G3
A3	Concave toeslopes and valley bottoms	0 to 15	Variable	5000 to 5800	12 to 24	A5, A8, A9, G2, G3
A4	Convex ridges and sideslopes	0 to 35	Variable	4000 to 5500	8 to 18	A1, A2, A5, A6, A7, B4
A5	Convex ridges and sideslopes	0 to 35	Variable	5000 to 5800	8 to 18	A3, A5, A6, A7, B5
A6	Convex ridges and sideslopes	0 to 35	Variable	4000 to 5500	8 to 18	A1, A4, A8, G2, G3
A8	Broad flats and basins	0 to 10	Variable	4000 to 5500	10 to 18	A2, A6, A10, G2, G3
A10	Broad flats and basins	0 to 10	Variable	4000 to 5500	10 to 18	A9, D3, G2
A11	Convex ridges and sideslopes	0 to 35	Variable	5000 to 6000	24 to 36	A12, A16
A12	Convex ridges and sideslopes	0 to 35	Southerly	5000 to 6000	24 to 36	A11, A16
A13	Concave Glacial troughs	0 to 35	Easterly	6000 to 7000	24 to 36	A14, A16
A14	Convex glacial carved ridges and sideslopes	10 to 70	Variable	6000 to 7500	24 to 36	A11, A13, A16
A15	Convex ridges and sideslopes	0 to 50	North	5000 to 6000	24 to 36	A11, A16
A16	Concave glacial troughs	0 to 35	Easterly	5000 to 6000	24 to 36	A11, A13, A14
A17	Convex ridgetops and sideslopes	0 to 35	Variable	5000 to 6000	24 to 36	A18
A18	Concave toeslopes and valley bottoms	0 to 15	Variable	5000 to 6000	24 to 36	A17
A19	Convex sideslopes	35 to 70	Variable	5000 to 6000	24 to 36	A18

Plant communities of the Central Oregon Pumice Zone [1/]

R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

WITHIN SOIL GROUP A

Plant Community Data 1/

Dominant Plant Communities	Sample Size	Plant Community Productivity: Wood Fiber-Cu. Ft./Acre/Year Mean	5% CI	Grasses & Forbes-lbs./Acre/Year Mean	5% CI
Ponderosa/bitterbrush/needlegrass (CP-S2-12)	31	39	6	27	10
Ponderosa/bitterbrush/needlegrass (CP-S2-12)	31	39	6	27	10
Mixed conifer/snowbrush-manzanita (CW-S1-12)	19	50	11	79	3
Ponderosa/bitterbrush/needlegrass (CP-S2-12)	31	39	6	27	10
Mixed conifer/snowbrush-manzanita (CW-S1-12)	19	50	11	79	3
Lodgepole/bitterbrush/needlegrass (CL-S2-11)	31	35	4	11	5
Lodgepole/bitterbrush/needlegrass (CL-S2-11)	31	35	4	11	5
Lodgepole/needlegrass basins (CL-G3-11)	24	20	5	12	5
Lodgepole/manzanita (CL-S3-11)	12	14	3	51	4
Mixed conifer/snowbrush-manzanita (CW-S1-12)	19	50	11	79	3
Mixed conifer/snowbrush (CW-S1-14)	7	44	12	N/A	N/A
Mixed conifer/manzanita (CR-S1-11)	5	N/A	N/A	N/A	N/A
Lodgepole/manzanita (CL-S3-11)	12	14	3	51	4
Mixed conifer/manzanita (CR-S1-11)	5	N/A	N/A		
Lodgepole/manzanita (CL-S3-11)	12	14	3	51	4
Mixed conifer/snowbrush-manzanita (CW-S1-12)	19	50	11	79	3
Mixed conifer/snowbrush (CW-S1-14)	7	44	12	N/A	N/A
Lodgepole/manzanita (CL-S3-11)	12	14	3	51	4
Mixed conifer/snowbrush-manzanita (CW-S1-12)	19	50	11	79	3
Mixed conifer/snowbrush (CW-S1-14)	7	44	12	N/A	N/A
Mixed conifer/snowbrush-manzanita (CW-S1-12)	19	50	11	79	3
Mixed conifer/snowbrush (CW-S1-14)	7	44	12	N/A	N/A
Mixed conifer/snowbrush-manzanita (CW-S1-12)	19	50	11	79	3
Mixed conifer/snowbrush (CW-S1-14)	7	44	12	N/A	N/A

RANGE IN SOIL CHARACTERISTICS OF

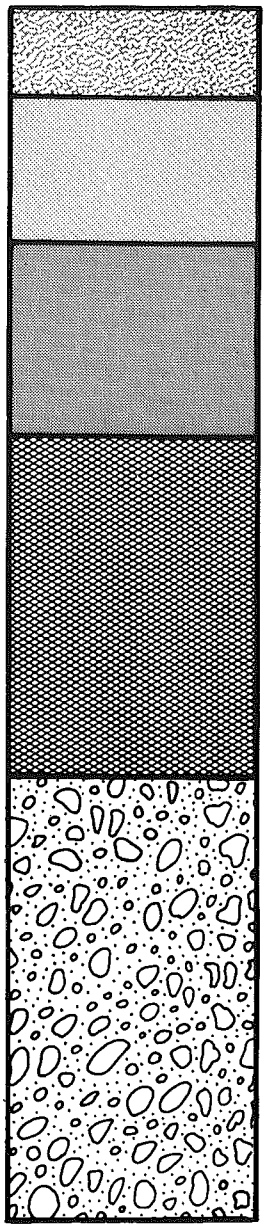
Land-type	Litter Layer		A1 Horizon			AC Horizon	
	Thickness (Inches)	% Ground Cover	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel	Thickness (Inches)	Texture of Soil
A1	½ to 3	50 to 70	2 to 6	Gravelly loamy coarse sand	15 to 35	8 to 12	Very gravelly loamy coarse sand
A2	½ to 3	50 to 75	4 to 6	Gravelly loamy coarse sand	15 to 35	8 to 18	Very gravelly loamy coarse sand
A3	½ to 3	50 to 75	4 to 6	Gravelly loamy coarse sand	15 to 35	8 to 18	Very gravelly loamy coarse sand
A4	½ to 3	40 to 70	2 to 6	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A5	½ to 3	40 to 70	2 to 6	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A6	½ to 2	40 to 70	2 to 6	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A8	½ to 2	40 to 70	2 to 6	Gravelly loamy coarse sand	15 to 35	8 to 12	Very gravelly loamy coarse sand
A10	½ to 1	10 to 40	2 to 6	Gravelly loamy coarse sand	15 to 35	8 to 12	Very gravelly loamy coarse sand
A11	½ to 2	30 to 60	2 to 4	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A12	½ to 2	40 to 70	2 to 4	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A13	½ to 2	30 to 70	2 to 4	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A14	½ to 2	30 to 70	2 to 4	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A15	½ to 3	50 to 80	2 to 4	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A16	½ to 2	30 to 70	2 to 4	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A17	½ to 2	50 to 80	2 to 4	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A18	½ to 3	60 to 80	2 to 6	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand
A19	½ to 2	50 to 80	2 to 4	Gravelly loamy coarse sand	15 to 35	6 to 12	Very gravelly loamy coarse sand

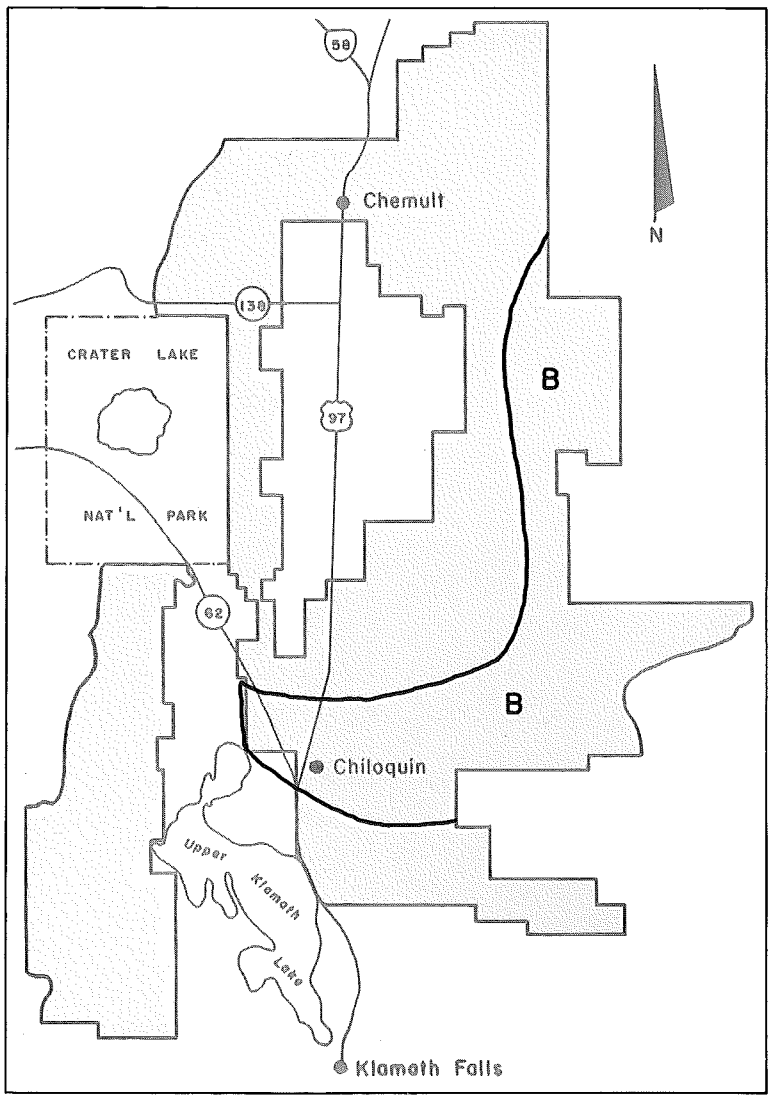
LANDTYPES WITHIN SOIL GROUP A

C Horizon			Buried Soil - IIB		
Percent Pumice Gravel	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel	Texture of Buried Soil	Depth to Bedrock (Inches)
35 to 50 hard pumice gravels	More than 30	Very gravelly coarse sand	50 to 85 hard pumice gravels	Very gravelly and cobbly loam	Greater than 60
35 to 50 hard pumice gravels	More than 30	Very gravelly coarse sand	50 to 85 hard pumice gravels	Very gravelly and cobbly loam	Greater than 60
35 to 50 hard pumice gravels	More than 30	Very gravelly coarse sand	50 to 85 hard pumice gravels	Very gravelly and cobbly loam	Greater than 60
35 to 50 hard pumice gravels	More than 30	Very gravelly coarse sand	50 to 85 hard pumice gravels	Very gravelly and cobbly loam	Greater than 60
35 to 50 hard pumice gravels	More than 30	Very gravelly coarse sand	50 to 85 hard pumice gravels	Very gravelly and cobbly loam	Greater than 60
35 to 50 hard pumice gravels	More than 30	Very gravelly coarse sand	50 to 85 hard pumice gravels	Very gravelly and cobbly loam	Greater than 60
35 to 50 hard pumice gravels	More than 30	Very gravelly coarse sand	50 to 85 hard pumice gravels	Very gravelly and cobbly loam	Greater than 60
35 to 50 hard pumice gravels	More than 30	Very gravelly coarse sand	50 to 85 hard pumice gravels	Very gravelly and cobbly loam	Greater than 60
35 to 50 soft pumice gravels	More than 40	Very gravelly coarse sand	50 to 85 soft pumice gravels	Unknown	Greater than 100
35 to 50 soft pumice gravels	More than 40	Very gravelly coarse sand	50 to 85 soft pumice gravels	Unknown	Greater than 100
35 to 50 soft pumice gravels	More than 40	Very gravelly coarse sand	50 to 85 soft pumice gravels	Unknown	Greater than 100
35 to 50 soft pumice gravels	More than 40	Very gravelly coarse sand	50 to 85 soft pumice gravels	Unknown	Greater than 100
35 to 50 soft pumice gravels	More than 40	Very gravelly coarse sand	50 to 85 soft pumice gravels	Unknown	Greater than 100
35 to 50 soft pumice gravels	More than 40	Very gravelly coarse sand	50 to 85 soft pumice gravels	Unknown	Greater than 100
35 to 50 soft pumice gravels	More than 40	Very gravelly coarse sand	50 to 85 soft pumice gravels	Unknown	Greater than 100
35 to 50 soft pumice gravels	More than 40	Very gravelly coarse sand	50 to 85 soft pumice gravels	Unknown	Greater than 100
35 to 50 soft pumice gravels	More than 40	Very gravelly coarse sand	50 to 85 soft pumice gravels	Unknown	Greater than 100

GENERAL SOIL PROFILE OF SOIL GROUP B

Soil horizon	Soil texture and horizon thickness
Litter layer	½ to 3 inches thick
A 1	Gravelly loamy coarse sand — 2 to 6 inches thick
A C	Very gravelly loamy coarse sand — 4 to 12 inches thick
C	Coarse sand to very gravelly coarse sand 10 to 30 inches thick
II B	Buried soil at depths of 20 to 40 inches — cobbly to very cobbly sandy loams and loams





SOIL GROUP B (SHANAHAN AND SHUKASH LIKE SOILS)

Soil Group B consists of soils that have formed in the air-laid mantle of pumice and ash over a buried soil. Depth to the buried soil ranges from 20 to 40 inches. A1 horizon textures are gravelly loamy coarse sands, with very gravelly coarse sand to coarse sand C horizons. The buried soil (II B horizon) textures are cobbly to very cobbly loams and sandy loams. Tree roots commonly occupy the buried soil except in the northeast portion of the Forest. Slope gradients range from 0 to 70 percent with most of the slopes less than 35 percent.

SOIL GROUP B LANDTYPES

B1, B2, B3, B4, B5, B6, B7, B8

Complexes: B1B8, B2B4, B2G1, B2H5, B3B4, B3B5, B4B7, B4G1, B4G2, B4H2, B4H5, B4H6, B5H2, B5H3, B6H6, B7B8, B7G1, B8G1, A4B4, A4B5, A5B5, A10B8, 4B4, 12B2.

DOMINANT SOIL GROUP B PLANT COMMUNITIES 1/

Ponderosa/bitterbrush/needlegrass CP S2 12
Ponderosa/bitterbrush-manzanita/needlegrass CP S2 13
Mixed conifer/snowbrush-manzanita CW S1 12
Lodgepole/bitterbrush/needlegrass CL S2 11
Lodgepole/needlegrass basins CL G3 11

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/

R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

SOIL GROUP B FEATURES AND QUALITIES

Drainage class - Excessively drained.

Infiltration class - Rapid except when surface soil is dry and has water repellent characteristics.

Permeability - Very rapid (Greater than 20 inches per hour)

Slope range - 0 to 70 percent.

Bulk density - 0 to 15 inches - 0.6 to 0.7 grams per cubic centimeter
15 to 30 inches - 0.5 to 0.65 grams per cubic centimeter

Natural fertility - low

Elevation range - 4,000 to 6,500 feet.

SOIL GROUP B INTERPRETATION

Sediment yield - Low.

Sediment size - A horizon - pumice, gravel, sand, and silt.
C horizon - pumice, gravel, and sand.

Potential for high surface soil temperatures - high.

Mixing and displacement hazard - high.

Dustiness hazard - high.

Mudiness hazard - low.

Dry ravel hazard - Road cutbanks and fills - high.
Natural slopes - low, except for high on landtype B6.

Detrimental compaction hazard - low

Natural stability - very stable

Unified engineering classification - A1 and AC horizons - SM, SW, SP
C horizon - GP

Soil hydrologic group - B

Soil-water relationships - inches of water in surface foot of soil at selected tensions.

Moisture tension (Bars)	0.1	0.5	1.0	15.0
Inches of water per foot of soil	3.5 to 5.0	1.0 to 2.0	0.75 to 1.0	0.5

Readily available water - 0.1 minus 0.5 bar water - 2.5 to 3.0 inches. During the 30 day establishment period for reforestation planting, tensions should not exceed 0.5 bars.

Less available water - 0.5 minus 15 bar water - 0.5 to 1.5 inches.

MAJOR SOIL MANAGEMENT CONSIDERATIONS FOR SOIL GROUP B

1. Low natural fertility - 70 to 80 percent of the total soil nutrients are in the upper 6 inches of soil.

2. Effective rooting zone is generally limited to A1 and AC horizons. Most of the available water for growth comes from these two horizons (8 to 24 inches thick).

3. The C horizon, which begins at 8 to 24 inches, generally impedes root extension. Lodgepole pine is affected more than other tree species. There is stronger impedence in the northeast portion of the Forest.

4. Slow water transfer rates for tree growth in the C horizon.

5. Careful manipulations of natural openings and created openings to manage cold air drainage.

6. Scattered throughout Soil Group B are small bedrock outcrops and shallow soil areas which are non-commercial sites and are difficult to regenerate.

SOIL GROUP B MANAGEMENT DIRECTION

Timber Harvest: Avoid removal or excessive displacement of the topsoil or A1 horizon. Areas with displacement or removal including roads, skidtrails, and landings should not exceed 10 percent on an area basis. Less soil displacement takes place when soils are moist.

Detrimental compaction is not a problem with these soils except in the main skidtrails and landings. These areas should be ripped or loosened to 18 inches if these areas are to be put back into full production. Nitrogen fertilizer may be advantageous when planting trees if grass competition is controlled on the disturbed soils.

Some site prep methods involve manipulating the soil in some manner. The preferred method for Soil Group B is vertical mixing such as discing to a depth of 6 to 12 inches except where long stolon sedge is present. Methods that decrease the total thickness of the A1 and AC horizons should be avoided.

When this happens a higher percentage of the roots of planted stock are planted in the gravelly and sterile C horizon. Areas that have long stolen sedge should be checked by the Forest Soil Scientist for alternative methods of mechanical site prep.

Fuels Management: On slopes less than 35%, maintain 1/2 inch of litter duff where present after a burn. On slopes over 35% and special problem areas (old brush fields), consult the Forest Soil Scientist for further on-site interpretations.

Estimated Taxonomic Classification: Ashy over loamy and ashy over loamy skeletal, mixed Typic Cryorthents.

Modal Location: SW1/4, SE1/4, Sec. 4, T34S., R7E.

Modal Description: (Landtype B4) Shanahan like.

A1 -- 0 to 4 inches (range - 2 to 6 inches thick); very dark grayish brown (10 YR 3/2) moist, gravelly loamy coarse sand; weak very fine granular structure; soft, very friable; about 15 percent cinders (gravel size pumice - 2 to 4 mm in diameter); slightly acid (pH 6.3); clear wavy boundary.

AC -- 4 to 15 inches (range - 4 to 14 inches thick) dark brown (10 YR 3/3 and 4/3) moist, very gravelly loamy coarse sand; massive; soft, very friable; about 25 percent cinders (gravel size pumice - 2 to 4 mm in diamater); slightly acid (pH 6.5); clear wavy boundary.

C -- 15 to 26 inches (range - 5 to 20 inches thick); light yellowish brown (2.5Y 6/4 moist) coarse sand; massive; soft, very friable; about 10 percent cinders (gravel size pumice - 2 to 10 mm in diameter); slightly acid (pH 6.5); clear wavy boundary.

Buried Soil - 26 to 45 inches (range greater than 20 inches); dark brown (7.5 YR 4/4 moist) cobbly sandy loam; massive; soft, very friable; about 25 percent hard lava cobble; neutral (pH 6.6).

Modal Location: NW1/4, SW1/4, Sec. 20, T.30S., R.11E.

Modal Description: (Landtype B4) - Skukash like

A1 -- 0 to 3 inches (range - 2 to 6 inches thick); very dark grayish brown (10 YR 3/2 moist) gravelly loamy coarse sand; weak very fine crumby structure; soft, very friable; about 20 percent cinders (gravel size pumice); slightly acid (pH 6.4); clear wavy boundary.

AC -- 3 to 13 inches (range 5 to 12 inches thick); dark brown (10 YR 3/3 and 4/3 moist) gravelly loamy coarse sand; massive; soft, very friable; about 25 percent cinders (gravel size pumice); slightly acid (pH 6.4); gradual wavy boundary.

C -- 13 to 34 inches (range 10 to 30 inches thick); brown (10 YR 5/3 moist to white (N8/moist) very gravelly coarse sand; single grained; loose; 50 to 75 percent cinders (gravel size pumice); neutral (pH 6.6); clear wavy boundary.

Buried soil - 34 to 60 inches (range greater than 20 inches); dark reddish brown (5 YR 3/3 moist) very cobbly loam; massive; slightly hard, friable; about 50 percent gravel and cobble, neutral (pH 6.9).

INTERPRETATIONS FOR LANDTYPES WITHIN SOIL GROUP B

Landtype	Erosion Hazard			Frost Heave Potential	Cold Air Drainage Hazard
	Sheet	Gully	Wind		
B1	Low	Low	Low to Mod.	Mod. to High	Mod.
B2	Low	Low to Mod.	Low	Mod. to High	Mod.
B3	Low	Low to Mod.	Low	Mod. to High	Mod.
B4	Low to Mod.	Low	Low to Mod.	Mod. to High	Low
B5	Low to Mod	Low	Low to Mod.	Mod. to High	Low
B6	High	Low	Low	Mod.	Low
B7	Low to Mod.	Low	Low to Mod.	Mod.	Low
B8	Low	Low	Low	High	High

FEATURES AND QUALITIES OF LANDTYPES

Land-Type	Landform	% Slope Range	Aspect	Elevation Range in Feet	Effective Rooting Depth Inches	Common Landtype Inclusions within Mapped Delineation
B1	Upland flats	0 to 10	Variable	4000 to 5500	10 to 40	B2, B4, B9, G1
B2	Concave toeslopes and drainageways	0 to 15	Variable	4500 to 5500	10 to 60	B1, B3, B4, G1 G2
B3	Concave toeslopes and drainageways	0 to 15	Variable	5000 to 6500	10 to 60	B1, B2, B3, G1, G2
B4	Convex ridges and side-slopes	0 to 35	Variable	4000 to 5500	10 to 40	B1, B2, B5, B7 B8, G1, G2, H3, H6
B5	Convex ridges and side-slopes	0 to 35	Variable	5000 to 6500	10 to 40	B3, B4, B6, B7, A5, H2
B6	Very steep sideslopes	35 to 70	Variable	4000 to 6500	10 to 40	B4, B5, B7, A4, A5, H3, H6
B7	Convex ridges and side-slopes	0 to 35	Variable	4000 to 5500	10 to 40	B1, B4, B8, G1, G2
B8	Broad flats and basins	0 to 10	Variable	4000 to 5500	10 to 60	B1, B7, G1, G2

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE [1/]

R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

WITHIN SOIL GROUP B

Dominant Plant Communities	Plant Community Data 1/ Plant Community Productivity				
	Sample Size	Wood Fiber-Cu. Ft./Acre/Year Mean	5% CI	Grasses & Forbes-lbs./Acre/Year Mean	5% CI
Ponderosa/bitterbrush-needlegrass (CP S2 12)	31	39	6	27	10
Ponderosa/bitterbrush/manzanita (CP S2 13)	17	33	6	28	15
Ponderosa bitterbrush/needlegrass (CL S2 12)	31	39	6	27	10
Ponderosa bitterbrush-manzanita/needlegrass (CW S1 12)	17	33	6	28	15
Mixed conifer/snowbrush-brush-manzanita (CW S1 12)	19	50	11	79	3
Ponderosa/bitterbrush/needlegrass (CP S2 12)	31	39	6	27	10
Ponderosa/bitterbrush-manzanita/needlegrass (CP S2 13)	17	33	6	28	15
Mixed conifer/snowbrush-manzanita (CW S1 12)	19	50	11	79	3
Ponderosa/bitterbrush-manzanita/needlegrass (CP S2 13)	17	33	6	28	15
Mixed conifer/snowbrush-manzanita (CW S1 12)	19	50	11	79	3
Lodgepole/bitterbrush/needlegrass (CL S2 11)	31	35	4	11	5
Lodgepole/bitterbrush/needlegrass (CL S2 11)	31	35	4	11	5

RANGE IN SOIL CHARACTERISTICS OF

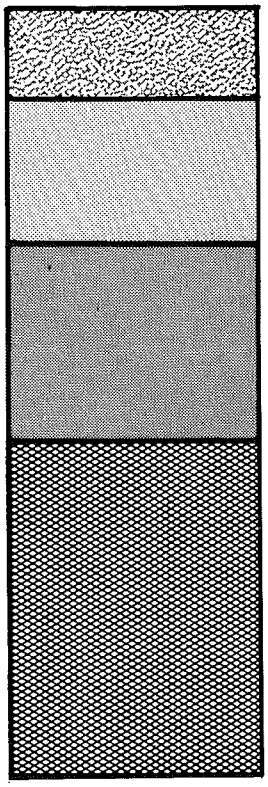
Land-type	Litter Layer		A1 Horizon			AC Horizon	
	Thickness (Inches)	% Ground Cover	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel	Thickness (Inches)	Texture of Soil
B1	½ to 3	50 to 70	2 to 6	Gravelly loamy coarse sand	15 to 35	4 to 12	Gravelly to very gravelly loamy coarse sand
B2	½ to 3	50 to 75	4 to 6	Gravelly loamy coarse sand	15 to 35	4 to 14	Gravelly to very gravelly loamy coarse sand
B3	½ to 3	50 to 75	4 to 6	Gravelly loamy coarse sand	15 to 35	4 to 14	Gravelly to very gravelly loamy coarse sand
B4	½ to 3	40 to 70	2 to 4	Gravelly loamy coarse sand	15 to 35	4 to 12	Gravelly to very gravelly loamy coarse sand
B5	½ to 3	50 to 75	2 to 4	Gravelly loamy coarse sand	15 to 35	4 to 12	Gravelly to very gravelly loamy coarse sand
B6	½ to 3	40 to 70	2 to 4	Gravelly loamy coarse sand	15 to 35	4 to 12	Gravelly to very gravelly loamy coarse sand
B7	½ to 2	40 to 70	2 to 4	Gravelly loamy coarse sand	15 to 35	4 to 12	Gravelly to very gravelly loamy coarse sand
B8	½ to 2	40 to 70	2 to 6	Gravelly loamy coarse sand	15 to 35	4 to 12	Gravelly to very gravelly loamy coarse sand

LANDTYPES WITHIN SOIL GROUP B

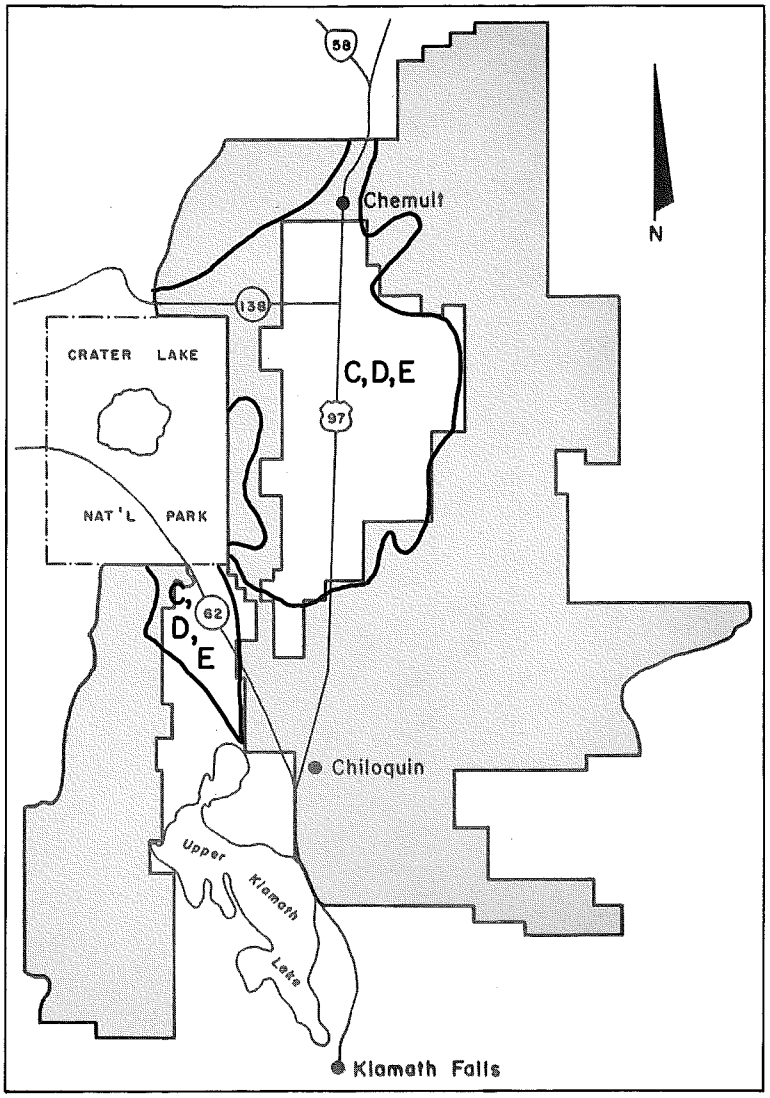
C Horizon				Buried Soil - IIB	
Percent Pumice Gravel	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel	Texture of Buried Soil	Depth to Bedrock (Inches)
20 to 50	10 to 30	Coarse sand to very gravelly coarse sand	10 to 75	Cobbly to very cobbly sandy loams and loams	20 to 40
20 to 50	10 to 30	Coarse sand to very gravelly coarse sand	10 to 75	Cobbly to very cobbly sandy loams and loams	20 to 60
20 to 50	10 to 30	Coarse sand to very gravelly coarse sand	10 to 75	Cobbly to very cobbly sandy loams and loams	20 to 60
20 to 50	10 to 30	Coarse sand to very gravelly coarse sand	10 to 75	Cobbly to very cobbly sandy loams and loams	20 to 40
20 to 50	10 to 30	Coarse sand to very gravelly coarse sand	10 to 75	Cobbly to very cobbly sandy loams and loams	20 to 40
20 to 50	10 to 30	Coarse sand to very gravelly coarse sand	10 to 75	Cobbly to very cobbly sandy loams and loams	20 to 40
20 to 50	10 to 30	Coarse sand to very gravelly coarse sand	10 to 75	Cobbly to very cobbly sandy loams and loams	20 to 40
20 to 50	10 to 30	Coarse sand to very gravelly coarse sand	10 to 75	Cobbly to very cobbly sandy loams and loams	20 to 60

GENERAL SOIL PROFILE OF SOIL GROUP C

Soil horizon	Soil texture and horizon thickness
Litter layer	½ to 3 inches
A I	Gravelly loamy coarse sand to gravelly and cobbly loamy coarse sand 2 to 6 inches thick
A C	Very gravelly and cobbly loamy coarse sand 8 to 20 inches thick
C	Very gravelly and cobbly loamy coarse sand — greater than 30 inches thick



SOIL GROUP C



SOIL GROUP C (MAKALAK LIKE SOILS)

Soil Group C consists of deep soils that have formed in very thick deposits of glowing avalanche type of pumice and ash. A1 horizon soils are gravelly and cobbly loamy coarse sands, with very gravelly and cobbly loamy coarse sand, AC and C horizons. Pumice gravel, and pumice cobble content ranges from 15 to 75 percent. Depth to bedrock is greater than 60 inches. Slope gradients range from 0 to 15 percent.

SOIL GROUP C LANDTYPES

C1, C2, C3, C4.

Complexes: C1C2, C1E2, C2D1, C2E3, C3E8.

DOMINANT SOIL C PLANT COMMUNITIES 1/ 2/

Lodgepole/manzanita CL S3 11
Lodgepole/bitterbrush/sedge CL S2 12
Ponderosa/bitterbrush-manzanita/sedge CP S2 14
Ponderosa/bitterbrush/sedge CP S2 15
Shasta red fir-white fir/chinquapin-prince's pine/long stolen sedge CR S3 11
Mixed conifer/snowbrush-bearberry CW C2 15

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/

R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

PLANT ASSOCIATIONS OF SOUTH CHILOQUIN AND KLAMATH RANGER DISTRICTS - WINEMA NATIONAL FOREST - 2/

R-6-Ecol-79-005
U.S.D.A. Forest Service, Pacific Northwest Region

SOIL GROUP C FEATURES AND QUALITIES

Drainage class - Excessively drained.

Infiltration class - Rapid except when soil surface is dry and has water repellent chacteristics.

Slope Range - 0 to 15 percent.

Permeability - Very rapid (Greater than 20 inches per hour).

Bulk density - 0.55 to 0.65 grams per cubic centimeter.

Natural fertility - low.

Elevation range - 4500 to 6500 feet.

SOIL GROUP C INTERPRETATION

Sediment yield - low.

Sediment size - A horizon - pumice gravel, sand, and silt.

C-horizon - Pumice gravel and sand.

Potential for high surface soil temperatures - high

Mixing and displacement hazard - moderate.

Dustiness hazard - high.

Dry ravel hazard - road cuts and fills, and natural slopes - low.

Detrimental compaction hazard - low.

Natural stability - very stable.

Unified engineering classification - Surface soil - SP
Subsoil - GP

Soil hydrologic group - A

Soil water relationship - Inches of water per surface foot of soil at selected tensions.

Moisture tension (Bars)	0.1	0.5	1.0	1.5
Inches of water per foot of soil	3.5 to 5.0	1.0 to 2.0	0.75 to 1.0	0.5

Readily available water - 0.1 minus 0.5 bars - 2.5 to 3.0 inches. During the 30 day establishment period for reforestation planting, tensions should not exceed 0.5 bars.

Less available water - 0.5 minus 1.5 inches - 0.5 to 1.5 inches.

MAJOR SOIL MANAGEMENT CONSIDERATIONS FOR SOIL GROUP C

1. Low natural fertility - 75 to 80 percent of the total soil fertility is in the upper 6 inches of soil.

2. Pumice cobble may cause problems when planting trees.

3. Some plant communities may have long stolon sedge and golden weed which are highly competitive to planted trees.

SOIL GROUP C MANAGEMENT DIRECTION

Timber Harvest: Avoid removal or excessive displacement of the topsoil (A1 horizon). Areas with displacement or removal, including skidtrails and landings should not exceed 10 percent on an area basis. Less soil displacement will take place when soils are moist.

Compaction is not a problem with Soil C except in the main skidtrails and landings. These areas should be ripped or loosened to 18 inches if these areas are to be put back into full production. Nitrogen fertilizer on the displaced soils may be advantageous if grass competition is controlled.

Mechanical site prep methods for Soil C depend on whether long stolon is present. If long stolon sedge is present, scalping to a depth just below the crown may be necessary. The pumice cobble may interfere with some of the other types of site prep such as discing. The Forest Soil Scientist will be available for a more intense look at these soils when determining the best method for site prep.

Fuels Management: Controlled burns should be designed to maintain 1/2 inch of litter duff.

Estimated Taxonomic Classification: Cindery typic cryorthent.

Modal Location: SW1/4, NW1/4, Sec. 13, T29S., R6E.

Modal Description: (Landtype C1)

A1 -- 0 to 3 inches (range - 2 to 6 inches thick); very dark brown (10 YR 2/2) moist, gravelly loamy coarse sand, weak very fine crumb structure; soft, very friable; about 20 percent cinders (pumice gravels 2 to 76 mm in diameter); strongly acid (pH 5.1); abrupt smooth boundary.

AC -- 3 to 20 inches (range - 8 to 20 inches) dark brown (7.5 YR 3/4 and 4/4) moist, very gravelly loamy coarse sand; massive; soft, very friable; about 35 to 40 percent pumice cinders 2 to 76 mm in diameter and 15 percent more than 76 mm in diameter; slightly acid (pH 6.1); gradual wavy boundary.

C -- 20 to 60 inches (range - more than 30 inches; dark reddish brown (5 YR 3/4 and 3/2 moist) very gravelly loamy coarse sand; massive; soft, very friable; about 45 to 55 percent pumice cinders 2 to 76 mm in diameter and 15 percent more than 76 mm in diameter; medium acid (pH 6.0).

INTERPRETATIONS FOR LANDTYPES WITHIN SOIL GROUP C

Landtype	Erosion Hazard			Frost Heave Hazard	Cold Air Drainage Hazard
	Sheet	Gully	Wind		
C1	Low	Low	Low	Mod.	Low
C2	Low	Low	Low	Mod.	Mod.
C3	Low	Low	Low	Low to Mod.	Low
C4	Low	Low	Low	Mod.	Low

FEATURES AND QUALITIES OF LANDTYPES

Land-Type	Landform	% Slope Range	Aspect	Elevation Range in Feet	Effective Rooting Depth Inches	Common Landtype Inclusions within Mapped Delineation
C1	Pumice and ash mantled glacial outwash valleys and flats	0 to 5	Variable	4500 to 5500	Greater than 48	C2, D2, E2, E3
C2	Pumice and ash mantled glacial outwash valleys and flats	0 to 15	Variable	4500 to 5500	Greater than 48	C1, E2, E3, D1
C3	Pumice and ash mantled glacial outwash valleys and flats	0 to 5	Variable	5500 to 6500	Greater than 48	E5, E8
C4	Pumice and ash mantled glacial outwash valleys and flats	0 to 5	Variable	4500 to 5500	Greater than 48	C2, E9

WITHIN SOIL GROUP C

Plant Community Data 1/ 2/

Dominant Plant Communities	Sample Size	Plant Community Productivity: Wood Fiber-Cu. Ft./Acre/Year Mean	5% CI	Grasses & Forbes-lbs./Acre/Year Mean	5% CI
Ponderosa/bitterbrush-manzanita/sedge (CP S2 14)	3	23	-	50	Too variable
Ponderosa/bitterbrush/sedge (CP S2 15)	10	38	9	51	20
Lodgepole bitterbrush/sedge (CL S2 12)	5	57	23	16	5
Lodgepole/manzanita (CL S3 11)	12	14	3	51	4
(CW C2 15)	6	*See chart below for species productivity			
(CR S3 11)	26	*			

		SF	WF	DF	PP	SP
Mixed conifer/snowbrush-bearberry (CW C2 15)	Mean	-	148	94	82	66
	5% CI	-	107	37	32	-
Shasta red fir-white fir/chinquapin-prince's pine/sedge (CR S3 11)	Mean	150	167	164	94	-
	5% CI	19	17	27	18	-

SF-Shasta fir, WF-White fir, DF-Douglas fir, PP-Ponderosa pine, SP-Sugar pine

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/

R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest

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R6-Ecol-79-005
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RANGE IN SOIL CHARACTERISTICS OF

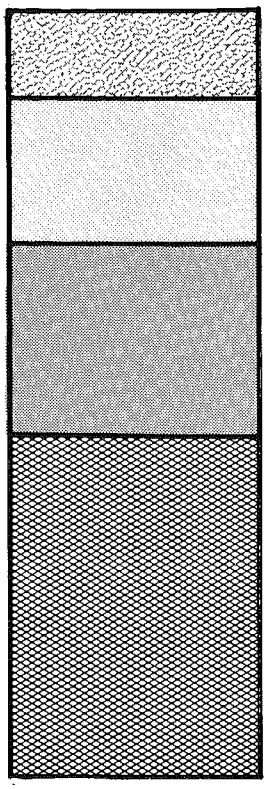
Land-type	Litter Layer		A1 Horizon			AC Horizon	
	Thickness (Inches)	% Ground Cover	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel	Thickness (Inches)	Texture of Soil
C1	½ to 3	50 to 70	3 to 6	Gravelly loamy coarse sand to gravelly & cobbly loamy coarse sand.	15 to 35	8 to 20	Very gravelly and cobbly loamy coarse sand
C2	½ to 2	50 to 70	3 to 6	Gravelly loamy coarse sand to gravelly & cobbly loamy coarse sand.	15 to 35	8 to 20	Very gravelly and cobbly loamy coarse sand
C3	½ to 2	50 to 70	2 to 4	Gravelly loamy coarse sand to gravelly & cobbly loamy coarse sand.	15 to 35	8 to 20	Very gravelly and cobbly loamy coarse sand
C4	½ to 3	60 to 80	3 to 6	Gravelly loamy coarse sand to gravelly & cobbly loamy coarse sand.	15 to 35	8 to 20	Very gravelly and cobbly loamy coarse sand

LANDTYPES WITHIN SOIL GROUP C

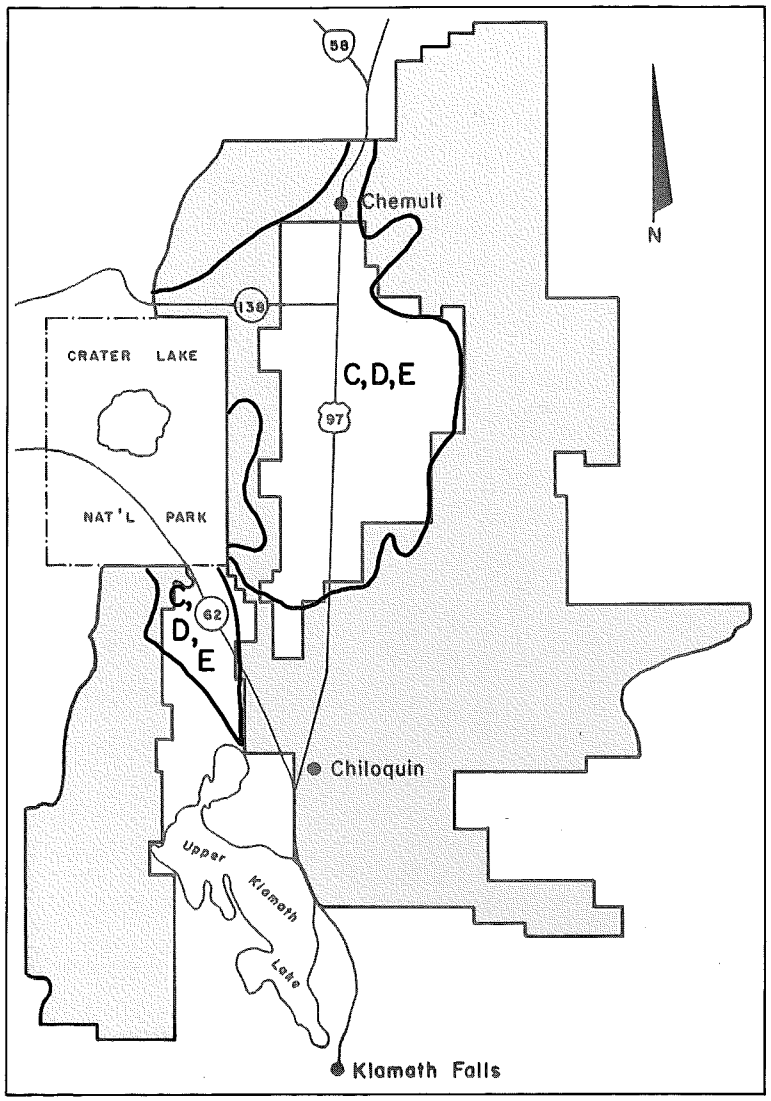
	C Horizon			
Percent Pumice Gravel and Cobble	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel	Depth to Bedrock (Inches)
35 to 75	Greater than 30	Very gravelly & cobbly loamy coarse sand.	35 to 75	Greater than 120
35 to 75	Greater than 30	Very gravelly & cobbly loamy coarse sand.	35 to 75	Greater than 120
35 to 75	Greater than 30	Very gravelly & cobbly loamy coarse sand.	35 to 75	Greater than 120
35 to 75	Greater than 30	Very gravelly & cobbly loamy coarse sand.	35 to 75	Greater than 120

GENERAL SOIL PROFILE OF SOIL GROUP D

Soil horizon	Soil texture and horizon thickness
Litter layer	½ to 3 inches thick
A1	Loamy sand to loamy coarse sand — 2 to 6 inches thick
AC	Loamy sand to gravelly loamy coarse sand 6 to 18 inches thick
C	Loamy sand to gravelly loamy coarse sand — greater than 20 inches thick



SOIL GROUP D



SOIL GROUP D (STEIGER LIKE SOILS)

Soil D consists of deep soils that have formed in fine ash deposits around the outer edge of the avalanche flow pumice. It occurs mainly in basins and along the edge of basins. A1 horizon soil textures are loamy coarse sands with loamy sand to gravelly loamy coarse sand AC and C horizons. Pumice gravel content ranges from 5 to 35 percent. Depth to buried soil or bedrock is greater than 60 inches. Slope gradients range from 0 to 15 percent.

SOIL GROUP D LANDTYPES

D1, D2, D3, D4, D5

Complexes: D1D2, D1G2, D1H4, D4X6, A8D1, C2D1

DOMINANT SOIL D PLANT COMMUNITIES 1/ 2/

Lodgepole/bitterbrush/needlegrass CL S2 11
Lodgepole/needlegrass basins CL G3 11
Ponderosa/bitterbrush/needlegrass CP S2 12
Mixed conifer/snowbrush-bearberry CW C2 15
White fir/chinquapin-boxwood-prince's pine CW H1 12
Shasta red fir-white fir/chinquapin-prince's pine/
long stolon sedge CR S3 11
Mountain hemlock/grouse huckleberry CM S1 11

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/

R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

PLANT ASSOCIATIONS OF SOUTH CHILOQUIN AND KLAMATH RANGER DISTRICTS - WINEMA NATIONAL FOREST - 2/

R-6-Ecol-79-005
U.S.D.A. Forest Service, Pacific Northwest Region

SOIL GROUP D FEATURES AND QUALITIES

Drainage class - Excessively drained.

Infiltration class - Rapid except when surface soil is dry and has water repellent tendencies.

Permeability - Very rapid (Greater than 20 inches per hour).

Slope range - 0 to 15 percent.

Bulk density - 0.55 to 0.65 grams per cubic centimeter.

Natural fertility - low.

Elevation range - 4200 to 6500 feet.

SOIL GROUP D INTERPRETATION

Sediment yield - low.

Sediment size - A horizon - pumice gravel, sand and silt.
C horizon - pumice gravel and sand.

Mixing and displacement hazard - high.

Dustiness hazard - extremely high.

Mudiness hazard - low.

Dry ravel hazard - road cuts and fills, and natural slopes - low.

Detrimental compaction hazard - low.

Potential for high surface soil temperature - high.

Natural stability - very stable.

Unified engineering classification - SP and SM.

Soil hydrologic Group - A.

Soil water relationship - Inches of water in surface foot of soil at selected tensions.

Moisture tension (Bars)	0.1	0.5	1.0	15.0
Inches of water per foot of soil	3.5 to 5.0	1.0 to 2.0	0.75 to 1.0	0.5

Readily available water - 0.1 minus 0.5 bar water - 2.5 to 3.0 inches. During the 30 day establishment period for reforestation planting, tensions should not exceed 0.5 bars.

Less available water - 0.5 minus 15 bar water - 0.5 to 1.5 inches.

MAJOR SOIL MANAGEMENT CONSIDERATIONS FOR SOIL GROUP D

1. Low natural fertility - 75 to 80 percent of the total soil nutrients are in the upper 6 inches of soil.

2. Some plant communities may have long stolon sedge or golden weed which are highly competitive to planted trees.

3. All Soil D landtypes except D3 have a favorable potential for intensive timber management due to favorable rooting depth and other characteristics.

4. Road surfaces are difficult to maintain in this soil material due to lack of fines and gravel size material.

SOIL GROUP D MANAGEMENT DIRECTION

Timber Harvest: Avoid removal or excessive displacement of the topsoil (A1 horizon). Areas with displacement or removal including roads, skidtrails, and landings should not exceed 10 percent on an area basis. Less soil displacement takes place when soils are moist. An exception can be made when doing site prep if long stolon sedge is present.

Soil compaction is not a problem with Soil D except in the main skidtrails and landings. These areas should be ripped or loosened to 18 inches if these areas are to be put back into full production. Nitrogen fertilizer on the displaced soil areas that are planted to trees may be advantageous if grass competition is controlled.

Mechanical site prep methods for Soil D depend on whether long stolon sedge is present or not. If long stolon sedge is present, scalping to a depth just below the crowns of the plants will be necessary. The preferred method, when long stolon sedge is not present, is vertical mixing such as discing to a depth of 6 to 12 inches.

Fuels management: Controlled burns should be designed to maintain 1/2 inch of litter duff.

Engineering: Due to the difficulty in maintaining road surfaces and extreme dustiness of this soil material, road surfacing should be considered on moderate and high use roads.

Estimated Taxonomic Classification: Ashy typic cryopsamment.

Modal Location: SE1/4, NW1/4, Sec. 19, T.34S., R.7E.

Modal Description: (Landtype D2)

A1 -- 0 to 4 inches (range - 2 to 6 inches thick); very dark brown (10YR 2/2 moist), loamy coarse sand; weak very fine crumb structure; soft, very friable; about 10 percent cinders (pumice gravels); medium acid (pH 5.6); abrupt wavy boundary.

AC -- 4 to 19 inches (range - 6 to 18 inches thick) very dark brown (10YR 3/3 moist) to dark yellowish brown (10YR 4/4) gravelly loamy coarse sand; massive; soft, very friable; about 20 percent cinders (pumice gravels) neutral (pH 6.7); gradual wavy boundary.

C -- 19 to 60 inches - yellowish red (5YR 5/4 and 5/6 moist) gravelly loamy coarse sand; massive; soft, very friable; 20 to 30 percent cinders (pumice gravels); slight increase in bulk density at 20" to 30"; slightly acid (pH 6.5).

INTERPRETATIONS FOR LANDTYPES WITHIN SOIL GROUP D

Landtype	Erosion Hazard			Frost Heave Hazard	Cold Air Drainage Hazard
	Sheet	Gully	Wind		
D1	Low	Low	Low	High	High
D2	Low	Low	Low	Mod.	Mod. to High
D3	Low	Low	Low	High	High
D4	Low	Mod.	Low	Mod.	Low to Mod.
D5	Low	Mod.	Low	Mod.	Low to Mod.

FEATURES AND QUALITIES OF LANDTYPES

Land-Type	Landform	% Slope Range	Aspect	Elevation Range in Feet	Effective Rooting Depth Inches	Common Landtype Inclusions within Mapped Delineation
D1	Pumice and ash mantled basins and lower toe-slopes	0 to 5	Variable	4200 to 5000	Greater than 48	D2, A7, C2, G2
D2	Pumice and ash mantled basins and lower toe-slopes	0 to 5	Variable	4200 to 5000	Greater than 48	D1, C1
D3	Pumice and ash mantled basins and lower toe-slopes	0 to 5	Variable	4300 to 5600	Greater than 48	D1, A9
D4	Concave valley bottoms and toeslopes	0 to 15	Variable	5500 to 6500	40 to 66	D5, X1
D5	Concave valley bottoms and toeslopes	0 to 15	Variable	4500 to 6000	40 to 60	D4, X1

WITHIN SOIL GROUP D

Plant Community Data

Dominant Plant Communities	Sample Size	Plant Community Productivity: Wood Fiber-Cu. Ft./Acre/Year Mean	5% CI	Grasses & Forbes-lbs./Acre/Year Mean	5% CI
Lodgepole/bitterbrush/needlegrass (CL S2 11)	31	35	4	11	5
Ponderosa/bitterbrush/needlegrass (CP S2 12)	31	39	6	27	10
Lodgepole/needlegrass basins (CL G3 11)	24	20	5	12	5
(CM S1 11)	13	*See chart below for species productivity			
(CR S3 11)	26	*			
(CW C2 15)	6	*			
(CW H1 12)	14	*			

		SF	WF	DF	PP	MH	SP
Mountain hemlock/grouse huckleberry (CM S1 11)	Mean	-	-	-	-	14	-
	5% CI	-	-	-	-	4	-
Shasta red fir-white fir/chinquapin-prince's pine/sedge (CR S3 11)	Mean	150	167	164	94	-	-
	5% CI	19	17	27	18	-	-
Mixed conifer/snowbrush-bearberry (CW C2 15)	Mean	-	148	94	82	-	66
	5% CI	-	107	37	32	-	-
White fir/chinquapin-boxwood-prince's pine (CW H1 12)	Mean	-	144	145	82	-	-
	5% CI	-	22	31	29	-	-

SF-Shasta fir, WF-White fir, DF-Douglas fir, PP-Ponderosa pine, SP-Sugar pine, MH-Mountain Hemlock

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/
R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

PLANT ASSOCIATIONS OF SOUTH CHILOQUIN AND KLAMATH RANGER DISTRICTS - WINEMA NATIONAL FOREST - 2/
R6-Ecol-79-005 U.S.D.A. Forest Service, Pacific Northwest Region

RANGE IN SOIL CHARACTERISTICS OF

Land-type	Litter Layer		A1 Horizon			AC Horizon	
	Thickness (Inches)	% Ground Cover	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel 1/	Thickness (Inches)	Texture of Soil
D1	1/2 to 2	50 to 70	3 to 6	Loamy sand to loamy coarse sand	0 to 15	6 to 18	Loamy sand to gravelly loamy coarse sand
D2	1/2 to 3	50 to 70	3 to 6	Loamy sand to loamy coarse sand	0 to 15	6 to 18	Loamy sand to gravelly loamy coarse sand
D3	1/2 to 1	20 to 40	2 to 4	Loamy sand to loamy coarse sand	0 to 15	6 to 18	Loamy sand to gravelly loamy coarse sand
D4	1 to 3	70 to 90	2 to 4	Loamy sand to loamy coarse sand	0 to 15	6 to 18	Loamy sand to gravelly loamy coarse sand
D5	1 to 3	70 to 90	2 to 4	Loamy sand to loamy coarse sand	0 to 15	6 to 18	Loamy sand to gravelly loamy coarse sand

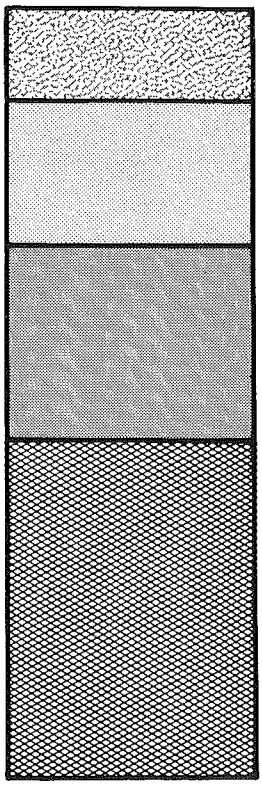
1/ 2 mm to 3 inches

SANDTYPES WITHIN SOIL GROUP D

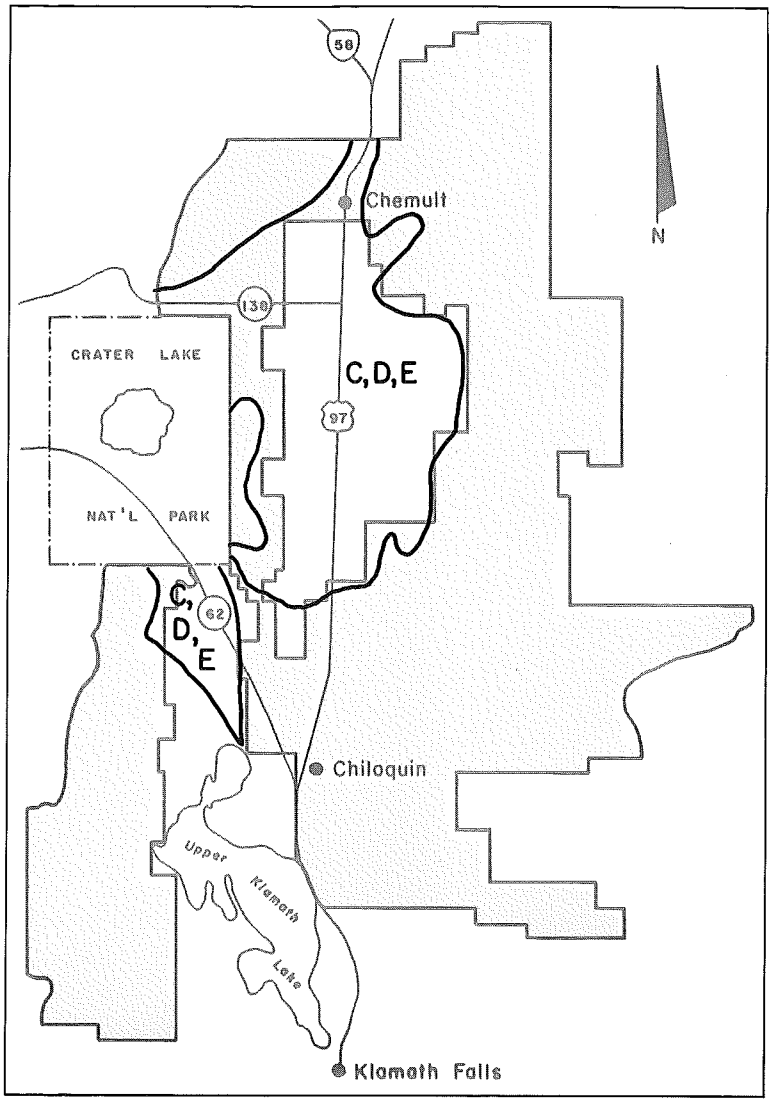
	C Horizon			Buried Soil - IIB	
Percent Pumice Gravel	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel	Texture of Buried Soil	Depth to Bedrock (Inches)
5 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	10 to 30	Loamy sand to gravelly loamy coarse sand	Greater than 120
5 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	10 to 30	Loamy sand to gravelly loamy coarse sand	Greater than 120
5 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	10 to 30	Loamy sand to gravelly loamy coarse sand	Greater than 120
5 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	10 to 30	Gravelly and cobbly sandy loam	48 to 72
5 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	10 to 30	Gravelly and cobbly sandy loam	48 to 72

GENERAL SOIL PROFILE OF SOIL GROUP E

Soil horizon	Soil texture and horizon thickness
Litter layer	½ to 3 inches thick
A1	Loamy sand to gravelly loamy coarse sand 3 to 8 inches thick
AC	Loamy sand to gravelly loamy coarse sand 4 to 12 inches thick
	Loamy sand to gravelly loamy coarse sand greater than 20 inches



SOIL GROUP E



SOIL GROUP E (UNNAMED SOIL)

Soil Group E consists of deep loamy sand to gravelly loamy coarse sand soils that have developed in material from the last stages of the eruption of Mt. Mazama. The soil material is composed of approximately 50 percent crystaline sand and 50 percent ash and pumice. In some places the soil material has been reworked by running water. Those areas may have portions of the soil profile which are more dense and influences the plant community that grows there (Landtype E1). Slope gradients range from 0 to 35 except on portions of the flanks of Mt. Scott where slopes range up to 70 percent (Landtype E10).

SOIL GROUP E LANDTYPES

E1, E2, E3, E4, E5, E6, E7, E8, E9, E10

Complexes: E6E8, A12E4, A16E8, C1E2, C2E3, C3E8, 4E10

DOMINANT SOIL GROUP E PLANT COMMUNITIES 1/ 2/

Ponderosa/bitterbrush-manzanita/sedge CP S2 14
Ponderosa/bitterbrush/sedge CP S2 15
Mixed conifer/snowbrush-manzanita CW S1 12
Mixed conifer/snowbrush CW S1 14
White fir/chinquapin-boxwood-prince's pine CW H1 12
Mixed conifer/manzanita CW S1 11
Mountain hemlock/grouse huckleberry CM S1 11
Lodgepole/bitterbrush/sedge CL S2 12
Lodgepole/manzanita CL S3 11

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/

R-6 Area Guide 4-2, January 1976
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PLANT ASSOCIATIONS OF SOUTH CHILOQUIN AND KLAMATH RANGER DISTRICTS - WINEMA NATIONAL FOREST - 2/

R6-Ecol-79-005
U.S.D.A. Forest Service, Pacific Northwest Region

SOIL GROUP E FEATURES AND QUALITIES

Drainage class - Excessively drained.

Infiltration class - Rapid except when surface soil is dry and has water repellent characteristics.

Permeability - Very rapid (greater than 20 inches per hour).

Slope range - 0 to 70 percent.

Bulk density - 0 to 15 inches - 0.7 to 0.85 grams per cubic centimeter.
15 to 30 inches - 0.7 to 1.1 grams per cubic centimeter.

Natural fertility - low - Soil chemical analysis shows a possible potassium deficiency.

Elevation range - 4200 to 7000 feet.

SOIL GROUP E INTERPRETATION

Sediment yield - low.

Sediment size - A horizon - sand and silt.
C horizon - sand and silt.

Mixing and displacement hazard - moderate.

Dustiness hazard - high.

Mudiness hazard - low.

Dry ravel hazard - road cuts and fills - moderate.
natural slopes - low.

Detrimental compaction hazard - low to moderate.

Potential for high surface soil temperature - high.

Natural stability - very stable.

Unified Engineering Classification - SP and SM.

Soil hydrologic Group - A.

Soil water relationship - Inches of water in surface foot of soil at selected tensions.

Moisture tension (Bars)	0.1	0.5	1.0	15.0
Inches of water per foot of soil	3.0 to 3.5	1.5 to 1.75	1.25	0.75

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Mudiness hazard - low.

Dry ravel hazard - road cuts and fills - moderate.
natural slopes - low.

Detrimental compaction hazard - low to moderate.

Potential for high surface soil temperature - high.

Natural stability - very stable.

Unified Engineering Classification - SP and SM.

Soil hydrologic Group - A.

Soil water relationship - Inches of water in surface foot of soil at selected tensions.

Moisture tension (Bars)	0.1	0.5	1.0	15.0
Inches of water per foot of soil	3.0 to 3.5	1.5 to 1.75	1.25	0.75

Readily available water - 0.1 minus 0.5 bar - 1.5 to 1.75 inches. During the 30 day establishment period for reforestation planting, tensions should not exceed 0.5 bars.

Less available water 0.5 bar - 0.75 to 1.00 inches.

MAJOR SOIL MANAGEMENT CONSIDERATIONS FOR SOIL GROUP E

1. Low natural fertility - 75 to 80 percent of the total soil nutrients are in the upper 6 inches of soil. Potassium levels are lower than other soils on the Forest.

2. Some plant communities may have long stolon sedge or golden weed which are highly competitive to planted trees.

3. Naturally unforested areas need more study to determine their suitability for growing trees.

4. Careful manipulation of natural openings and created openings to manage cold air drainage. (Landtypes E3 and E9).

5. Low productivities of the high elevation landtypes E5 and E8.

SOIL GROUP E MANAGEMENT DIRECTION

Timber Mgt.: Avoid removal or excessive displacement of the A1 horizon. Areas with displacement or removal including roads, skidtrails, and landings should not exceed 10 percent on an area basis. An exception can be made when doing site prep if long stolon sedge is present.

Detrimental compaction can be more of a problem for Soil E than other pumice and ash soils. Main skidtrails and landings should be ripped or loosened to 18 inches if these areas are to be put back into full production. Nitrogen fertilizer may be advantageous when planting trees and grass competition is controlled.

Mechanical site prep methods for Soil E depend on whether long stolon sedge is present or not. If long stolon is present, scalping to a depth just below the crowns of the plants may be necessary. The preferred method when long stolon sedge is not present is vertical mixing such as discing to a depth of 6 to 12 inches.

Fuels Management: On slopes less than 35 percent, maintain 1/2 inch of litter duff. On slopes over 35 percent and special problem areas, consult the Forest Soil Scientist for further on-site interpretations.

Estimated Taxonomic Classification: Typic cryopsamment.

Modal Location: SE1/4, SW1/4, Sec. 14, T.32S., R.7 1/2E.

Modal Description: (Landtype E3)

A1 -- 0 to 6 inches (range - 4 to 8 inches); very dark grayish brown (10YR 3/2 moist), loamy sand; weak very fine crumb structure; soft, very friable; medium acid (pH 5.8); gradual smooth boundary.

AC -- 6 to 15 inches (range - 4 to 12 inches); brown to dark brown (10YR 4/3 and 3/3 moist) loamy sand; weak very fine crumb structure; soft, very friable; slightly acid (pH 6.1); gradual smooth boundary.

C -- 15 to 60 inches (range - more than 20 inches); brown to dark brown (7.5 YR 4/4) loamy sand; massive; soft, very friable; slightly acid (pH 6.3).

INTERPRETATIONS FOR LANDTYPES WITHIN SOIL GROUP E

Landtype	Erosion Hazard			Frost Heave Potential	Cold Air Drainage Hazard
	Sheet	Gully	Wind		
E1	Mod.	Low to Mod.	Low	Mod.	Mod.
E2	Low	Low	Low	Mod.	Mod.
E3	Low	Low	Low	High	High
E4	Low to Mod.	Low	Low	Mod.	Low to Mod.
E5	Low to Mod.	Low	Low	Mod.	Low
E6	Low to Mod.	Low	Low	Mod.	Low
E7	Low	Low	Low	Mod.	Mod.
E8	Low	Low	Low	Mod.	High
E9	Low	Low	Low	Mod. to High	Mod.
E10	High	Low	Low	Mod.	Low

FEATURES AND QUALITIES OF LANDTYPES

Land-Type	Landform	% Slope Range	Aspect	Elevation Range in Feet	Effective Rooting Depth Inches	Common Landtype Inclusions within Mapped Delineation
E1	Highly variable.	0 to 15	Variable	4000 to 5500	Somewhat restricted at 20"	E2, E3, E9
E2	Flat broad drainageways.	0 to 10	Variable	4000 to 5500	Greater than 36	E1, E3, C1, C2
E3	Flat broad drainageways.	0 to 10	Variable	4000 to 5500	Greater than 36	E2, C1, C2
E4	Mixed concave drainageways and convex ridges and sideslopes.	0 to 35	Variable	6000 to 7000	Greater than 36	E5, E8
E5	Convex ridgetops and sideslopes and flats.	0 to 35	Variable	6000 to 7000	Greater than 36	E4, E6, E8, A14, C2
E6	Convex ridges and sideslopes.	0 to 35	Variable	5000 to 6500	Greater than 36	E4, E7, A12, A15, A17, A18
E7	Concave toeslopes and drainageways.	0 to 15	Variable	5500 to 6500	Greater than 36	E6, A16, A17, A19
E8	Concave toeslopes and drainageways.	0 to 15	Variable	6000 to 7000	Greater than 36	E4, E7, A16
E9	Flat broad drainageways.	0 to 15	Variable	4500 to 5500	Greater than 36	E1, E3
E10	Steep convex sideslopes	35 to 70	Variable	5500 to 6500	Greater than 36	E6, E7, A17

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/
R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

PLANT ASSOCIATIONS OF SOUTH CHILOQUIN AND KLAMATH RANGER DISTRICTS - WINEMA NATIONAL FOREST - 2/
R6-Ecol-79-005 U.S.D.A. Forest Service, Pacific Northwest Region

WITHIN SOIL GROUP E

Plant Community Data 1/ 2/

Dominant Plant Communities	Sample Size	Plant Community Productivity: Wood Fiber-Cu. Ft./Acre/Year Mean	5% CI	Grasses & Forbes-lbs./Acre/Year Mean	5% CI
Unclassified dry meadow.	N/A	N/A	N/A	N/A	N/A
Ponderosa/bitterbrush/manzanita/ sedge (CP S2 14)	3	23	Too Variable	50	Too Variable
Ponderosa/bitterbrush/sedge (CP S2 15)	10	38	9	51	20
Lodgepole/bitterbrush/sedge (CL S2 12)	5	57	23	16	5
Mixed conifer/manzanita (CW S1 11)	N/A	N/A	N/A	N/A	N/A
Mountain hemlock/grouse huckle-berry (CM S1 11)	N/A	N/A	N/A	N/A	N/A
Lodgepole/manzanita (CL S3 11)	12	14	3	51	4
Mixed conifer/snowbrush-man-zanita (CW S1 12)	19	50	11	79	3
Mixed conifer/snowbrush (CW S1 14)	7	44	12	8	5
Mixed conifer/snowbrush-man-zanita (CW S1 12)	19	50	11	79	3
Mixed conifer/snowbrush (CW S1 14)	7	44	12	8	5
Lodgepole/manzanita (CW S3 11)	12	14	3	51	4
White fir/chinquapin-boxwood-prince's pine (CW H1 12)*	14	-	-	N/A	N/A
Mixed conifer/snowbrush-man-zanita (CW S1 12)	19	50	11	79	3
Mixed conifer/snowbrush (CW S1 14)	7	44	12	8	5

		WF	DF	PP
*CW H1 12	Mean	144	145	82
	5% CI	22	31	29

WF-White fir, DF-Douglas fir, PP-Ponderosa pine

RANGE IN SOIL CHARACTERISTICS OF

Land-type	Litter Layer		A1 Horizon			AC Horizon	
	Thickness (Inches)	% Ground Cover	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel 1/	Thickness (Inches)	Texture of Soil
E1	1/2 to 1	30 to 50	4 to 8	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand
E2	1/2 to 3	50 to 70	4 to 8	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand
E3	1/2 to 2	50 to 70	4 to 8	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand
E4	1/2 to 3	50 to 80	3 to 6	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand
E5	1/2 to 2	50 to 75	3 to 6	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand
E6	1/2 to 3	50 to 80	3 to 6	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand.
E7	1/2 to 3	50 to 80	3 to 6	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand.
E8	1/2 to 3	50 to 80	3 to 6	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand.
E9	1/2 to 3	50 to 80	3 to 6	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand.
E10	1/2 to 3	50 to 80	3 to 6	Loamy sand to gravelly loamy coarse sand	0 to 20	4 to 12	Loamy sand to gravelly loamy coarse sand.

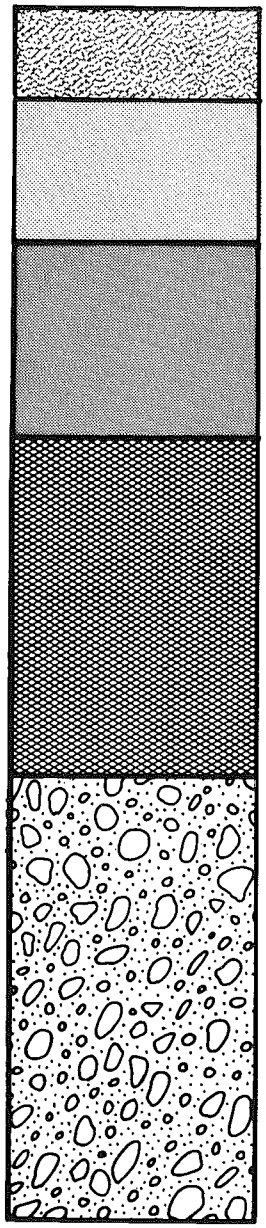
1/ 2 mm to 3 inches

LANDTYPES WITHIN SOIL GROUP E

	C Horizon			
Percent Pumice Gravel[1]	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel[1]	Depth to Bedrock (Inches)
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 96
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 96
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 96
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 40
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 40
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 40
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 96
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 96
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 96
0 to 20	Greater than 20	Loamy sand to gravelly loamy coarse sand	0 to 20	Greater than 40

GENERAL SOIL PROFILE OF SOIL GROUP G

Soil horizon	Soil texture and horizon thickness
Litter layer	½ to 3 inches
A1	Sandy loam to gravelly loamy coarse sand — 2 to 6 inches thick
AC	Loamy coarse sand to gravelly loamy coarse sand — 4 to 10 inches thick
C	Gravelly coarse sand to very gravelly coarse sand — 10 to more than 24 inches thick
IIB	Buried soil at depths greater than 40 inches gravelly and cobbly loams



SOIL GROUP G

OCCURS THROUGHOUT

THE PUMICE AND ASH

SOIL AREA

SOIL GROUP G (WICKIUP-LIKE AND OTHER UNNAMED SOILS).

Soil Group G consists of somewhat poorly and poorly drained soils in concave drainageway positions. Most of the soil material is water reworked pumice and ash. These soils have water tables at or near the surface in the spring and at varying depths during the summer. The A1 horizon soil texture ranges from loams to gravelly sandy loams and gravelly loamy coarse sands. AC and C horizons are gravelly sandy loams to loamy coarse sands and very gravelly loamy sands. Slope gradients range from 0 to 5 percent.

SOIL GROUP G LANDTYPES

G1, G2, G3

Complexes: G1G3, G2G3, A4G2, A6G2, A8G1, A8G2, A8G3, B2G1, B4G1, B4G2, B7G1, B8G1, D1G2, 2G2, 2G3, 14G1, 14G3, 15G3

DOMINANT SOIL GROUP E PLANT COMMUNITIES 1/

Lodgepole/sedge-grass wetland CL M1 11
Lodgepole/blueberry/forb wetland CL M3 11
Lodgepole/bearberry CL M2 11
Lodgepole/bitterbrush/forb CL S2 13
Lodgepole/bitterbrush/fescue CL S2 14

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/

R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

SOIL GROUP G FEATURES AND QUALITIES

Drainage class - Somewhat poorly to poorly drained.

Infiltration rate - Rapid.

Permeability - Rapid (6.0 to 20 inches per hour).

Slope range - 0 to 5 percent.

Bulk density - 0.55 to 0.70 grams per cubic centimeter.

Natural fertility - low to moderate.

Elevation range - 4200 to 5500 feet.

SOIL GROUP G INTERPRETATIONS

Sediment yield - low.

Sediment size - A1 horizon - pumice gravel, sand, and silt
C horizon - pumice gravel and sand.

Mixing and displacement hazard - moderate.

Dustiness hazard - moderate.

Mudiness hazard - moderate to high

Dry ravel hazard - road cuts and fills - low.
natural slopes - low.

Detrimental compaction hazard - moderate.

Potential for high surface soil temperature - high.

Natural stability - very stable.

Unified Engineering Classification - A1 and AC horizons - ML, SM, SW, SP.
C horizon - GP.

Soil hydrologic group - C and D.

Soil water relationship - Inches of water in surface foot of soil at selected tensions for landtype G1 and G2. Landtype G3 was not rated due to mostly season long high water table.

Moisture tension (Bars)	0.1	0.5	1.0	15.0
Inches of water per foot of soil	3.5 to 5.0	1.0 to 2.0	0.75 to 1.0	0.5

Readily available water - 0.1 minus 0.5 bar water - 2.5 to 3.0 inches. During the 30 day establishment period for reforestation planting, tensions should not exceed 0.5 bars.

Less available water - 0.5 bar - 0.5 minus 15 bar water - 0.5 to 1.5 inches.

MAJOR SOIL MANAGEMENT CONSIDERATIONS FOR SOIL GROUP G

1. Landtypes within Soil Group G have highly variable watertables. Landtype G1 and G2 watertables are at or near the surface during the spring thaw, but by June 15 they have generally dropped to below 30 inches. The watertable in landtype G3 may remain at or near the surface until the middle of July and then dropping to 20 to 40 inches by August 15.

2. Grasses and forbes may cause competition for planted trees.

3. These soils are common components of the riparian and streamside management zones.

SOIL GROUP G MANAGEMENT DIRECTION

Timber harvest: Avoid removal or excessive displacement of the A1 horizon. Areas with displacement or removal including roads, skidtrails and landings should not exceed 10 percent on an area basis. Soil compaction can be a problem when the soils are excessively wet due to high watertables in the spring. Avoid timber harvest activities when soils are excessively wet.

Site prep methods for landtype G1 and G2 are similar to Soil Group A except wait until watertable is below 30 inches. Landtype G3 probably does not need site prep as planting is not generally necessary. Very limited acres of Landtype G3 will be clearcut due to the wildlife constraints for this landtype which is within the riparian and streamside management zones.

Fire Management: Controlled burns should be designed to maintain 1/2 inch of litter duff.

Estimated Taxonomic Classification: Cindery aquic Cryorthents and cindery cryaquents.

Modal Location: NW1/4, SE1/4, Sec. 11, T.34S., R.11E.

Modal Description: (Landtype G2) Cindery aquic cryorthents.

A1 -- 0 to 4 inches (range - 2 to 6 inches thick); very dark gray (10YR 3/1 moist), loamy coarse sand; weak very granular structure; soft, very friable; about 10 percent cinders (gravel size); slightly acid (pH 6.4); clear smooth boundary.

AC -- 4 to 12 inches (range - 6 to 10 inches thick); dark grayish brown (10YR 4/2 moist) loamy coarse sand; weak fine crumb structure; soft, very friable;

10 to 20 percent cinders (gravel size); medium acid (pH 6.0); clear wavy boundary.

C -- 12 to 46 inches (range - 14 to greater than 30 inches); grayish brown (2.54 5/2 moist) very gravelly coarse sand; massive soft, very friable; more than 35 percent cinders (gravel size); slightly acid (pH 6.4).

SOIL GROUP G (UNNAMED SOIL)

Modal Location: SW1/4 SW1/4, sec. 7, T.28S., R.10E.

Modal Description: (Landtype G3) Cindery Cryaquents

A1 -- 0 to 7 inches (range - 5 to 10 inches thick); black (10YR 2/1 moist) loam to silt loam; weak fine crumb structure; soft, very friable; slightly sticky and slightly plastic; about 5 percen tcinders (gravel size pumice); slightly acid (pH 6.4); gradual smooth boundary.

AC -- 7 to 12 inches (range 3 to 8 inches thick); very dark gray to dark gray (10YR 3/1 to 4/1 moist) sandy loam; weak fine crumb structure; soft, very friable; nonsticky and nonplastic; about 10 percent cinders (gravel size pumice); slightly acid (pH 6.4); gradual wavy boundary.

C -- 12 to 40 inches (range - greater than 15 inches); dark gray (10YR 4/1 moist) very gravelly loamy sand; nonsticky and nonplastic; about 50 percent cinders (gravel size pumice); neutral (pH 6.8).

INTERPRETATIONS FOR LANDTYPES WITHIN SOIL GROUP G

Landtype	Erosion Hazard			Frost Heave Potential	Cold Air Drainage Hazard
	Sheet	Gully	Wind		
G1	Low	Mod.	Low	High	High
G2	Low	Mod.	Low	High	High
G3	Low	Mod.	Low	High	High

RANGE IN SOIL CHARACTERISTICS OF

Land-type	Litter Layer		A1 Horizon			AC Horizon	
	Thickness (Inches)	% Ground Cover	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel	Thickness (Inches)	Texture of Soil
G1	1/2 to 2	60 to 80	2 to 6	Sandy loam to gravelly loamy coarse sand	5 to 20	6 to 10	Loamy coarse sand to gravelly loamy coarse sand
G2	1/2 to 2	60 to 80	2 to 6	Sandy loam to gravelly loamy coarse sand	5 to 20	6 to 10	Loamy coarse sand to gravelly loamy coarse sand
G3	1/2 to 3	80 to 100	4 to 6	Loam to sandy loam.	5 to 10	4 to 8	Sandy loam to gravelly loamy sand

FEATURES AND QUALITIES OF LANDTYPES

Land-Type	Landform	% Slope Range	Aspect	Elevation Range in Feet	Effective Rooting Depth Inches	Common Landtype Inclusions within Mapped Delineation
G1	Valley Bottoms	0 to 5	Variable	4200 to 5500	36	G2, G3, B9, 2
G2	Valley Bottoms	0 to 5	Variable	4200 to 5500	36	G1, G3, A9, 2
G3	Valley Bottoms	0 to 5	Variable	4200 to 5500	30	G1, G2, 1

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/
R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

LANDTYPES WITHIN SOIL GROUP G

C Horizon				Buried Soil - IIB	
Percent Pumice Gravel	Thickness (Inches)	Texture of Soil	Percent Pumice Gravel	Texture of Buried Soil	Depth to Bedroc (Inches)
10 to 35	10 to 20	Gravelly coarse sand to very gravelly coarse sand.	25 to 60	Gravelly and cobbly loam	Greater than 40
10 to 35	More than 24	Gravelly coarse sand to very gravelly coarse sand.	25 to 60	Gravelly and cobbly loam	Greater than 60
10 to 25	Greater than 14	Gravelly coarse sand to very gravelly coarse sand.	25 to 60	Gravelly and cobbly loam	Greater than 60

WITHIN SOIL GROUP G

Dominant Plant Communities	Plant Community Data 1/ Plant Community Productivity				
	Sample Size	Wood Fiber-Cu. Ft./Acre/Year		Grasses & Forbes-lbs./Acre/Year	
		Mean	5% CI	Mean	5% CI
Lodgepole/bitterbrush/forb (CL S2 13)	12	34	4	24	20
Lodgepole/bitterbrush/fescue (CL S2 14)	19	43	5	75	20
Lodgepole/bitterbrush/forb (CP S2 13)	12	34	4	24	20
Lodgepole/bitterbrush/fescue (CL S2 14)	19	43	5	75	20
Lodgepole/sedge-grass wetlands (CL M1 11)	5	66	35	1225	415
Lodgepole/bearberry (CL M2 11)	8	42	14	33	
Lodgepole/blueberry/forb wetland (CL M3 11)	12	54	12	105	61

SPECIAL FEATURES OF THE NON-PUMICE AND ASH SOILS OF THE WINEMA N.F.

About 25 percent of the Forest has soils that have formed in weathered basalts, andesites, breccias, plyroclastics and sedimentary rocks. The landforms are controlled by a combination of fault systems, volcanic eruption centers, glaciation and geologic erosion. These soils occur in the South Chiloquin Block (southern portion of the Chiloquin Ranger District) and most of the Klamath Ranger District except for the north end of the District. Along the edge of the airlaid Mt. Mazama pumice and ash there is a transition zone where the depth of pumice and ash is less than 15 inches. Also there are areas within the airlaid pumice where natural erosion has decreased the pumice and ash depth to less than 15 inches. Because these soils will react under management more like non-pumice and ash soils, they were included in this group of soils.

SOIL CHEMICAL ANALYSIS

Limited soil chemical analysis data for this area shows fairly low phosphorus levels. The higher producing sites and high elevation sites had the lowest levels (generally less than 10 parts per million). On the South Chiloquin Block the levels were higher (20 to 40 parts per million). Personal communication with Oregon State personnel indicated that these low levels of phosphorous are sufficient for natural stands. The tree needs were possibly being met from mycorrhizae on the roots. If more intensive management is practiced (fertilizing, etc.) it will be necessary to consider the low phosphorous levels.

Nitrogen levels from the limited soil chemical analysis were within the expected levels. The surface soils (0 to 6 inches) had levels ranging form 0.1 to 0.4 percent nitrogen. Levels at 6 to 12 inches ranged from 0.03 to 0.15 percent and at 12 to 18 inches less than 0.10 percent. (Areas that are covered with heavy ceanothis brush have higher levels - 0.30 to 0.50 percent.)

Potassium levels were highest on the south Chiloquin Block (soil group H) ranging from 600 to 1100 parts per million. On the Klamath District for Soil Groups R and X the lower elevations ranged from 200 to 700 parts per million and at higher elevations were less than 200 parts per million. The low levels at high elevations need more testing.

Soils in the South Chiloquin Block have lower productivities than the soils in the Klamath District. This probably is due to the lower rainfall in this area. Limited soil chemical analysis data shows somewhat higher potassium levels for these soils and similar nitrogen and phosphorus levels.

A composite of the soil chemical testing is included in the appendix on page

COARSE FRAGMENT CONTENT EFFECTS

A common problem in managing these soils is the wide range in coarse fragment content (rocks over 2 millimeters in diameter). Within a mapped landtype

delineation the coarse fragment content may vary from 10 to 75 percent. It was not possible to map these areas in greater detail at the level of survey. This limits the usefullness of this survey for project needs. Coarse fragment content affects the type of site prep and planting, success of planting, effectiveness of ripping, detrimental compactability and plant available water storage. It will be the land managers responsibility to get more detailed project level soils information to meet his needs. Future soil scientist's time can be directed towards mapping these soils in greater detail. Using more detailed surveys the land managers and soil scientist can then set up guidelines for operability, methodology, fuels management, etc. for project planning. Following is an interpretation chart based on coarse fragment content which relates to Soil Group H, R, and X.

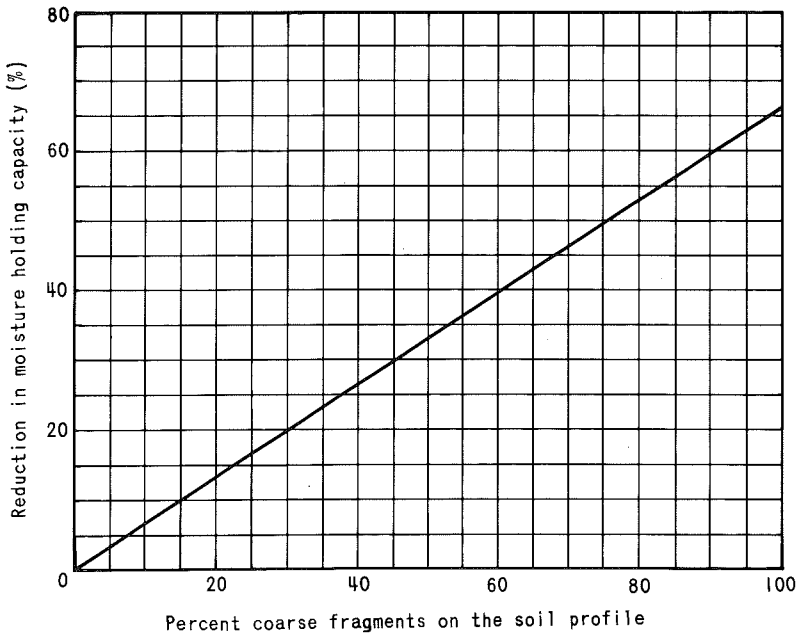
Interpretations based on coarse fragment content*

Percent Coarse Fragment Content	Detrimental Compaction Hazard	Mixing and displacement Hazard	Predicted Planting Success	Ease in Ripping
25 TO 45	High	Mod.	High	Easy
45 to 60	Mod.	Mod.	Mod.	Mod.
60 plus	Low	Low	Low	Diff.

*Coarse fragments content includes all rock material greater than 2 millimeters.

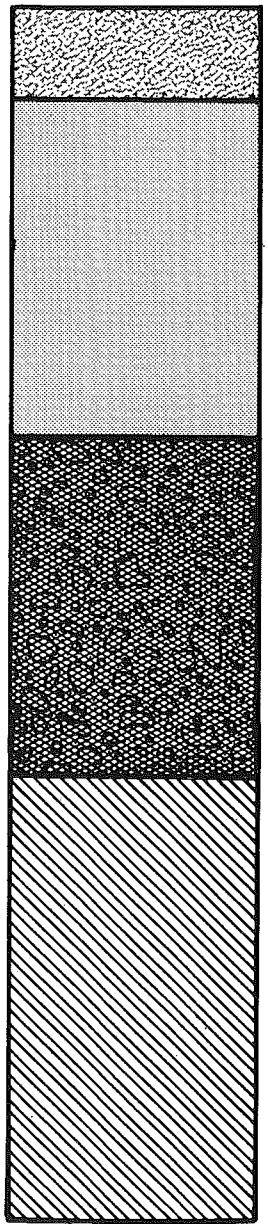
Soil moisture storage is affected by coarse fragment content. Research by Coil (Coil, T.S. 1953) shows that there is not a percent for percent reduction in storage due to coarse fragments. For example if a soil has 60 percent coarse fragments there is a 40 percent reduction in water storage. Following is a graph showing the relationship for different coarse fragment levels and the reduction in moisture holding capacity. This does not relate to pumice or cinder type coarse fragments, only for non-porous type rocks.

Soil Moisture Storage as affected by Coarse Fragment Content

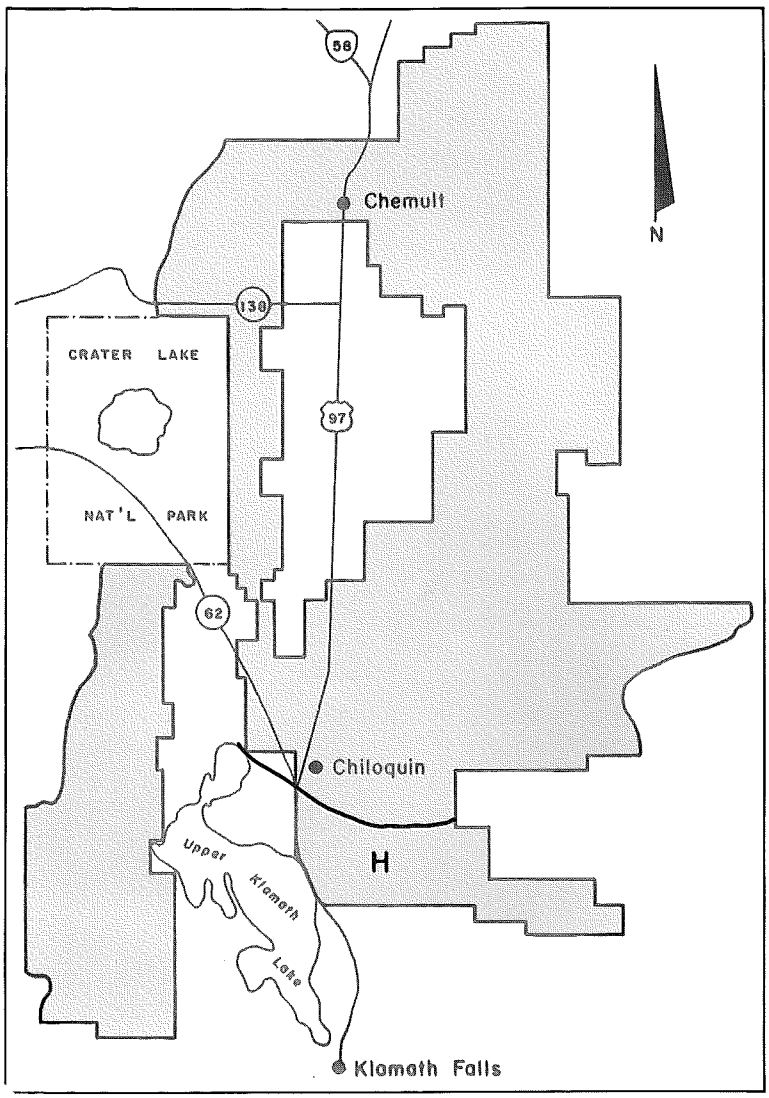


GENERAL SOIL PROFILE OF SOIL GROUP H

Soil horizon	Soil texture and horizon thickness
Litter layer	½ to 3 inches thick
A1	Gravelly to gravelly and cobbly loams and sandy loams (Land types H1, H2, H3, and H4). Coarse sandy loam to gravelly coarse sandy loams (Land types H5, H6 and H7). 2 to 8 inches thick
AC, B and C	Gravelly to very gravelly and cobbly sandy loams, loams and clay loams — 10 to 60 inches thick
Bedrock	30 inches to greater than 72 inches



SOIL GROUP H



SOIL GROUP H (YAWHEE AND WOODCOCK LIKE OTHER UNNAMED SOILS).

Soil Group H consists of well drained gravelly and cobbly loamy soils. The soil material is derived from a mixture of volcanic ash, weathered andesites, basalts, breccias and sedimentary bedrock. Gravel, cobble, and stones make up 10 to 75 percent of the soil material. Soil Group H landforms are controlled by old fault systems and volcanic eruptive centers. Portions of Soil Group H are along the transition zone or are eroded areas within the air laid pumice and ash area. Pumice and ash depths are less than 15 inches. Slope gradients range from 0 to 75 percent with the steeper (25 to 75 percent) slopes occuring on old fault scarps.

SOIL GROUP H LANDTYPES

H1, H2, H3, H4, H5, H6, H7

Complexes: H1H3, H1H4, H1H5, H1H7, H2H3, H3H7, H5H6, H5H7, B2H5, B4H2, B4H5, B4H6, B5H2, B5H3, B6H6, D1H4, 4H3, 5H3, 12H1, 12H2, 12H5, 12H7, 13H3, 13H4, 13H5, 13H6, 13H7

DOMINANT SOIL GROUP H PLANT COMMUNITIES [1/]

Ponderosa/bitterbrush/needlegrass CP S2 12
Ponderosa/bitterbrush/fescue CP S2 11
Mixed conifer/showbrush-squawcarpet/strawberry
CW S1 16
White fir/snowberry/strawberry CW S3 12

PLANT ASSOCIATIONS OF SOUTH CHILOQUIN AND KLAMATH RANGER DISTRICTS - WINEMA NATIONAL FOREST - [1/]

R6-Ecol-79-005
U.S.D.A. Forest Service, Pacific Northwest Region

SOIL GROUP H FEATURES AND QUALITIES

Drainage class - Well drained.

Infiltration rate - Moderate to rapid.

Permeability - 0 to 12 inches - rapid (6.0 to 20 inches per hour).
12 to 24 inches - mod. (0.6 to 2.0 inches per hour).

Slope range - 0 to 70 percent.

Bulk density - 0 to 12 inches - 0.75 to 0.9 grams per cubic centimeter.
12 to 24 inches - 0.80 to 1.0 grams per cubic centimeter.

Natural fertility - moderate.

Elevation range - 4500 to 6500 feet.

SOIL GROUP H INTERPRETATION

Interpretations based on coarse fragment content for all Soil Group H landtypes.

Percent Coarse Fragment Content	Detrimental Compaction Hazard	Mixing and displacement Hazard	Predicted Planting Success	Ease in Ripping
25 to 45	High	Mod.	High	Easy
45 to 60	Mod.	Mod.	Mod.	Mod.
60 plus	Low	Low	Low	Diff.

*Coarse fragments content includes all rock material greater than 2 millimeters.

Dustiness hazard - Moderate for landtypes H1, H2, H3, H4.

High for landtypes H5, H6, H7.

Mudiness hazard - Moderate.

Natural Stability: Very stable.

Unified Engineering Classification - GM and ML.

Soil hydrologic group - A and B.

Soil water relationship - Inches of water in surface foot of soil at selected tensions.*

*Does not take coarse fragment content into consideration. To compensate for coarse fragments, refer to Special Features of Non-pumice and Ash Soils.

Moisture tension (Bars)	0.1	0.5	1.0	15.0
Inches of water per foot of soil	3 to 4	1.5 to 2.0	1.0 to 1.75	0.75 to 1.0

Readily available water - (0.1 minus 0.5 bar water) - 1.5 to 2.0 inches per foot of soil. During the 30 day establishment period for reforestation planting, moisture tensions should not exceed 0.5 bars.

Less available water - (0.5 minus 15 bar water) - 0.75 to 1.0 inches per foot of soil

MAJOR SOIL MANAGEMENT CONSIDERATIONS FOR SOIL GROUP H

1. Soils with more than 60 percent coarse fragments will be extremely difficult to plant and also have satisfactory survival due to the limited plant available water in the 0.1 to 0.5 bar moisture range.

2. Soils with less than 50 percent coarse fragments are highly susceptible to compaction when at optimum moisture levels for compaction.

3. Soil Group H landtypes have a high productivity potential and a moderate to high potential for reduction in productivity due to management activities.

4. Steep slopes on landtypes H3 and H6.

SOIL GROUP H MANAGEMENT DIRECTION

Timber Mgt.: The wide range in coarse fragment content within the landtypes of Soil Group H limit the usefulness of the soil mapping for project planning. Coarse fragment content affects the type of site prep and planting, effectiveness of ripping, detrimental compactability and plant available water. Coarse fragments include all of the rock fragments in the soil from 2 millimeters to greater than 2 feet. It will be the land managers responsibility to get project level soils information to meet his needs. Future soil scientist's time should be directed towards mapping these Soil Group H landtypes in greater detail. Using more detailed surveys the land manager and soil scientist can then set up guidelines for operability, methodology, fuels management, etc. for project planning.

Fuels Management: Present state of knowledge indicates that if 1/2 inch of litter duff is maintained after broadcast burning, there should be no impairment of soil productivity. Brush fields with ceanothis probably can withstand hotter burns due to the natural higher nitrogen levels.

Estimated Taxonomic Classification: Ashy-skeletal Typic Cryandepts and loamy-skeletal mixed Typic Cryochrepts and Argie Pachic Cryoborolls.

Modal Location: NE1/4, NW1/4, Sec. 5, T.36S., R.9E. (Woodcock like)

Modal Description: (Landtype H4)

Litter Layer: 2 to 0 inches; needle mat, needles partially decomposed in lower part.

A Horizon - 0 to 10 inches; dark brown (7.5 YR 3/3 moist) gravelly sandy loam, brown (7.5 YR 5/3 dry); weak very fine crumb structure; soft, very friable, nonsticky and nonplastic; 20 percent gravels and 10 percent cobbles; slightly acid (pH 6.4); gradual wavy boundary. (6 to 12 inches thick).

B21 Horizon - 10 to 20 inches, dark reddish brown (5 YR 3/3 moist) very gravelly and cobbly loam, brown (5 YR 5/3 dry); weak to moderate subangular block structure; slightly hard, friable, sticky and plastic; 30 percent gravels and 20 percent cobbles and stones; slightly acid (pH 6.3); gradual wavy boundary. (8 to 20 inches thick).

B22 Horizon - 20 to 36 inches; dark reddish brown (5 YR 3/4 moist) very gravelly and cobbly loam to clay loam, reddish brown (5 YR 5/4 dry); moderate fine subangular blocky structure; hard, friable, sticky and plastic; 30 percent gravels and 30 percent cobbles and stones; slightly acid (pH 6.4); gradual wavy boundary. (8 to 16 inches thick).

C Horizon - 36 to 50 inches; reddish brown (5 YR 4/4 moist) very gravelly and cobbly loam, reddish brown (5 YR 5/4 dry); weak fine subangualr blocky structure; slightly hard, firm, sticky and plastic, 30 percent gravels and 40 percent cobble and stones; neutral (pH 6.8).

Modal Location: SW1/4, SE1/4, Sec. 19, T.36S., R.9E. (Yawhee like)

Modal Description: (Landtype H1)

Litter Layer: 1/2 inch to 0; loose mat of pine and fir needles.

A Horizon - 0 to 13 inches; very dark grayish brown (10 YR 3/2 moist) very cobbly and stony coarse sandy loam; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; 20 percent gravel and 20 percent cobble and stones; slightly acid (pH 6.4); clear wavy boundary (8 to 15 inches thick).

C Horizon - 13 to 28 inches; dark yellowish brown (10 YR 3/4 moist) very cobbly loamy coarse sand; massive; soft, very friable; 25 percent gravel and 25 percent cobble and stones; slightly acid (pH 6.3); clear wavy boundary. (5 to 18 inches thick).

IIB Horizon - 28 to 50 inches; dark brown (10 YR 3/3 moist) very gravelly loam; common fine and medium angular blocky structure; hard, firm, slightly sticky and slightly plastic; 55 percent gravels and 5 percent cobbles; slightly acid (pH 6.1)

INTERPRETATIONS FOR LANDTYPES WITHIN SOIL GROUP H

Land-type	Erosion Hazard			Frost Heave Potential	Cold Air Drainage Hazard	Sediment Yield Potential	Sediment Size	Potential for High Surface Soil Temperatures
	Sheet	Gully	Wind					
H1	Low to Mod.	Low	Low	Low	Low	Low	Sand and Silt	Mod. to High
H2	Low	Low	Low	Low	Low	Low	Sand and Silt	Low
H3	High	Low	Low	Low	Low	High	Sand and Silt	Mod. to High
H4	Low	Mod.	Low	Mod.	Mod.	Low	Sand and Silt	Mod.
H5	Low to Mod.	Low	Low	Low	Low	Low	Sand and Silt	High
H6	High	Low	Low	Low	Low	High	Sand and Silt	Mod. to High
H7	Low	Mod.	Low	Mod.	Mod.	Low	Sand and Silt	Mod.

FEATURES AND QUALITIES OF LANDTYPES

Land-Type	Landform	% Slope Range	Aspect	Elevation Range in Feet	Effective Rooting Depth Inches	Common Landtype Inclusions within Mapped Delineation
H1	Ridges and convex sideslopes	0 to 35	Variable 0 to 15 15-35 So.	4500 to 6500	24 to 36	H2, H3, H4, H5, 12
H2	Convex sideslopes	15 to 35	North	4500 to 6500	20 to 36	H1, H3, H4
H3	Steep convex sideslopes	35 to 70	Variable	4500 to 6500	20 to 36	H1, H4, H6, 13
H4	Concave toeslopes and drainageways	0 to 15	Variable	4500 to 6500	30 to 48	H1, H2, H3, H7, 2
H5	Ridges and convex sideslopes	0 to 35	Variable	4500 to 5000	24 to 36	H1, H4, H6, H7, 12, 13
H6	Steep convex sideslopes	35 to 70	Variable	4500 to 5000	20 to 36	H3, H4, H5, H7, 13
H7	Concave toeslopes and drainageways	0 to 15	Variable	4500 to 5000	30 to 48	H4, H5, 12

LANT ASSOCIATIONS OF SOUTH CHILOQUIN AND KLAMATH RANGER DISTRICTS - WINEMA ATIONAL FOREST - 1/
6-Ecol-79-005 U.S.D.A. Forest Service, Pacific Northwest Region

WITHIN SOIL GROUP H

Dominant Plant Communities	Plant Community Data 1/ Plant Community Productivity Sample Size	Wood Fiber-Cu. Ft./Acre/Year Mean
(CW S1 16)	12	* See chart below for species productivty. Grass and forb productivity not available.
(CW S3 12)	15	*
(CW S1 16) (CW S3 12)	12 15	* *
(CW S1 16) (CW S3 12)	12 15	* *
(CW S1 16) (CW S3 12)	12 15	* *
(CP S2 12) (CP S2 11)	3 2	* *
(CP S2 12) (CP S2 11)	3 2	* *
(CP S2 12) (CP S2 11)	3 2	* *

		PP	WF	DF	SP	IC
Mixed conifer/snowbrush-squaw-carpet/strawberry (CW S1 16)	Mean	38	43	42	34	21
	5% CI	8	20	15	8	-
White fir/snowberry/strawberry (CW S3 12)	Mean	60	69	29	-	-
	5% CI	23	16	22	-	-
Ponderosa pine/bitterbrush/needlebrass (CP S2 12)	Mean	36	-	-	-	-
	5% CI	-	-	-	-	-
Ponderosa pine/bitterbrush/fescue (CP S2 11)	Mean	61	-	-	-	-
	5% CI	-	-	-	-	-

PP-Ponderosa pine, WF-White fir, DF-Douglas-fir, SP-Sugar pine, IC-Incense cedar.

RANGE IN SOIL CHARACTERISTICS OF

Land-type	Litter Layer		A1 Horizon				
	Thickness (Inches)	% Ground Cover	Thickness (Inches)	Texture of Soil	Coarse Fragments Gravel	Cobble	Stones
H1	1/2 to 2	60 to 80	4 to 8	Gravelly to gravelly & cobbly loams & sandy loams.	15 to 35	10 to 30	0 to 30
H2	1/2 to 2	60 to 80	4 to 8	Gravelly to gravelly & cobbly loams & sandy loams.	15 to 35	10 to 30	0 to 30
H3	1/2 to 2	60 to 80	2 to 6	Gravelly to very gravelly & cobbly loams & sandy loams.	15 to 45	10 to 30	0 to 30
H4	1/2 to 3	70 to 90	4 to 8	Gravelly to gravelly & cobbly loams & sandy loams.	15 to 30	0 to 20	0 to 20
H5	1/2 to 2	50 to 75	4 to 6	Coarse sandy loam to gravelly coarse sandy loam.	10 to 35	10 to 30	0 to 30
H6	1/2 to 2	50 to 75	2 to 4	Coarse sandy loam to gravelly coarse sandy loam.	10 to 45	10 to 30	0 to 30
H7	1/2 to 2	60 to 80	4 to 6	Coarse sandy loam to gravelly coarse sandy loam.	10 to 30	0 to 20	0 to 20

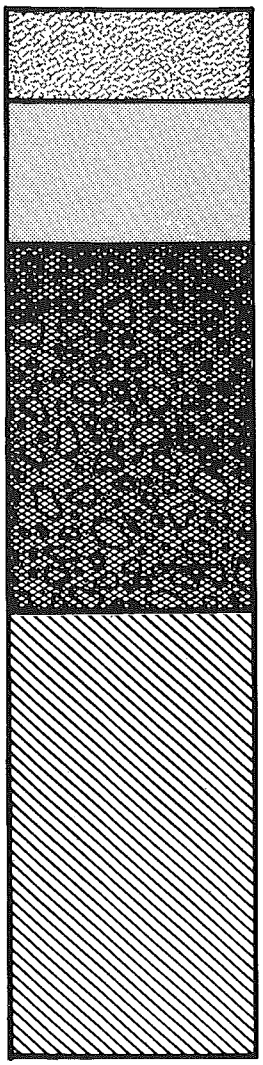
LANDTYPES WITHIN SOIL GROUP H

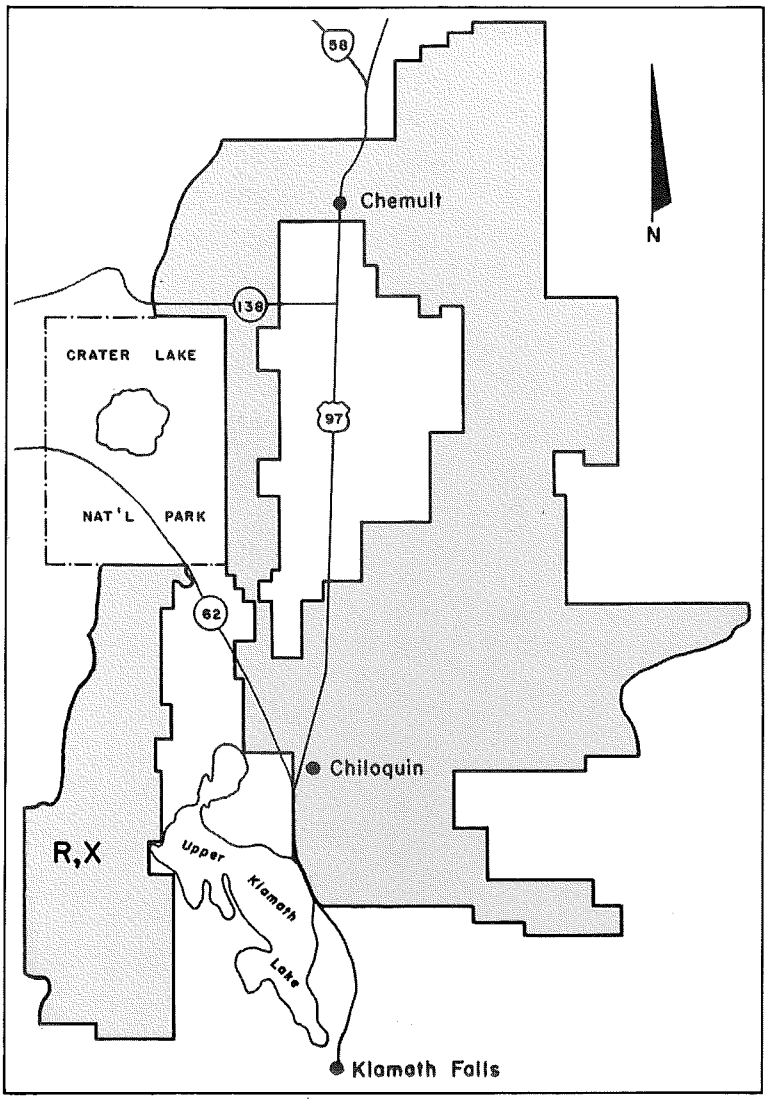
AC, B and C Horizons

Thickness (Inches)	Texture of Soil	Coarse Fragments			Depth to Bedrock (Inches)
		Gravel	Cobble	Stones	
10 to 50	Gravelly to very gravelly and cobbly sandy loams, loams & clay loams.	20 to 45	10 to 40	0 to 40	30 to greater than 72
10 to 50	Gravelly to very gravelly and cobbly sandy loams, loams & clay loams.	20 to 45	10 to 45	0 to 40	30 to greater than 72
10 to 40	Gravelly to very gravelly and cobbly sandy loams, loams & clay loams.	25 to 50	20 to 50	0 to 50	30 to greater than 72
10 to 60	Gravelly to very gravelly and cobbly sandy loams, loams & clay loams.	20 to 45	10 to 40	0 to 40	Greater than 72
10 to 40	Gravelly to very gravelly and cobbly sandy loams, loams & clay loams.	10 to 45	10 to 40	0 to 40	30 to greater than 72
10 to 40	Gravelly to very gravelly and cobbly sandy loams, loams & clay loams.	10 to 50	20 to 50	0 to 50	30 to greater than 72
10 to 50	Gravelly to very gravelly and cobbly sandy loams, loams & clay loams.	10 to 40	20 to 40	0 to 40	Greater than 72

GENERAL SOIL PROFILE OF SOIL GROUP R

Soil horizon	Soil texture and horizon thickness
Litter layer	1 to 4 inches thick
A1	Fine sandy loams, gravelly to very gravelly and cobbly sandy loams — 4 to 12 inches thick
AC, B and C	Gravelly and cobbly to very gravelly and cobbly loams and clay loams — 10 to 60 inches thick
Bedrock	36 to greater than 60 inches





SOIL GROUP R (OATMAN LIKE AND OTHER UNNAMED SOILS).

Soil Group R consists of well drained gravelly and cobbly fine sandy loam to loam soils. The soil material is derived from a mixture of volcanic ash, weathered andesites, basalts, mudflows, and pyroclastics. Also, portions of Soil Group R have been glaciated, occurring mainly at higher elevations. Soil Group R landforms are controlled by a combination of fault systems, volcanic eruptive centers and glaciation. Gravel, cobble, and stones make up 10 to 75 percent of the soil material. Soil depth is generally greater than 60 inches with an effective rooting depth of 20 to 40 inches. Slope gradients range from 0 to 70 percent with an elevation range of 4000 to 8300 feet.

SOIL GROUP R LANDTYPES

R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11.

Complexes: R1R2, R1R3, R4R5, R4R6, R4R7, R8R9, R8R10, R5X3, 4R5, 4R8, 4R9, 4R11

DOMINANT SOIL GROUP H PLANT COMMUNITIES 1/

Mixed conifer/snowbrush-bearberry CW S2 15
White fir/chinquapin-boxwood-prince's pine CW H1 12
Shasta red fir-white fir/chinquapin-prince's pine/sedge CR S3 11
Mountain hemlock/grouse huckleberry CM S1 11
White fir-Alder/shrub meadow CW M1 11

PLANT COMMUNITIES OF KLAMATH AND SOUTH CHILOQUIN RANGER DISTRICTS - WINEMA NATIONAL FOREST - 1/

R6-AREA GUIDE 4-3, MARCH 1976
U.S.D.A. Forest Service, Pacific Northwest Region

SOIL GROUP R FEATURES AND QUALITIES

Drainage class - Well drained.

Infiltration rate - Rapid except when soil surface is extremely dry and has water repellent characteristics.

Permeability - 0 to 12 inches - moderately rapid - 2.0 to 6.0 inches/hr.
12 to 24 inches - moderate - 0.6 to 2.0 inches/hr.

Slope range - 0 to 70 percent.

Undisturbed bulk density - 0 to 15 inches - 0.80 to 1.0 grams per cubic centimeter.

15 to 30 inches - 0.90 to 1.1 grams per cubic centimeter.

Areas that have had management activities in the past, may have bulk densities of 0.9 to 1.5 grams per cubic centimeter.

Natural fertility - high.

Elevation range - 4000 to 8300 feet.

SOIL GROUP R INTERPRETATION

Interpretations based on coarse fragment content* for all Soil Group R landtypes.

Percent Coarse Fragment Content	Detrimental Compaction Hazard	Mixing and displacement Hazard	Predicted Planting Success	Ease in Ripping
25 to 45	High	Mod.	High	Easy
45 to 60	Mod.	Mod.	Mod.	Mod.
60 plus	Low	Low	Low	Diff.

*Coarse fragments content includes all rock material greater than 2 millimeters.

Dustiness hazard - Low to moderate.

Mudiness hazard - Moderate.

Natural stability: Very stable.

Unified Engineering Classification - GM and ML.

Soil hydrologic group - A and B.

Inches of water in surface foot of soil at selected tensions.*

Moisture tension (Bars)	0.1	0.5	1.0	15.0
Inches of water per foot of soil	3 to 4	1.5 to 2.0	1.0 to 1.75	0.75 to 1.0

Readily available water - (0.1 minus 0.5 bar water) - 1.5 to 2.0 inches per foot of soil. During the 30 day establishment period for reforestation planting, moisture tensions should not exceed 0.5 bars.

Less available water - (0.5 minus 15 bar water) - 0.75 to 1.0 inches per foot of soil

*Does not take coarse fragment into consideration. To compensate for coarse fragments, refer to Special Features of Non-pumice and Ash Soils of the Winema National Forest section.

MAJOR SOIL MANAGEMENT CONSIDERATIONS FOR SOIL GROUP R

1. Soils with more than 60 percent coarse fragments will be extremely difficult to plant and attain satisfactory survival due to the limited plant available water in the 0.1 to 0.5 bar moisture range.

2. Soils with less than 50 percent coarse fragments are highly susceptible to compaction when at optimum moisture levels for compaction.

3. Soil Group R landtypes have the highest productivity potentials of any on the Forest and the greatest potential for reduction in productivity due to management activities.

4. Landtypes R3, R6, and R10 occur on concave slope positions and generally have lower coarse fragment contents.

5. Steep slopes on landtypes R2, R5, R7, R9, and R11.

SOIL GROUP R MANAGEMENT DIRECTION

Timber Mgt.: The wide range in coarse fragment content within the landtypes of Soil Group R limit the usefulness of the soil mapping for project planning. Coarse fragment content affects the type of site prep and planting, effectiveness of ripping, detrimental compactability and plant available water. Coarse fragments include all of the rock fragments in the soil from 2 millimeters to greater than 2 feet. It will be the land managers responsibility to get project level soils information to meet his needs. Future soil scientist's time should be directed towards mapping these Soil Group R landtypes in greater detail. Using more detailed surveys the land manager and

soil scientist can then set up guidelines for operability, methodology, fuels management, etc. for project planning.

Fuels Management: Present state of knowledge indicates that if 1/2 inch of litter duff is maintained after broadcast burning, there should be no impairment of soil productivity. Brush fields with ceanothis probably can withstand hotter burns due to higher nitrogen levels. On slopes over 35 percent, consult the Forest soil scientist for more detailed information.

Estimated Taxonomic Classification: Loamy-skeletal, mixed dystric cryochrepts.

Modal Location: NE1/4, NW1/4, Sec. 26, T.35S., R.6E.

Modal Description: (Landtype R1)

Litter Layer: 01 - 3 to 0 inches; needle mat, needles partially decomposed in lower part.

A Horizon - 0 to 6 inches; dark brown (7.5 YR 3/3 moist) very gravelly loam, brown (7.5 YR 5/3 dry); weak fine granular structure; soft, very friable, nonsticky and nonplastic; 45 percent gravel and 10 percent cobble and stones; slightly acid (pH 6.2); clear wavy boundary. (4 to 8 inches thick).

A3 Horizon - 6 to 17 inches, brown (7.5 YR 3/4 moist) very gravelly loam, light brown (7.5 YR 6/3 dry); weak very fine granular structure; soft very friable, slightly sticky and slightly plastic; 40 percent gravels and 10 percent cobble and stones: slightly acid (pH 6.4); gradual wavy boundary, (0 to 14 inches thick).

B Horizon - 17 to 34 inches; dark yellowish brown (10 YR 3/4 moist) very gravelly loam pale brown (10 YR 6/3 dry); weak very fine and fine subangular blocky structure; soft to slightly hard, friable, slightly sticky and slightly plastic; 40 percent pebbles and 20 percent cobbles and stones; slightly acid (pH 6.5); gradual wavy boundary (9 to 30 inches thick).

C Horizon - 34 to 60 inches; dark brown (10 YR 3/3 moist) very gravelly loam, pale brown (10 YR 6/3 dry); massive; slightly hard, friable, slightly sticky and slightly plastic; 40 percent pebbles and 25 percent cobble and stones; neutral (pH 6.6).

Bedrock at depths greater than 60 inches.

Modal Location: NE1/4, NW1/4, Sec 26, T.35S., R.6E.

Modal Description: (Landtype R1)

Litter Layer: 01 - 3 to 0 inches; needle mat, needles partially decomposed in lower part.

A Horizon - 0 to 6 inches: dark brown (7.5 YR 3/3 moist) very gravelly loam, brown (7.5 YR 5/3 dry); weak fine granular structure; soft, very friable,

nonsticky and nonplastic; 45 percent gravel and 10 percent cobble and stones; slightly acid (pH 6.2). Clear wavy boundary. (4 to 8 inches thick).

A3 Horizon - 6 to 17 inches; brown (7.5 YR 3/4 moist) very gravelly loam, light brown (7.5 YR 6/3 dry); weak very fine granular structure; soft very friable, slightly sticky and slightly plastic; 40 percent gravels and 10 percent cobble and stones: slightly acid (pH 6.4); gradual wavy boundary, (0 to 14 inches thick).

B Horizon - 17 to 34 inches; dark yellowish brown (10 YR 3/4 moist) very gravelly loam pale brown (10 YR 6/3 dry); weak very fine and fine subangular blocky structure; soft to slightly hard, friable, slightly sticky and slightly plastic; 40 percent pebbles and 20 percent cobbles and stones; slightly acid (pH 6.5); gradual wavy boundary (9 to 30 inches thick).

C Horizon - 34 to 60 inches; dark brown (10 YR 3/3 moist) very gravelly loam, pale brown (10 YR 6/3 dry); massive; slightly hard, friable, slightly sticky and slightly plastic; 40 percent pebbles and 25 percent cobble and stones; neutral (pH 6.6).

Bedrock at depths greater than 60 inches.

INTERPRETATIONS FOR LANDTYPES WITHIN SOIL GROUP R

Land-type	Erosion Hazard			Frost Heave Potential	Cold Air Drainage Hazard	Sediment Yield Potential	Sediment Size	Potential for High Surface Soil Temperatures
	Sheet	Gully	Wind					
R1	0-20% slopes - low 20-35% slope - mod.	Low	Low	Low	Low	Low	Fine sand & silt	Mod. to High
R2	Severe	Low	Low	Low	Low	Mod.	Fine sand & silt	Mod. to High
R3	Low	Low to Mod.	Low	Low	Mod.	Low	Fine sand & silt	Mod.
R4	0-20% slopes - low 20-35% slopes - mod.	Low	Low	Mod.	Low	Low	Fine sand & silt	Mod.
R5	Severe	Low	Low	Low	Low	Mod.	Fine sand & silt	Low
R6	Low	Low to Mod.	Low	Mod.	Mod.	Low	Fine sand & silt	Low to Mod.
R7	Severe	Low	Low	Low	Low	Mod.	Fine sand & silt	Mod.
R8	0-20% slopes - low 20-35% slopes - mod.	Low	Low	Low	Low	Low	Fine sand & silt	Low
R9	Severe	Low	Low	Low	Low	Mod.	Fine sand & silt	Low
R10	Low	Low to Mod.	Low	Mod.	Mod.	Low	Fine sand & silt	Low
R11	0-30% slopes - low 30-60% - severe	Low	Low to Mod.	Mod.	Low	Mod.	Fine sand & silt	Low

FEATURES AND QUALITIES OF LANDTYPES

Land-Type	Landform	% Slope Range	Aspect	Elevation Range in Feet	Effective Rooting Depth Inches	Common Landtype Inclusions within Mapped Delineation
R1	Convex ridges & sideslopes	0 to 35	Southerly	4000 to 5500	30 to 48	R2, R3, R4, X5, X7
R2	Very steep convex side-slopes	35 to 70	Southerly	4000 to 5500	20 to 48	R1, R3, R5, X5, X7
R3	Concave toeslopes & valley bottoms	0 to 35	Southerly	4000 to 5500	36 to 60	R1, R4, R6, X5, X7
R4	Convex ridges & sideslopes	0 to 35	Variable	5000 to 6000	30 to 48	R1, R5, R7, X1, X3
R5	Very steep convex side-slopes	35 to 70	Northerly	5000 to 6000	20 to 48	R4, R6, R7, R8, X1, X3
R6	Concave toeslopes and valley bottoms	0 to 35	Variable	5000 to 6000	36 to 60	R4, R6, R7, R8, X1, X4
R7	Very steep convex side-slopes	35 to 70	Southerly	5000 to 6000	20 to 48	R5, R6, R8, X1, X2, X4
R8	Convex ridges & sideslopes	0 to 35	Variable	5500 to 7500	24 to 48	R4, R9, R10, X2, X6
R9	Steep convex sideslopes	35 to 75	Variable	5500 to 7500	20 to 40	R5, R7, R8, R10, X2, X6
R10	Concave toeslopes & valley bottoms	0 to 35	Variable	5500 to 7500	30 to 60	R8, R9, X2, X6
R11	Convex ridges & sideslopes	10 to 60	Variable	7500 to 8300	20 to 40	4, RR, X2, X6

PLANT COMMUNITIES OF KLAMATH AND SOUTH CHILOQUIN RANGER DISTRICTS - WINEMA NATIONAL FOREST - 1/

R6-AREA GUIDE 4-3, MARCH 1976
U.S.D.A. Forest Service, Pacific Northwest Region

WITHIN SOIL GROUP R

Plant Community Data 1/
Plant Community Productivity

Dominant Plant Communities	Sample Size	Wood Fiber-Cu. Ft./Acre/Year Mean
(CW C2 15)	6	* See chart below for species productivty. Grass and forb productivity not available.
(CW H1 12)	14	*
(CW C2 15)	6	*
(CW H1 12)	14	*
(CW C2 15)	6	*
(CW H1 12)	14	*
(CW H1 12)	14	*
(CW H1 12)	14	*
(CW M1 11)	4	*
(CW H1 12)	14	*
(CW H1 12)	14	*
(CR S3 11)	26	*
(CR S1 12)	23	*
(CM S1 11)	13	*
(CR S3 11)	26	*
(CR S1 12)	23	*
(CM S1 11)	13	*
(CR S3 11)	26	*
(CR S1 12)	23	*
(CM S1 11)	13	*
(CM S1 11)	13	*

		PP	WF	DF	SP	SF	MH*
Mixed conifer/snowbrush-bearberry (CW C2 15)	Mean	82	148	94	66	-	-
	5% CI	32	107	37	-	-	-
White fir/chinquapin-boxwood-prince's pine (CW H1 12)	Mean	82	144	145	-	-	-
	5% CI	29	22	31	-	-	
Shasta red fir-white fir/chinquapin-prince's pine/sedge (CR S3 11)	Mean	94	167	164	-	150	-
	5% CI	18	17	27	-	19	-
Shasta red fir-mountain hemlock/manzanita/long-stolon sedge (CR S1 12)	Mean	-	140	-	-	100	54
	5% CI	-	-	-	-	26	-
Mountain hemlock/grouse huckleberry (CM S1 11)	Mean	-	-	-	-	-	14
	5% CI	-	-	-	-	-	4
White fir-Alder/shrub meadow (CW M1 11)	Mean	-	-	-	-	-	-
	5% CI	-	-	-	-	-	-

PP-Ponderosa pine, WF-White fir, DF-Douglas-fir, SP-Sugar pine, SF-Shasta red fir, MH-Mountain hemlock

RANGE IN SOIL CHARACTERISTICS OF

Land-type	Litter Layer		A1 Horizon				
	Thickness (Inches)	% Ground Cover	Thickness (Inches)	Texture of Soil	Coarse Fragments 1/ Gravel	Cobble	Stones
R1	1 to 3	70 to 90	4 to 10	Gravelly to very gravelly & cobbly fine sandy loams & loams	10 to 50	0 to 40	0 to 40
R2	1 to 3	60 to 80	4 to 8	Gravelly to very gravelly & cobbly fine sandy loams & loams & sandy loams.	0 to 50	0 to 50	0 to 40
R3	1 to 4	75 to 100	6 to 12	Fine sandy loams & loams, gravelly to gravelly & cobbly sandy loams & loams	5 to 40	0 to 30	0 to 30
R4	1 to 3	70 to 90	4 to 10	Gravelly to very gravelly & cobbly sandy loams.	10 to 50	0 to 40	0 to 50
R5	1 to 3	70 to 90	4 to 8	Gravelly to very gravelly & cobbly sandy loams.	10 to 50	0 to 50	0 to 50
R6	1 to 4	80 to 100	6 to 12	Fine sandy loams to gravelly fine sandy loam.	5 to 40	0 to 40	0 to 50
R7	1 to 3	60 to 80	4 to 8	Gravelly to very gravelly & cobbly sandy loams.	10 to 50	0 to 50	0 to 50
R8	1 to 3	70 to 90	4 to 10	Gravelly to very gravelly & cobbly sandy loams.	15 to 50	0 to 40	0 to 50
R9	1 to 3	60 to 80	4 to 8	Gravelly to very gravelly & cobbly sandy loams.	15 to 50	0 to 40	0 to 50
R10	1 to 4	75 to 100	6 to 12	Fine sandy loams to gravelly fine sandy loams.	15 to 50	0 to 40	0 to 40
R11	1 to 2	60 to 80	4 to 8	Gravelly to very gravelly & cobbly sandy loams.	15 to 50	0 to 40	0 to 50

Coarse fragments 1/
Gravel - 2 millimeters to 3 inches
Cobble - 3 to 10 inches
Stones - 10 inches and greater

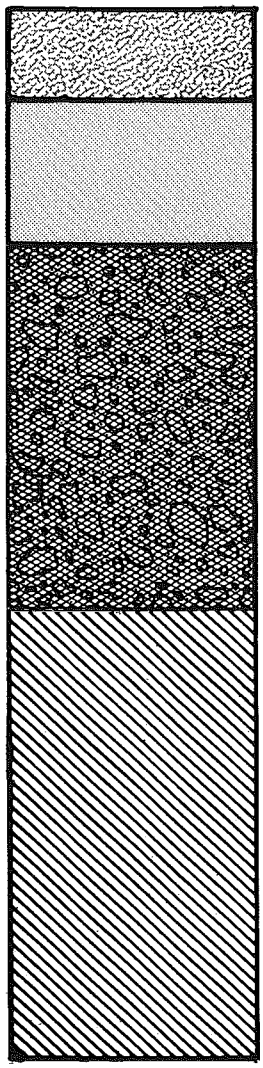
LANDTYPES WITHIN SOIL GROUP R

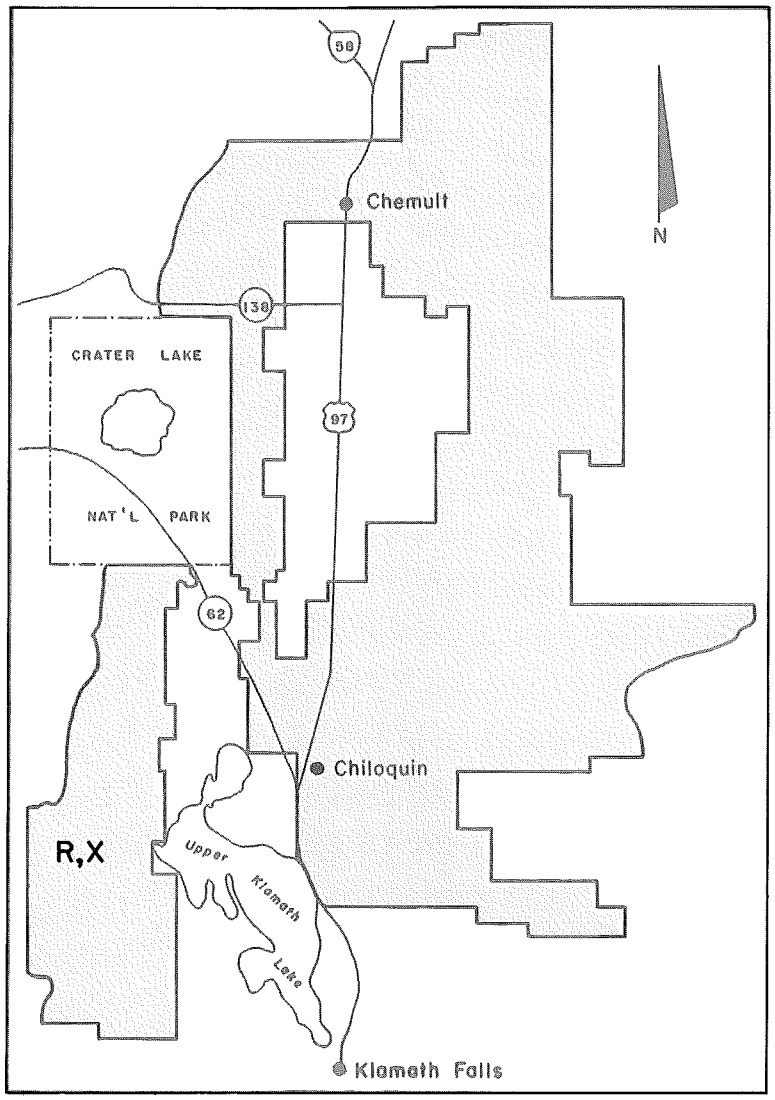
AC, B and C Horizons

Thickness (Inches)	Texture of Soil	Coarse Fragments 1/ Gravel	Cobble	Stones	Depth to Bedrock (Inches)
20 to 50	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	20 to 50	10 to 50	0 to 50	Greater than 60
20 to 40	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	20 to 50	10 to 60	0 to 60	Greater than 60
20 to 60	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	10 to 40	10 to 40	0 to 40	Greater than 60
20 to 50	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	20 to 50	10 to 50	0 to 50	Greater than 60
20 to 40	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	20 to 50	10 to 60	0 to 60	Greater than 60
20 to 60	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	10 to 40	10 to 40	0 to 40	Greater than 60
20 to 40	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	20 to 50	10 to 60	0 to 60	Greater than 60
20 to 50	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	20 to 40	10 to 50	0 to 40	Greater than 48
20 to 40	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	20 to 40	10 to 50	0 to 50	Greater than 48
20 to 60	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	10 to 30	10 to 40	0 to 40	Greater than 48
10 to 50	Gravelly & cobbly to very gravelly & cobbly loams & clay loams.	20 to 40	10 to 50	0 to 50	Greater than 36

GENERAL SOIL PROFILE OF SOIL GROUP X

Soil horizon	Soil texture and horizon thickness
Litter layer	1 to 4 inches thick
A1	Gravelly to very gravelly and cobbly sandy loams and loamy sands — 3 to 12 inches thick
AC, B and C	Gravelly to very gravelly and cobbly loams, sandy loams and loamy sands — 12 to 40 inches thick
Dense glacial till, mudflow or bedrock	15 to greater than 50 inches





SOIL GROUP X (UNNAMED SOILS)

Soil Group X consists of well drained gravelly to very gravelly and cobbly sandy loams and loamy sands. The soil material is derived predominently from glacial till with some volcanic mudflow materials. Portions of the surface soil are derived from volcanic ash. Soil Group X landforms include glacial troughs; glaciated sideslopes and hummocky upland areas with small lakes. Gravel, cobble, and stones make up 15 to 75 percent of the soil material. Soil depth is generally greater than 40 inches, but dense glacial till or mudflow material severely limits rooting depth on some of the Soil Group X landtypes. Slope gradient ranges from 0 to 35 percent with an elevation range of 4000 feet to 7000 feet.

SOIL GROUP R LANDTYPES

X1, X2, X3, X4, X5, X6, X7

Complexes: X3X4, D4X6, R5X3, 4X2, 4X3, 4X6

DOMINANT SOIL GROUP X PLANT COMMUNITIES 1/

Mixed conifer/snowbrush-bearberry CW C2 15
White fir/chinquapin-boxwood-prince's pine CW H1 12
White fir/alder/shrub meadows (dry to moist) CW M1 11
Shasta red fir-white fir/chinquapin-prince's pine/
sedge CR S3 11
Mountain hemlock/grouse huckleberry CM S1 11

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R6-Ecol-79-0005
U.S.D.A. Forest Service, Pacific Northwest Region

SOIL GROUP X FEATURES AND QUALITIES

Drainage class - Well drained.

Infiltration rate - Moderate to rapid except when soil surface is extremely dry and has water repellent characteristics.

Permeability - 0 to 12 inches - rapid 6.0 to 20.0 inches/hr.
12 to 20 inches - moderate - 0.6 to 2.0 inches/hr.

Slope range - 0 to 70 percent.

Undisturbed bulk density - 0 to 10 inches - 0.80 to 1.0 grams per cubic centimeter.

10 to 20 inches - 0.85 to 1.1 grams per cubic centimeter.

Past management activities may have increased bulk densities to 0.9 to 1.5 grams per cubic centimeter.

Natural fertility - Moderate to high.

Elevation range - 4500 to 7000 feet.

SOIL GROUP X INTERPRETATION

Interpretations based on coarse fragment content* for all Soil Group X landtypes.

Percent Coarse Fragment Content	Detrimental Compaction Hazard	Mixing and displacement Hazard	Predicted Planting Success	Ease in Ripping
25 to 45	High	Mod.	High	Easy
45 to 60	Mod.	Mod.	Mod.	Mod.
60 plus	Low	Low	Low	Diff.

*Coarse fragments content includes all rock material greater than 2 millimeters.

Dustiness hazard - Moderate.

Mudiness hazard - Moderate.

Natural stability: Very stable.

Unified Engineering Classification - GM and ML.

Potential for rapid water runoff during spring thaw or rain on snow is moderate to high. This is due to the limited water storage space in the soil

and the impervious nature of the dense glacial till or mudflow underlying the soil at fairly shallow depths.

Soil hydrologic group - B and C.

Inches of water in surface foot of soil at selected tensions.*

Moisture tension (Bars)	0.1	0.5	1.0	15.0
Inches of water per foot of soil	2.5 to 4.0	1.25 to 2.0	0.75 to 1.75	0.50 to 1.0

Readily available water - (0.1 minus 0.5 bar water) - 1.25 to 2.0 inches per foot of soil. During the 30 day establishment period for reforestation planting, moisture tensions should not exceed 0.5 bars.

Less available water - (0.5 minus 15 bar water) - 0.75 to 1.0 inches per foot of soil

*Does not take coarse fragment content into consideration. To compensate for coarse fragments, refer to Special Features of Non-pumice and Ash Soils of the Winema National Forest section.

MAJOR SOIL MANAGEMENT CONSIDERATIONS FOR SOIL GROUP X

1. Soils with more than 60 percent coarse fragments will be extremely difficult to plant and attain satisfactory survival due to the limited plant available water in the 0.1 to 0.5 bar moisture range.

2. Soils with less than 50 percent coarse fragments are highly susceptible to compaction when at optimum moisture levels for compaction.

3. Proper culvert placement and spacing is important for Soil X due to the potential rapid runoff during the spring thaw period or rain on snow conditions.

SOIL GROUP X MANAGEMENT DIRECTION

Timber Mgt.: The wide range in coarse fragment content within the landtypes of Soil Group X limit the usefulness of the soil mapping for project planning. Coarse fragment content affects the type of site prep and planting, effectiveness of ripping, detrimental compactability and plant available water. Coarse fragments include all of the rock fragments in the soil from 2 millimeters to greater than 2 feet. It will be the land managers responsibility to get project level soils information to meet his needs. Future soil scientist's time should be directed towards mapping these Landtypes in greater detail. Using more detailed surveys the land manager and soil scientist can then set up guidelines for operability, methodology, fuels management, etc. for project planning.

Fuels Management: Present state of knowledge indicates that if 1/2 inch of litter duff is maintained after broadcast burning, there should be no impairment of soil productivity. Brush fields with ceanothis probably can withstand hotter burns due to the naturally higher nitrogen levels.

Estimated Taxonomic Classification: Loamy-skeletal and sandy skeletal mixed, with some medial skeletal families of andic cryochrepts.

Modal Location: NW1/4, NW1/4, Sec. 16, T.36S., R.5E.

Modal Description: (Landtype X2)

Litter Layer: 2 to 0 inches; needle mat needles partially decomposed in lower part.

A1 Horizon - 0 to 6 inches; very dark grayish brown (10 YR 3/2 moist) very gravelly and cobbly sandy loam brown (10 YR 5/3 dry); weak fine granular structure; soft, very friable, nonsticky and nonplastic; 25% gravel and 20% cobble; medium acid (pH 6.0); gradual wavy boundary (3 to 12 inches thick).

AC Horizon - 6 to 12 inches, dark brown (10 YR 3/3 moist) very gravelly and cobbly sandy loam pale brown (10 YR 6/3 dry); weak fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 20% gravel and 30% cobble; slightly acid (pH 6.2); clear boundary. (4 to 10 inches thick).

B Horizon - 12 to 21 inches; dark yellowish brown (10 YR 4/4 moist) very gravelly and cobbly sandy loam, light yellowish brown (10 YR 6/4 dry); weak fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 20% gravel and 35% cobble; slightly acid (pH 6.2); clear abrupt boundary. (6 to 20 inches thick).

C Horizon - 21 inches plus - dense glacial till.

INTERPRETATIONS FOR LANDTYPES WITHIN SOIL GROUP X

Land-type	Erosion Hazard			Frost Heave Potential	Cold Air Drainage Hazard	Sediment Yield Potential	Sediment Size	Potential for High Surface Soil Temperatures
	Sheet	Gully	Wind					
X1	Low	Mod.	Low	Low to Mod.	Mod.	Mod.	Sand & Silt	Low
X2	Low to Mod.	Low	Low	Low to Mod.	Low to Mod.	Low	Sand & Silt	Low
X3	Mod.	Low	Low	Low	Low	Low	Sand & silt	Low
X4	Low	Mod.	Low	Low	Low to Mod.	Low	Sand & silt	Low
X5	Low to Mod.	Low	Low	Low	Low	Low	Sand & silt	Mod.
X6	Low to Mod.	Low	Low	Low to Mod.	Low	Low	Sand & silt	Mod.
X7	Low to Mod.	Low	Low	Low to Mod.	Low	Low	Sand & silt	Mod.

FEATURES AND QUALITIES OF LANDTYPES

Land-Type	Landform	% Slope Range	Aspect	Elevation Range in Feet	Effective Rooting Depth Inches	Common Landtype Inclusions within Mapped Delineation
X1	Relatively narrow glacial troughs. Occur in valley bottoms and lower slopes.	0 to 35	Variable	4500 to 5500	20 to 30	X3, X4, X5, X7, R3, R6
X2	Short hummochy convex and concave slopes within glacial troughs. Occur in upper part of valley glaciers.	0 to 35	Variable	5500 to 7000	15 to 30	X3, X6, D4, 4
X3	Convex sideslopes and ridges.	0 to 35	Variable	5500 to 6500	15 to 30	X1, X2, X4, X7, D5
X4	Concave toeslopes and valley bottoms.	0 to 35	Variable	5500 to 6500	20 to 36	X1, X3, X5, D5, R5, R7
X5	Convex sideslopes and ridges.	0 to 35	Variable	4000 to 5000	20 to 40	X1, X3, X4, R1
X6	Short hummochy convex sideslopes and ridges.	0 to 35	Variable	5500 to 6500	20 to 30	X1, X2, R10, D4
X7	Short hummochy convex sidesloes and ridgetops.	0 to 35	Variable	4500 to 6000	20 to 30	X1, X3, X4, D5, R4

PLANT ASSOCIATIONS OF SOUTH CHILOQUIN AND KLAMATH RANGER DISTRICTS - WINEMA NATIONAL FOREST - 1/

R6-Ecol-79-0005
U.S.D.A. Forest Service, Pacific Northwest Region

WITHIN SOIL GROUP X

Plant Community Data 1/
Plant Community Productivity

Dominant Plant Communities	Sample Size	Wood Fiber-Cu. Ft./Acre/Year Mean
(CW M1 11)	4	* See chart below for species productivty. Grass and forb productivit not available.
(CW H1 12)	14	*
(CM S1 11)	13	*
(CR S3 11)	26	*
(CW C2 15)	6	*
(CW H1 12)	14	*
(CW C2 15)	6	
(CW H1 12)	14	*
(CW C2 15)	6	*
(CM S1 11)	13	*
(CR S3 11)	26	*
(CW C2 15)	6	*
(CW H1 12)	14	

		PP	WF	DF	SP	SF	MH*
Mixed conifer/snowbrush-bear-berry (CW C2 15)	Mean	82	148	94	66	-	-
	5% CI	32	107	37	-	-	-
White fir/chinquapin-boxwood-prince's pine (CW H1 12)	Mean	82	144	145	-	-	-
	5% CI	29	22	31	-	-	
Shasta red fir-white fir/ chinquapin-prince's pine/ sedge (CR S3 11)	Mean	94	167	164	-	150	-
	5% CI	18	17	27	-	19	-
Shasta red fir-mountain hemlock/manzanita/long-stolon sedge (CR S1 12)	Mean	-	140	-	-	100	54
	5% CI	-	-	-	-	26	-
Mountain hemlock/grouse huckleberry (CM S1 11)	Mean	-	-	-	-	-	14
	5% CI	-	-	-	-	-	4
White fir-alder/shrub meadow (CW M1 11)	Mean	-	-	-	-	-	-
	5% CI	-	-	-	-	-	-

PP-Ponderosa pine, WF-White fir, DF-Douglas-fir, SP-Sugar pine, SF-Shasta red fir
MH-Mountain hemlock

RANGE IN SOIL CHARACTERISTICS OF

Land-type	Litter Layer		A1 Horizon				
	Thickness (Inches)	% Ground Cover	Thickness (Inches)	Texture of Soil	Coarse Fragments		
					Gravel	Cobble	Stones
X1	1 to 4	75 to 100	6 to 12	Gravelly to very gravelly & cobbly sandy loams	15 to 50	10 to 40	0 to 30
X2	1 to 2	60 to 80	3 to 6	Gravelly to very gravelly & cobbly sandy loams & loamy sands	15 to 50	10 to 40	0 to 30
X3	1 to 3	60 to 80	4 to 8	Gravelly to very gravelly & cobbly sandy loams	15 to 50	10 to 40	0 to 30
X4	1 to 3	70 to 90	6 to 10	Gravelly to very gravelly & cobbly sandy loams	15 to 50	10 to 40	0 to 30
X5	1 to 3	60 to 80	4 to 8	Gravelly to very gravelly & cobbly sandy loams	15 to 50	10 to 40	0 to 30
X6	1 to 3	60 to 80	3 to 6	Gravelly to very gravelly and cobbly loamy sands	15 to 50	0 to 30	0 to 30
X7	1 to 3	60 to 80	4 to 8	Gravelly to very gravelly & cobbly loamy sands.	15 to 50	0 to 30	0 to 30

LANDTYPES WITHIN SOIL GROUP X

AC, B and C Horizons					
Thickness (Inches)	Texture of Soil	Coarse Fragments			Depth to Dense Glacial Till, Mudflow or Bedrock
		Gravel	Cobble	Stones	
15 to 30	Gravelly to very gravelly & cobbly sandy loams	20 to 50	20 to 40	0 to 30	20 to 60
12 to 24	Gravelly to very gravelly & cobbly sandy loams	20 to 50	20 to 40	0 to 30	15 to 30
10 to 24	Gravelly to very gravelly & cobbly loams to sandy loams	20 to 50	20 to 40	0 to 30	15 to 30
15 to 40	Gravelly to very gravelly & cobbly loams to sandy loams	20 to 50	20 to 40	0 to 30	20 to 50
16 to 36	Gravelly to very gravelly & cobbly loams to sandy loams	20 to 50	20 to 40	0 to 30	20 to 40
15 to 36	Gravelly to very gravelly & cobbly sandy loams to loamy sands	15 to 50	0 to 40	0 to 40	20 to 40
15 to 36	Gravelly to very gravelly & cobbly sandy loams to loamy sands	15 to 50	0 to 40	0 to 40	20 to 40

MISCELLANEOUS LANDTYPES

Land-type	Landform	% Slope Range	Aspect	Elevation Range in Feet
1	Flat to gently sloping valley bottoms. Wet meadows.	0 to 5	Variable	4000 to 6500
2	Flat to gently sloping valley bottoms. Dry and moist meadows.	0 to 10	Variable	4000 to 6500
3	Flat river bottom with oxbows with pumice and ash soil material. Williamson and Sprague River bottoms.	0 to 5	Variable	4200 to 4800
4	Bedrock outcrops rock talus slopes, rocky glacial dumps.	Not rated	Variable	4200 to 8300
5	Very steep convex sideslopes with a thin mantle of soil.	50-greater than 100	Variable	4000 to 6500
6	Pumice and ash mantled sand dunes.	0 to 20	Variable	4500 to 5000
7	Cobbly glacial outwash fan terraces.	0 to 15	Variable	4200 to 5000
8	Concave toeslopes and valley bottoms.	0 to 10	Variable	4200 to 4500
9	Cobbly glacial outwash fans.	0 to 15	Variable	4200 to 5000
10	Flat loamy streanbottoms, non-pumice areas.	0 to 5	Variable	4200 to 4500
11	Broad flat basins - non-pumice areas.	0 to 5	Variable	4500 to 5500
12	Convex sideslopes & ridges & concave toeslopes. Mountain mohogany & juniper sites.	0 to 35	Variable	4000 to 5500
13	Very steep convex sideslopes mountain mahogany and juniper sites.	35 to 75	Variable	4000 to 5500
14	Broad flats on lava flow plains - scab rock flats.	0 tO 35	Variable	4500 to 5500
15	Remnant of an old beach line or strand line along Upper Klamath Marsh.	0 to 15	Variable	4500 to 4600
16	Remnant of an old beach line or strand line along Upper Klamath Marsh.	0 to 15	Variable	4500 to 4600
17	Sideslopes of cindercones.	20 to 60	Variable	4100 to 5500
18	Sideslopes of cindercones.	20 to 60	Variable	5000 to 6000
19	Sideslopes of cindercones.	20 to 60	Variable	6000 to 7500
20	Pumice and ash mantled sideslopes of cindercones.	20 to 60	Variable	4500 to 5500
21	Pumice and ash mantled sideslopes of cindercones.	20 to 60	Variable	5500 to 6000

FEATURES AND QUALITIES

Drainage Class	Infiltration Class	Permeability	Estimated Undisturbed Bulk Density	Natural Fertility	Effective Rooting Depth Inches
Very poorly drained	Moderate	Moderate	0.70 to 1.0	High	15 to 20
Somewhat poorly drained	Moderate	Mod. to moderately rapid.	0.70 to 1.0	High	20 to 30
Somewhat poorly & poorly drained	Moderate	Moderate	0.60 to 0.70	Moderate	20 to 30
Not rated	Not rated	Not rated	Not rated	Not rated	Not rated
Excessively drained	Rapid	Rapid	0.8 to 1.1	Low to Mod.	Variable
Excessively drained	Rapid	Very rapid	0.6 to 1.0	Low	48 to 60
Somewhat poorly drained	Moderate	Moderate	0.85 to 1.1	Moderate	20 to 30
Mod. to somewhat poorly drained	Mod. to rapid	Mod. to moderately rapid	0.85 to 1.0	High	30 to 42
Well to moderately well drained	Moderate	Moderate	0.85 to 1.1	Moderate	30 to 42
Somewhat poorly drained	Moderate	Mod. to moderately rapid	0.85 to 1.0	High	20 to 30
Somewhat poorly drained	Mod. to rapid	Mod. to moderately rapid	0.8 to 0.9	High	20 to 30
Moderately well drained	Moderate	A horizon-Mod. B horizon*	0.9 to 1.1	Low	15 to 25
Well drained	Moderate	A horizon-Mod. B horizon*	0.9 to 1.1	Low	15 to 25
Moderately well drained	Moderate	A horizon-Mod. B horizon*	0.9 to 1.1	Low	10 to 15
Somewhat poorly drained	Rapid	Rapid	0.6 to 0.8	Moderate	30 to 42
Moderately well drained	Rapid	Rapid to very rapid	0.6 to 0.8	Moderate	36 to 48
Excessively drained	Rapid	Very rapid	0.7 to 0.85	Moderate	36 to 48
Excessively drained	Rapid	Very rapid	0.7 to 0.85	Moderate	36 to 48
Excessively drained	Rapid	Very rapid	0.7 to 0.85	Moderate	36 to 48
Excessively drained	Rapid	Very rapid	0.6	Low	20 to greater than 36
Excessively drained	Rapid	Very rapid	0.6	Low	20 to greater than 36

* B horizon - Slow to very slow

MISCELLANEOUS LANDTYPE FEATURES AND QUALITIES

Plant Community Data 1/ 2/

Land-type	Dominant Plant Community Code	Sample Size	Plant Community Productivity: Wood Fiber-Cu. Ft./Acre/Year Mean	Wood Fiber-Cu. Ft./Acre/Year 5% CI	Grasses & Forbs -lbs./Acre/Year Mean	Grasses & Forbs -lbs./Acre/Year 5% CI
1	Wet Meadow (MW)	5	Grass Comm.	-	2456	1218
2	Moist (hairgrass) meadow (MM-19)	7	" "	-	1947	525
	Moist (bluegrass) meadow (MM-90)	6	" "	-	2009	420
3	Moist (hairgrass) meadow (MM-19)	7	" "	-	1947	525
	Moist (bluegrass) meadow (MM-90)	6	" "	-	2009	420
	Wet meadow (MW)	5	" "	-	2456	1218
4	Not rated	-	-	-	-	-
5	Not rated	-	-	-	-	-
6	Ponderosa pine/bitterbrush/ fescue (CP-S2-11)	43	42	4	121	19
	Lodgepole/bitterbrush/fescue (CL-S2-14)	19	43	5	75	20
7	Lodgepole pine/huckleberry/ forb (CL-S4-13)	5	80	12	N/A	N/A
8	Lodgepole pine/huckleberry/ forb (CL-S4-13)	5	80	12	N/A	N/A
9	Ponderosa pine/bitterbrush/ fescue (CP-S2-11)	2	46	-	N/A	N/A
10	Lodgepole pine/huckleberry/ forb (CL-S4-13)	5	80	12	N/A	N/A
11	Lodgepole pine/huckleberry/ forb (CL-S4-13)	5	80	12	N/A	N/A
12	Juniper/bitterbrush/bunchgrass (CJ-53-11)	4	Brush Comm.	Brush Comm.	240	57
12	Ponderosa pine/bitterbrush-big sagebrush/fescue (CP S1 11)	8	10	-	N/A	N/A
13	Juniper/bitterbrush/bunchgrass (CJ-53-11)	4	Brush Comm.	Brush Comm.	240	57
13	Ponderosa pine/bitterbrush-big sagebrush/fescue (CP S1 11)	-	10	-	217	65
14	Low sagebrush/fescue (SD-19-12)	5	Brush Comm.	Brush Comm.	179	-
	Bluegrass scabland (GB-99)	4	" "	" "	70	28

MISCELLANEOUS LANDTYPE FEATURES AND QUALITIES (Continued)

Plant Community Data

Land-type	Dominant Plant Community Code	Sample Size	Plant Community Productivity: Wood Fiber-Cu. Ft./Acre/Year Mean	Wood Fiber-Cu. Ft./Acre/Year 5% CI	Grasses & Forbs -lbs./Acre/Year Mean	Grasses & Forbs -lbs./Acre/Year 5% CI
15	Lodgepole/bitterbrush/forb (CL-S2-13)	12	34	4	24	20
16	Ponderosa pine/bitterbrush/ fescue (CP-S2-11)	43	42	4	121	19
17	Mixed conifer/snowbrush-bear-berry (CW-C2-15)	*	*	*	N/A	N/A
18	Mixed conifer/snowbrush-bear-berry (CW-C2-15)	*	*	*	N/A	N/A
	White fir/chinquapin-boxwood-prince's pine (CW-H1-12)	*	*	*	N/A	N/A
19	Mountain hemlock/grouse huckle-berry (CM-S1-11)	*	*	*	N/A	N/A
	Shasta red fir/longstolon sedge (CR-G1-11)	*	*	*	N/A	N/A
20	Ponderosa pine/bitterbrush/ needlegrass (CP-S2-12)	31	39	6	27	10
	Ponderosa/bitterbrush-manzanita needlegrass	17	33	6	28	15
21	Mixed conifer/snowbrush/manzanita (CW-S1-12)	19	50	11	79	3
	Mixed conifer/snowbrush (CW S1 14)	7	44	12	80	5

	Plots		PP	WF	DF	SP	MH	SF
* Mixed conifer/snowbrush-bearberry (CW C2 15)	6	Mean	82	148	94	66	-	-
		5% CI	32	107	37	-	-	-
* White fir/chinquapin-boxwood-prince's pine (CW H1 12)	14	Mean	82	144	45	-	-	-
		5% CI	29	22	31	-	-	-
* Mountain hemlock/grouse huckleberry (CM S1 11)	13	Mean	-	-	-	-	14	-
		5% CI	-	-	-	-	-	-
* Shasta red fir/longstolon sedge (CR G1 11)	6	Mean	-	-	-	-	-	178
		5% CI	-	-	-	-	-	68

PLANT COMMUNITIES OF THE CENTRAL OREGON PUMICE ZONE 1/
R-6 Area Guide 4-2, January 1976
U.S.D.A. Forest Service, Pacific Northwest Region

PLANT ASSOCIATIONS OF SOUTH CHILOQUN AND KLAMATH RANGER DISTRICTS - WINEMA NATIONAL FOREST - 2/
R6-Ecol-79-005 U.S.D.A. Forest Service, Pacific Northwest Region

Misc. Land-types	Erosion Hazard			Frost Heave	Cold Air Drainage	Sediment Yield Potential	Sediment Size	Potential for Rapid Water Runoff	Potential for High Surface Soil Temps.
	Sheet	Gully	Wind						
1	Low	Mod.	Low	Low	High	Low	Silt, sand	Low	Low
2	Low	Mod. to High	Low	Mod.	High	Mod.	Silt, sand, gravel	Low	Low
3	Low	Mod.	Low	Mod.	High	Mod.	Silt, sand, gravel	Low	Low
4	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated	High	Not rated
5	Severe	Low	Low	Low	Low	High	Sand, silt	High	High
6	Low	Low	Low to Mod.	Mod.	Low to Mod.	Low	Sand	Low	High
7	Low	Low	Low	Low	Mod.	Low	Sand, silt	Low	Low
8	Low	Low	Low	Low	Low	Low	Sand, silt	Low	Low
9	Low	Low	Low	Low	Low	Low	Sand, silt	Low	Low
10	Low	Low	Low	Low	Mod.	Low	Sand, silt, clay	Low	Low
11	Low	Low	Low	High	High	Low	Silt	Low	Low
12	Mod.	Low	Low	High	Low	Low to Mod.	Silt, clay	Mod.	Mod.
13	Severe	Low	Low	High	Low	High	Silt, clay	High	Mod.
14	Mod.	Low	Mod.	High	Low	Mod.	Silt, clay	High	Mod.
15	Low	Low	Low to Mod.	High	High	Low	Sand	Low	Mod.
16	Low	Low	Low to Mod.	Mod.	Mod.	Low	Sand	Low	Mod.
17	Low	Low	Low	Low to Mod.	Low	Low	Sand	Low	Mod.
18	Low	Low	Low	Low to Mod.	Low	Low	Sand	Low	Low
19	Low	Low	Low to Mod.	Low	Low	Low	Sand	Low	Low
20	Mod.	Low	Low to Mod.	Mod.	Low	Low	Sand	Low	High
21	Mod.	Low	Low to Mod.	Mod.	Low	Low	Sand	Low	Mod.

Additional miscellaneous landtype interpretations on page 122.

Mixing and Displacement Hazard	Dustiness Hazard	Muddiness Hazard	Detrimental Compaction Hazard	Natural Stability	Engineering Classification - (Unified System)	Soil Hydrologic Group
Low	Low	Low	High	Not rated	Not rated	D
Low to Mod.	Low	Mod.	High	Not rated	Not rated	B
Mod.	Mod.	Mod.	Mod.	Not rated	SM, SP	C
Low	Low	Low	Low	Very stable	Not rated	Not Rated
High	Mod.	Mod.	Low	Stable	Not rated	B
High	High	Low	Low	Very stable	SW	A
Low	Low	Low	Low	Very stable	GM	B
Mod.	Low	Mod.	Mod.	Very stable	ML	A
Low	Low	Low	Low	Very stable	GM	B
Mod.	Low	Mod.	Mod.	Very stable	ML	B
Mod.	Mod.	Mod.	Mod.	Very stable	ML	B
Mod.	Mod.	Mod.	Mod.	Very stable	GC, CH	C
High	Mod.	Mod.	Mod.	Very stable	GC, CH	C
Mod.	Low	Mod.	Low	Very stable	GC, CH	D
Mod.	High	Low	Mod.	Very stable	Variable	B
Mod.	High	Low	Mod.	Very stable	Variable	B
Mod.	Mod.	Low to Mod.	Mod.	Very stable	GM	A
Mod.	Mod.	Low to Mod.	Mod.	Very stable	GM	A
Mod.	Mod.	Low to Mod.	Mod.	Very stable	GM	A
High	High	Low	Low	Very stable	SP, SM, GM	A
High	High	Low	Low	Very stable	SP, SM, GM	

RANGE IN MISCELLANEOUS

Land-type	Litter Layer: Thickness (Inches)	Litter Layer: % Ground Cover	A1 Horizon: Thickness (Inches)	A1 Horizon: Texture of Soil	Coarse Fragments: Gravel	Coarse Fragments: Cobble	Coarse Fragments: Stones
1	0 to 2	90 to 100	6 to 12	Loam to silty clay loam	0 to 10	0 to 10	0
2	0 to 1	80 to 100	6 to 12	Sandy loam to loam & gravelly sandy loams	0 to 20	0 to 20	0 to 10
3	0 to 1	80 to 100	6 to 12	Loamy sands, sandy loams, gravelly sandy loams, & loams	10 to 40	0 to 10	0
4	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated
5	Not rated	Not rated	2 to 6	Extremely variable	10 to 50	10 to 30	10 to 30
6	0 to 2	40 to 60	4 to 6	Loamy coarse sand	20 to 50	0	0
7	0 to 2	50 to 75	4 to 8	Gravelly to very gravelly & cobbly sandy loams & loams	10 to 40	20 to 50	0 to 20
8	0 to 2	60 to 80	4 to 8	Sandy loams to gravelly sandy loams	0 to 15	0	0
9	0 to 2	40 to 60	4 to 8	Gravelly to very gravelly & cobbly sandy loams & loams	10 to 40	20 to 50	0 to 20
10	0 to 2	70 to 90	4 to 8	Sandy loam	0 to 15	0	0
11	0 to 2	70 to 100	4 to 8	Sandy loams & loams to gravelly sandy loams	0 to 25	0	0
12	0 to 1	20 to 40 1/	4 to 6	Gravelly to very gravelly & cobbly sandy loams & loams	20 to 40	0 to 30	0 to 20
13	0 to 1	10 to 30 1/	4 to 6	Gravelly to very gravelly & cobbly sandy loams & loams	20 to 40	0 to 30	0 to 20
14	0 to 1	0 to 20 2/	3 to 6	Gravelly to very cobbly & stony sandy loams & loams	20 to 40	0 to 30	0 to 20
15	0 to 3	50 to 70	4 to 6	Highly variable mixture of pumice, ash, sand, & old buried soils	20 to 40	0 to 20	0 to 10
16	0 to 2	60 to 80	4 to 6	Highly variable mixture of pumice, ash, sand, & old buried soils	20 to 40	0 to 20	0 to 10
17	0 to 3	50 to 70	4 to 8	Very gravelly & cobbly sandy loams 3/	10 to 30	0 to 30	0 to 10
18	0 to 3	60 to 80	3 to 6	Very gravelly & cobbly sandy loams 3/	10 to 30	0 to 30	0 to 10
19	0 to 2	50 to 70	3 to 6	Very gravelly & cobbly sandy loams 3/	10 to 30	0 to 30	0 to 10
20	0 to 3	50 to 70	3 to 6	Gravelly loamy coarse sand	20 to 40	0	0
21	0 to 3	60 to 80	3 to 6	Gravelly loamy coarse sand	20 to 40	0	0

1/ Rock fragments cover 30 to 60 percent of the soil surface.

2/ Rock fragments cover 50 to 75 percent of the soil surface.

3/ Gravel and cobble are cindery with high porosity which can store water.

LANDTYPE CHARACTERISTICS

Horizon & Thickness (Inches)	Texture of soil	Coarse Fragments			Depth to Bedrock (Inches)
		Gravel	Cobble	Stones	
B Horizon 20 to 50	Loam to silty clay loam	0 to 20	0 to 10	0	Greater than 96
B Horizon 20 to 50	Sandy loam to loam	10 to 30	0 to 20	0 to 10	Greater than 96
C Horizon 20 to 50	Loamy sand, sandy loam & loam	20 to 50	0 to 20	0 to 10	Greater than 96
Not rated	Not rated	Not rated	Not rated	Not rated	Not rated
Variable 10 to 30	Extremely variable	20 to 60	10 to 30	10 to 30	Variable
C Horizon 30 to greater than 50	Loamy sand and sand	0 to 40	0	0	Greater than 96
AC & B Horizon 30 to greater than 50	Gravelly to very gravelly & cobbly sandy loams & loams	10 to 40	20 to 50	0 to 20	Greater than 96
AC & B Horizon 20 to greater than 50	Sandy loam to gravelly loams	0 to 15	0	0	Greater than 96
B Horizon 30 to greater than 50	Gravelly to very gravelly & cobbly sandy loams & loams	10 to 40	20 to 50	0 to 20	Greater than 96
B Horizon 20 to greater than 50	Sandy loam	0 to 15	0	0	Greater than 96
B Horizon 20 to greater than 50	Sandy loams & loams to gravelly sandy loams	0 to 25	0	0	Greater than 96
B Horizon 10 to 20	Gravelly to very gravelly cobbly or stony loams, clay loams or clays	20 to 40	0 to 30	0 to 20	Cemented at 15 to 25
B Horizon 10 to 20	Gravelly to very gravelly cobbly or stony loams, clay loams or clays	20 to 40	0 to 30	0 to 20	Cemented 15 to 25
B Horizon 10 to 15	Gravelly to very gravelly, cobbly, or stony loams, clay loams, or clays	20 to 40	0 to 40	0 to 30	Cemented at 15
Variable 20 to greater than 50	Highly variable mixture of pumice, ash, sand, and old buried soils	20 to 40	0 to 40	0 to 40	Variable
Variable 20 to greater than 50	Highly variable mixture of pumice, ash, sand, and old buried soil	20 to 40	0 to 40	0 to 40	Variable
AC & C Horizon 20 to greater than 50	Very gravelly & cobbly sandy loam 3/	20 to 40	10 to 30	0 to 10	Highly variable
AC & C Horizon 20 to greater than 50	Very gravelly & cobbly sandy loam 3/	20 to 40	10 to 30	0 to 10	Highly variable
AC & C Horizon 20 to greater than 50	Very gravelly & cobbly sandy loam 3/	20 to 40	10 to 30	0 to 10	Highly variable
AC & C Horizon 20 to greater than 50	Very gravelly coarse sands or very gravelly & cobbly sandy loams 3/	20 to 50	0 to 30	0 to 10	Greater than 60
AC & C Horizon 20 to greater than 50	Very gravelly loamy coarse sand or very gravelly & cobbly sandy loams	20 to 50	0 to 30	0 to 10	Greater than 60

MISCELLANEOUS LANDTYPE INTERPRETATIONS (Continued)

Land-type	Water Retention Characteristics	Major Management Concerns	Estimated Taxonomic Classification
1	Not rated	Excessive compaction and puddling from grazing while soil is wet.	Unclassified
2	Not rated	Portions of this unit that have a bluegrass ground cover may be grazed until the sod breaks up and exposes the soil to erosive forces.	Unclassified
3	Not rated	If grass sod in broken soil material is highly erosive. Streambanks are highly erosive.	Ashy typic cryorthents
4	Not rated	Potential source for road rock.	Unclassified
5	Not rated	Severe erosion hazard and difficult to revegetate. Areas should be entered with extreme care.	Unclassified
6	Similar to Soil Group E	Somewhat limited plant available water may influence survival of planted stock.	Cindery typic cryorthents
7	Similar to Soil Group R	Gravel and cobbly severely limit plant available water in surface foot of soil. Potential source for road rock.	Loamy skeletal, mixed family; argic aquic cryoborolls.
8	Similar to Soil Group R	High water table in spring limits species adaptability.	Coarse loamy mixed family, aquic cryoborolls.
9	Similar to Soil Group R	Gravel and cobble severely limit plant available water in surface foot of soil. Potential source for road rock.	Loamy skeletal mixed family, argic pachic cryoborolls
10	Not rated	High water table in spring limits species adaptability.	Coarse loamy mixed family, aquic cryoborolls
11	Not rated	High water table in spring limits species adaptability.	Coarse loamy mixed family, aquic cryoborolls
12	Not rated	Limited plant available water and saturated soil conditions in spring limit the species adaptability. Non-commercial forest site.	Fine loamy skeletal, mixed, frigid, family, typic argixerolls
13	Not rated	Limited plant available water and saturated soil conditions in spring limit the species adaptability. Severe erosion hazard due to steep slopes and shallow soil. Non-commercial forest site.	Fine loamy skeletal mixed, frigid, family, typic argixerolls
14	Not rated	Limited plant available water and saturated soil conditions in spring limit the species adaptability. Surface rock protects the shallow soil from erosion forces. Soil not suited for range rehab projects without soil scientist input.	Clayey, montmorillonitic, frigid, shallow abruptic durixeralfs
15	Not rated	High water table in spring and cold air drainage limit species adaptability to lodgepole pine.	Unclassified
16	Not rated	Large boulders from old beach line may cause construction problems (minor). Good tree growing site.	Unclassified
17	Not rated	Potential source for road rock. If soils are compacted by management activities, the erosion hazard can become severe on slopes over 35 percent. Compaction also may reduce productivity.	Cindery family of typic cryothents
18	Not rated	Potential source for road rock. If soils are compacted by management activities, the erosion hazard can become severe on slopes over 35 percent. Compaction also may reduce productivity.	Cindery family of typic cryothents
19	Not rated	Potential source for road rock. If soils are compacted by management activities the erosion hazard can become severe on slopes over 35 percent. Compaction also may reduce productivity.	Cindery family of typic cryorthents
20	Similar to Soil Group A	Potential source for road rock. Potential for moderate erosion during high intensity thunderstorm due to water repellency characteristics. High dry ravel hazard from management activities when soil is dry.	Ashy over loamy, mixed cryorthents. Cindery typic cryorthents.
21	Similar to Soil Group A	Potential source for road rock. Potential for moderate erosion during high intensity thunderstorm due to water repellency characteristics. High dry ravel hazard from management activities when soil is dry.	Ashy over loamy, mixed cryorthents. Cindery typic cryorthents.

APPENDIX

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Pumice and Ash Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
A1	0-6	6.4	14	228	4.7	0.76	0.15	0.42	4.42	0.11	11.90	-
A1	6-12	6.4	17	170	2.7	0.76	0.13	0.16	2.85	0.05	9.95	
A1	12-15	6.4	6	84	1.2	0.46	0.13	-	0.73	0.01	6.42	
A4	0-3	5.5	17	192	4.5	0.20	0.09	-	11.48	0.19	15.8	3.0
A4	3-10	6.0	4	128	1.8	0.30	0.10	-	3.54	0.05	9.0	-
A4	15-20	6.3	5	64	0.7	0.16	0.17	-	0.60	0.01	-	-
A4	0-4	5.7	7	128	1.5	0.10	0.09	-	5.06	0.05	-	14.0
A4	5-10	6.4	3	84	2.1	0.20	0.15	-	2.12	0.03	9.5	-
A4	14-18	6.8	7	60	1.2	0.16	0.21	-	0.76	0.01	-	-
A4	0-4	5.9	6	124	1.9	0.10	0.10	-	4.46	0.06	8.4	2.6
A4	6-10	6.3	4	96	1.5	0.20	0.10	-	2.01	0.03	8.0	-
A4	15-20	6.5	5	60	1.0	0.16	0.17	-	0.54	0.01	-	-
A4	0-3	5.9	6	124	2.7	0.10	0.09	-	5.44	0.05	6.4	1.2
A4	6-10	6.4	4	140	1.8	0.30	0.10	-	2.28	0.04	5.9	-
A4	14-18	6.8	-	96	0.6	0.16	-	-	0.71	0.01	2.5	Trace

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Pumice and Ash Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
A12	0-4	5.7	13	136	4.3	0.46	0.09	0.35	10.31	0.11	15.63	1.5
A12	4-8	5.9	3	72	0.9	0.25	0.09	0.25	2.67	0.03	8.81	2.6
A12	10-14	6.0	4	76	0.4	0.25	0.10	0.20	1.28	0.03	8.43	0.6
A12	0-4	5.2	11	76	1.2	0.10	0.09	0.09	7.03	0.09	22.90	4.8
A12	8-12	5.8	8	44	0.4	0.10	0.10	0.13	3.91	0.03	11.45	19.5
A12	15-20	5.8	4	20	0.4	0.03	0.04	0.13	1.88	0.02	11.70	22.5
A14	0-4	5.9	9	72	1.2	0.10	0.09	0.14	3.02	0.06	18.6	11.8
A14	8-12	6.1	11	44	1.0	0.10	0.15	0.08	2.61	0.03	27.58	0.3
A14	15-20	6.1	5	26	0.7	0.10	0.15	0.08	1.67	0.02	10.25	1.8
A14	0-4	5.5	11	292	1.5	0.16	0.09	-	7.66	0.04	23.70	2.9
A14	8-12	5.9	10	60	0.9	0.10	0.15	-	2.66	0.05	17.52	4.0
A14	0-4	5.3	5	48	2.1	0.25	0.07	-	15.10	0.18	32.07	-
A14	8-12	6.0	4	16	0.6	0.03	0.15	-	1.56	0.03	10.15	-
A16	0-4	5.3	9	88	1.3	0.16	0.09	0.24	7.01	0.12	12.83	8.0
A16	6-10	5.6	5	84	0.9	0.20	0.10	0.24	2.72	0.07	11.11	8.4
A16	12-10	5.8	7	222	4.0	1.80	0.28	0.41	1.52	0.06	16.49	29.0

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Pumice and Ash Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
C1	0-4	5.8	18	140	2.3	0.25	0.09	0.27	5.39	0.10	10.36	1.2
C1	4-8	5.9	6	100	1.3	0.25	0.07	0.26	1.05	0.05	7.25	1.6
C1	10-16	6.1	5	116	1.0	0.20	0.09	0.21	0.78	0.02	4.89	1.1
C1E2	0-4	5.8	9	76	2.1	0.16	0.09		3.82	0.12	8.70	2.7
C1E2	6-10	6.4	5	96	2.4	0.43	0.09		1.20	0.06	10.42	0.3
C1E2	12-16	6.3	4	96	1.8	0.30	0.09		0.73	0.04	10.42	0.8
C2E3	0-3	5.8	15	174	3.0	0.20	0.09	-	6.8	0.10	17.4	1.2
C2E3	6-12	6.2	9	136	2.1	0.16	0.09	-	3.48	0.06	13.1	-
C2E3	15-20	6.3	8	116	1.0	0.16	0.09	-	1.52	0.03	9.3	-
D1	0-6	5.6	17	222	2.7	0.63	0.10	0.42	6.18	0.14	18.32	-
D1	6-12	6.1	7	164	1.5	0.59	0.10	0.32	2.15	0.05	13.67	-
D1	12-18	6.0	4	250	0.7	0.63	0.15	-	0.68	0.02	9.21	
D1	0-3	5.3	30	228	3.8	0.20	0.15	-	10.06	0.19	16.15	1.0
D1	5-10	6.2	14	280	2.4	0.30	0.21	-	6.69	0.05	10.5	0.5
D1	20-24	6.6	5	490	3.0	0.46	0.33	-	0.49	0.01	6.8	-
D5	0-5	6.3	19	204	3.2	0.25	0.10	0.29	1.36	0.08	12.73	Trace
D5	6-12	6.6	19	146	1.6	0.16	0.09	0.19	3.09	0.05	9.77	Trace

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Pumice and Ash Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
D5	12-18	6.4	15	136	1.5	0.10	0.10	0.22	1.74	0.03	8.07	Trace
D5	0-5	6.8	32	232	4.7	0.30	0.13	-	7.03	0.10	15.07	-
D5	6-12	6.7	18	186	2.1	0.25	0.10	-	2.67	0.04	15.26	-
D5	0-5	6.4	20	262	4.7	0.36	0.10	0.25	8.09	0.10	14.19	Trace
D5	6-12	7.0	16	198	1.0	0.53	0.09	0.12	1.96	0.04	7.97	Trace
D5	0-5	6.3	27	208	4.5	0.59	0.09	-	6.21	0.10	10.35	-
D5	6-12	6.4	11	124	1.8	0.43	0.07	-	2.00	0.04	9.02	-
E1	0-4	5.2	11	26	0.7	0.10	0.07	0.18	5.44	0.16	11.76	4.9
E1	4-8	6.0	5	32	1.3	0.10	0.07	0.15	3.82	0.09	7.30	1.5
E1	12-16	6.3	4	44	1.3	0.16	0.09	0.11	1.94	0.06	6.07	2.1
E3	0-3	5.7	13	54	0.6	0.03	0.07	-	6.36	0.10	9.6	10.6
E3	9-15	6.0	12	36	0.6	0.03	0.09	-	1.85	0.04	7.55	12.0
E3	16-24	6.1	11	36	0.6	0.03	0.09	-	0.92	0.02	12.3	-
E3	25-30	6.1	19	26	0.4	0.03	0.09	-	0.33	0.01	3.0	0.6

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

South Chiloquin Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
H1	0-4	6.4	33	1060	12.5	2.50	0.10	-	3.14	0.10	27.23	-
H1	4-8	6.2	23	524	14.3	3.8	0.13	-	1.78	0.08	21.32	-
H4	0-4	6.1	37	960	9.9	2.5	0.09	-	3.35	0.12	28.94	0.2
H4	4-8	6.1	25	840	10.8	2.7	0.10	-	2.46	0.06	27.44	0.6
H4	8-12	6.1	24	620	9.5	3.0	0.13	-	1.57	0.06	21.43	-
H4	0-4	6.5	27	1060	13.5	2.40	0.09	0.50	4.97	0.13	31.09	1.8
H4	4-8	6.4	33	880	11.4	3.40	0.10	0.25	1.73	0.06	27.71	1.2
H4	10-14	6.4	11	720	12.5	3.00	0.15	0.19	1.15	0.04	21.00	1.7

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Klamath R.D. Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
R1	0-4	6.2	6	336	7.1	0.59	0.21	-	7.24	0.15	29.58	-
R1	6-10	6.2	3	418	7.2	0.69	0.09	-	3.13	0.09	34.26	-
R1	0-4	6.1	5	432	14.3	0.92	0.07	-	10.72	0.24	39.58	0.6
R1	4-8	6.4	3	424	7.9	0.59	0.07	-	4.18	0.10	22.66	0.5
R1	8-12	6.2	2	352	5.6	0.46	0.10	-	1.99	0.07	22.55	0.7
R1R3	0-6	6.6	7	540	11.6	0.87	0.01	0.34	4.50	0.1	26.68	1.0
R1R3	6-12	6.5	5	720	9.0	1.2	0.01	0.26	1.39	0.05	20.87	0.40
R1R3	12-18	6.3	3	600	7.5	1.3	0.04	0.23	1.05	0.04	20.40	0.40
R1R3	0-6	6.7	10	880	12.3	1.2	0.17	-	3.88	0.09	27.00	-
R1R3	6-12	6.4	5	720	9.0	1.1	0.01	-	1.87	0.06	23.35	-
R1R3	12-18	6.4	5	880	9.1	1.0	0.02	-	1.44	0.05	22.37	-
R1R3	0-6	6.5	9	760	8.8	1.2	0.01	0.40	2.73	0.08	23.73	0.60
R1R3	6-12	6.2	10	760	9.7	1.2	0.02	0.30	1.96	0.06	22.65	0.40
R1R3	0-6	6.6	8	720	11.6	1.1	0.01	-	3.78	0.11	26.77	-
R1R3	6-12	6.3	6	374	10.4	1.4	0.63	-	2.11	0.07	24.01	-

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Klamath R.D. Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
R1X5	0-4	6.0	9	170	5.6	0.36	0.04	-	10.83	0.29	31.09	-
R1X5	6-10	6.1	2	156	2.1	0.46	0.10	-	3.61	0.10	22.39	-
R1X5	10-15	5.8	2	106	1.9	0.43	0.09	-	2.93	0.09	21.80	-
R3	0-4	6.3	7	490	12.7	1.50	0.09		8.42	0.19	36.46	-
R3	4-8	6.3	5	536	8.1	1.50	0.07		3.56	0.04	27.55	
R3	8-12	6.3	3	444	7.2	1.30	0.09		1.50	0.06	23.25	-
R3	0-4	5.4	14	208	3.0	0.43	0.10		7.64	0.18	22.39	1.8
R3	6-10	5.7	5	208	2.1	0.43	0.13		3.66	0.09	19.01	1.8
R3	0-4	6.4	6	392	11.0	1.3	0.07	0.50	6.77	0.16	57.56	1.0
R3	6-10	6.6	2	628	5.8	0.92	0.04	0.39	2.71	0.09	41.23	0.6
R3	12-15	6.5	2	480	4.5	0.92	0.09	0.22	1.82	0.05	26.19	1.2
R3	0-4	6.6	12	604	15.3	1.3	0.13	-	7.19	0.20	42.33	-
R3	6-10	6.6	7	540	10.8	0.9	0.07	-	4.19	0.11	26.99	-
R4	0-6	5.9	6	262	4.4	0.46	0.02	0.29	10.06	0.27	34.26	2.0
R4	6-12	6.0	4	216	3.1	0.37	0.01	0.33	6.61	0.14	26.96	2.0
R4	12-18	6.0	2	228	2.7	0.37	0.00	0.26	4.93	0.12	25.74	2.2

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Klamath R.D. Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
R4	0-6	6.4	3	408	6.4	0.54	0.01	-	6.70	0.13	26.63	-
R4	6-12	6.5	2	464	4.6	0.37	0.00	-	2.78	0.09	23.77	-
R4	12-18	6.4	3	720	5.1	0.58	0.00	-	2.11	0.06	21.25	-
R4	0-5	6.5	6	256	7.5	0.53	0.09	0.30	11.82	0.31	28.14	Trace
R4	6-12	6.4	3	146	2.7	0.25	0.09	0.19	3.01	0.11	23.57	Trace
R4	0-5	6.4	4	476	9.1	0.53	0.09	-	7.84	0.29	23.18	-
R4	6-12	6.4	4	256	6.2	0.53	0.09	-	6.02	0.15	25.52	-
R4	0-5	6.2	8	536	6.9	0.69	0.13	0.30	11.86	0.25	42.04	Trace
R4	6-12	6.2	2	358	3.7	0.63	0.09	0.23	3.98	0.10	24.06	Trace
R4	0-5	7.1	2	640	13.5	0.69	0.04	-	8.47	0.20	37.28	-
R4	6-12	7.1	2	760	6.6	1.1	0.07	-	3.26	0.10	24.93	-
R4	0-5	6.5	4	280	9.7	0.76	0.04	0.29	13.05	0.33	29.45	0.80
R4	6-12	6.7	1	256	5.3	0.43	0.04	0.19	5.0	0.11	24.11	0.60
R4	12-18	6.7	1	320	9.1	0.36	0.07	0.19	2.75	0.07	18.61	3.2
R4	0-5	6.6	3	198	7.7	0.43	0.13	-	15.68	0.32	27.18	-
R4	6-12	6.5	1	96	2.5	0.16	0.09	-	4.58	0.11	18.91	-

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Klamath R.D. Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
R4	0-5	6.5	4	200	6.2	0.43	0.10	-	12.67	0.22	24.74	2.4
R4	6-12	6.6	3	100	3.0	0.25	0.09	-	3.35	0.06	17.02	9.6
R4	0-3	6.2	8	424	5.9	0.59	0.09	-	6.8	0.17	26.55	1.4
R4	6-10	6.3	5	336	3.8	0.36	0.09	-	3.64	0.09	20.65	4.0
R4	14-18	6.3	19	298	3.5	0.25	0.09	-	2.07	0.06	18.45	4.0
R4	0-4	6.6	13	352	12.4	0.76	0.04		9.59	0.06	37.64	0.9
R4	6-10	6.4	6	398	6.8	0.53	0.04		3.68	0.12	30.17	0.9
R4	0-4	6.2	13	432	13.3	0.82	0.07		11.65	0.29	39.24	0.5
R4	8-12	6.6	3	388	11.4	0.43	0.10		4.98	0.16	34.16	0.2
R4	0-4	6.2	6	262	5.8	0.53	0.07	-	7.97	0.21	34.26	1.5
R4	6-12	6.2	26	256	3.4	0.46	0.04	-	3.18	0.11	21.19	2.9
R4	0-4	6.0	5	286	4.8	0.36	0.07	-	6.77	0.18	28.29	-
R4	6-12	6.5	3	256	4.3	0.25	0.10	-	1.77	0.09	23.70	-
R4R6	0-4	6.4	3	352	7.4	0.36	0.09	-	5.04	0.11	23.70	-
R4R6	8-12	6.3	1	640	7.1	0.86	0.07	-	0.98	0.03	18.72	-
R4R6	6-10	6.8	4	436	9.5	0.43	0.07	-	3.41	0.07	23.80	0.6

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Klamath R.D. Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
R4R6	0-4	6.3	29	530	10.6	0.89	0.09	-	6.61	0.14	29.38	-
R4R6	6-12	6.4	5	432	7.4	0.89	0.09	-	3.49	0.08	32.46	-
R4R6	0-4	6.3	8	424	8.6	0.76	0.07	-	6.20	0.13	30.77	1.5
R4R6	6-12	6.7	3	544	9.0	0.59	0.07	-	2.06	0.07	30.57	1.2
R4R6	0-4	6.4	11	490	18.3	1.5	0.09	-	11.11	0.28	32.76	-
R4R6	6-12	6.6	4	418	7.4	0.82	0.13	-	3.14	0.05	23.40	-
R4R6	0-4	6.1	11	424	16.5	1.3	0.07	-	15.22	0.35	42.52	2.3
R4R6	6-12	6.2	7	310	6.1	0.69	0.17	-	3.2	0.11	29.53	4.0
R4R6	0-4	6.4	9	636	27.0	2.2	0.13	-	20.26	0.40	52.98	-
R4R6	6-12	6.3	2	368	6.9	0.92	0.09	-	3.03	0.09	21.44	-
R5X3	0-4	5.7	7	336	17.3	1.40	0.09	0.30	25.79	0.42	50.42	1.9
R5X3	4-8	6.0	21	216	5.1	0.53	0.10	0.31	4.39	0.11	22.23	0.5
R5X3	8-12	5.7	21	336	6.1	0.99	0.10	0.23	3.82	0.09	26.85	0.6
R6	6-10	6.6	9	484	9.9	0.63	0.09	-	2.61	0.07	23.5	-
R6	0-4	6.6	8	600	7.4	0.63	0.09	-	7.34	0.14	24.0	3.6

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Klamath R.D. Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
R6	0-3	6.7	6	398	12.0	1.1	0.07	-	6.58	0.15	24.5	1.0
R6	0-14	6.7	3	298	5.3	0.53	0.09	-	3.1	0.07	16.10	7.6
R6	16-24	6.5	6	274	4.2	0.46	0.09	-	1.69	0.04	17.3	4.0
R6	0-3	6.6	2	346	6.8	0.69	0.10	-	4.62	0.09	19.35	Trace
R6	8-12	6.7	15	476	6.1	0.89	0.09	-	2.12	0.04	16.5	1.2
R8X2	0-4	5.5	2	112	1.9	0.20	0.09	0.12	6.70	0.11	21.91	7.4
R8X2	4-8	5.7	4	84	1.5	0.43	0.13	0.28	3.14	0.06	23.14	43.0
R8X3	0-4	5.6	3	96	2.1	0.16	0.09	-	14.86	0.35	32.76	-
R8X3	4-8	5.9	2	48	0.9	0.10	0.10	-	5.49	0.13	25.09	-
R8X3	8-12	5.7	2	48	0.6	0.10	0.09	-	4.86	0.10	20.64	-
R10X2	0-6	5.6	5	100	3.0	0.36	0.09	-	5.21	0.11	31.17	3.1
R10X2	6-10	5.6	3	116	2.1	0.46	0.09	-	5.54	0.10	19.28	3.2
10	0-3	6.0	64	572	11.4	5.5	0.13	-	4.02	0.11	23.72	4.4
10	3-6	6.2	34	672	9.9	5.2	0.13	-	2.41	0.07	23.16	5.2
10	12-15	6.5	19	536	6.4	7.0	0.13	-	0.51	0.03	18.14	-

SOIL CHEMICAL ANALYSIS - SOIL TESTING LAB O.S.U. CORVALLIS, OR

Klamath R.D. Soils

Landtype	Sample Depth in.	PH	P (ppm)	Extractable cations				B (ppm)	Organic Matter	Total Nitrogen	C.E.C.	Sulfate Sulfur (ppm)
				K (ppm)	Ca (Meg/100g)	Mg (Meg/100g)	Na (Meg/100g)					
10	0-3	6.2	110	760	11.8	7.1	0.13	-	4.50	0.11	26.51	1.6
10	3-6	6.3	66	672	9.9	6.4	0.13	-	1.99	0.07	23.90	1.6
10	12-15	6.4	27	398	8.4	8.2	0.19	-	1.36	0.04	22.04	-
10	0-3	6.2	51	604	8.6	3.8	0.10	-	2.98	-	25.02	0.4
10	3-6	6.3	42	504	7.5	3.0	0.13		2.20	0.23	17.76	0.4
10	12-15	6.5	36	556	7.1	4.0	0.10	-	0.91	0.19	16.83	-
10	0-3	6.4	98	398	10.8	4.8	0.10	-	3.34	0.07	22.23	0.9
10	3-6	6.5	78	418	9.3	5.1	0.13	-	2.88	0.06	21.48	1.0
10	12-15	6.3	46	412	8.6	5.4	0.15	-	1.10	0.05	19.81	-
17	0-4	6.5	7	640	13.9	2.1	0.09	-	4.90	0.14	30.87	0.8
17	8-12	5.9	3	600	8.8	2.5	0.10	-	2.08	0.07	42.72	0.4
17	15-20	6.0	2	586	9.5	2.2	0.17	-	2.03	0.04	30.77	0.4

APPENDIX II

Temperature, Precipitation and Water Balance Data for Selected Locations 1/

Sand Creek Station
Klamath County

Long. 121° 59' W
Lat. 42° 59' N
Elev. 4682 ft.

	Temperature Data* of			Precipitation and Water Balance Data* Inches					
Calendar Period	Ave. Max.	Ave. Min.	Ave.	Ave. P	Ave. PE	Surplus P-PE	Deficit PE-P	Cum Surplus	Cum Deficit
Jan.	36.4	12.6	24.5	5.2	0.00	5.2		14.8	
Feb.	40.7	15.9	28.3	3.4	0.00	3.4		18.2	
March	46.7	20.6	33.6	2.9	0.3	2.6		20.8	
April	54.8	25.0	39.9	1.7	1.3	0.4		21.2	
May	64.1	30.0	47.0	1.6	2.3		0.7		0.7
June	71.5	34.2	52.9	1.2	3.5		2.3		3.0
July	81.1	38.3	59.7	0.4	4.3		3.9		6.9
Aug.	79.9	36.1	58.0	0.3	4.0		3.7		10.6
Sept.	72.6	31.2	51.9	0.5	2.5		2.0		12.6
Oct.	60.4	27.1	43.7	2.2	1.4	0.8		0.8	
Nov.	45.5	21.2	33.3	3.9	0.2	3.7		4.5	
Dec.	38.1	17.8	27.9	5.1	0.00	5.1		9.6	
Annual	57.7	25.8	41.7	28.4				21.2	12.6
Record Period*	16 yrs	16 yrs	16 yrs	1931-52					

Ave FFS (32°)* = PE of FES (32°) =
Ave FFS (28°)* = PE of FFS (28°) =

Cascade Summit Station
Klamath County

Long. 122° 02' W
Lat. 43° 35' N
Elev. 4841 ft.

	Temperature Data* of			Precipitation and Water Balance Data* Inches					
Calendar Period	Ave. Max.	Ave. Min.	Ave.	Ave. P	Ave. PE	Surplus P-PE	Deficit PE-P	Cum Surplus	Cum Deficit
Jan.	33.8	20.0	26.9	7.9	0.00	7.9		25.7	
Feb.	36.1	21.3	28.7	6.0	0.00	6.0		31.7	
March	41.2	23.8	32.5	6.0	0.00	6.0		37.7	
April	48.9	27.9	38.4	3.7	1.0	2.7		40.4	
May	57.2	32.9	45.1	2.2	2.3		0.1		0.1
June	64.3	37.4	50.9	2.2	3.1		0.9		1.0
July	75.0	42.5	58.8	0.4	4.3		3.9		4.9
Aug.	73.9	41.8	57.8	0.3	3.6		3.3		8.2
Sept.	64.6	37.5	51.1	1.3	2.5		1.2		9.4
Oct.	53.6	33.1	43.4	4.0	1.4	2.6		2.6	
Nov.	41.4	26.5	33.9	6.7	0.2	6.5		9.1	
Dec.	37.2	22.9	30.0	8.7	0.00	8.7		17.8	
Annual	52.3	30.6	41.5	49.4				40.4	9.4
Record Period*	15 yrs	15 yrs	15 yrs	931-47					

Ave FFS (32°)* = PE of FFS (32°) =
Ave FFS (28°)* = PE of FFS (28°) =

Chemult and Chemult Station
Klamath County

Long. 121° 47' W
Lat. 42° 13' N to 43° 15' N
Elev. 4750 to 4760 ft.

	Temperature Data* of			Precipitation and Water Balance Data* Inches					
Calendar Period	Ave. Max.	Ave. Min.	Ave.	Ave. P	Ave. PE	Surplus P-PE	Deficit PE-P	Cum Surplus	Cum Deficit
Jan.	38.6	9.6	25.1	4.5	0.00	4.5		13.0	
Feb.	41.3	15.3	28.7	3.6	0.00	3.6		16.6	
March	46.7	18.6	33.3	2.3	0.3	2.0		18.6	
April	56.6	23.2	39.7	1.2	1.3		0.1		0.1
May	64.7	28.7	46.8	1.4	2.3		0.9		1.0
June	71.8	32.8	51.3	1.5	3.1		1.6		2.6
July	82.9	35.6	59.4	0.6	4.3		3.7		6.3
Aug.	81.8	32.7	57.4	0.6	3.6		3.0		9.3
Sept.	74.3	28.7	50.9	0.9	2.5		1.6		10.9
Oct.	60.5	24.6	42.5	1.9	1.4	0.5		0.5	
Nov.	46.5	19.5	32.8	3.4	0.2	3.2		3.7	
Dec.	39.0	15.8	29.2	4.8	0.00	4.8		8.5	
Annual	58.7	23.8	41.4	26.7				18.6	10.9
Record Period*	14 yrs	14 yrs	1937-59 dis	1937-59 dis					

Ave. FFS (32°)* Always/to Always; 0 — PE of FFS (32°) = 0
Ave. FFS (28°)* 7/25 to 8/5; 11 days — PE of FFS (28°) =1.4

Chiloquin Station
Klamath County

Long. 121° 52' W
Lat. 42° 35' N
Elev. 4200 ft.

	Temperature Data* of			Precipitation and Water Balance Data* Inches					
Calendar Period	Ave. Max.	Ave. Min.	Ave.	Ave. P	Ave. PE	Surplus P-PE	Deficit PE-P	Cum Surplus	Cum Deficit
Jan.	38.6	14.8	27.1	2.7	0.00	2.7		7.4	
Feb.	42.8	19.1	31.1	1.8	0.00	1.8		9.2	
March	49.4	24.0	36.7	1.5	0.6	0.9		10.1	
April	59.1	27.3	43.2	1.1	1.6		0.5		0.5
May	67.6	32.3	49.9	1.5	2.6		1.1		1.6
June	73.9	37.1	55.4	1.1	3.4		2.3		3.9
July	83.8	41.1	62.5	0.3	5.5		5.2		9.1
Aug.	83.7	39.3	61.5	0.3	3.9		3.6		12.7
Sept.	77.3	32.9	55.1	0.6	2.8		2.2		14.9
Oct.	64.1	27.7	45.9	1.4	1.7		0.3		15.2
Nov.	49.4	21.8	35.6	2.3	0.5	1.8		1.8	
Dec.	41.1	20.0	30.7	2.9	0.00	2.9		4.7	
Annual	60.9	28.1	44.6	17.5				10.1	15.2
Record Period*	17 yrs	18 yrs	17 yrs	1931-55					

Ave. FFS (32°)* 6/21 to 7/22; 31 days — PE of FFS (32°) =
Ave. FFS (28°)* 6/21 to 8/24; 73 days — PE of FFS (28°) =

Fort Klamath Station
Klamath County

Long. 121° 50' W to 121° 51' W
Lat. 42° 39' N to 42° 40' N
Elev. 4200 ft.

Table 110

	Temperature Data* of			Precipitation and Water Balance Data* Inches					
Calendar Period	Ave. Max.	Ave. Min.	Ave.	Ave. P	Ave. PE	Surplus P-PE	Deficit PE-P	Cum Surplus	Cum Deficit
Jan.			25.6	3.5	0.00	3.5		10.3	
Feb.			28.2	3.0	0.00	3.0		13.3	
March			34.3		0.3	2.6		15.9	
April			41.4	1.3	1.3		0.0		0.0
May			49.0	1.3	2.6		1.3		1.3
June			55.9	0.8	3.4		3.0		4.9
July			61.8	0.4	4.6		4.2		9.1
Aug.			60.4	0.3	3.9		3.6		12.7
Sept.			52.4	0.5	2.5		2.0		14.7
Oct.			45.2	1.6	1.4	0.2		0.2	
Nov.			34.8	3.3	0.5	2.8		3.0	
Dec.			29.2	3.8	0.00	3.8		6.8	
Annual			43.0	22.7				15.9	14.7
Record Period*			20 yrs	1864-98 dis.					

Ave. FFS (32°)
Ave. FFS (28°)

PE of FFS (32°) =
PE of FFS (28°) =

1/ Temperature and water balance for Oregon Weather Stations. Special Report 150, May 1963. Agricultural Experiment Station, Oregon State University, Corvallis, Oregon.

APPENDIX III

DEFINITIONS OF SOIL INTERPRETATIONS

Erosion Hazard

Sheet Erosion Potential

This rating is based on expected losses of surface soil when all vegetative cover, including litter, is removed. Evaluations of climate, slope gradient and length, soil characteristics, hydrologic characteristics of the soil, water repellent characteristics and bedrock materials of each landtype unit are considered in making ratings. Rill erosion is considered a part of sheet erosion.

Low - Little loss of soil materials is expected. Some minor sheet and rill erosion may occur.

Moderate - Some loss of surface soil materials can be expected. Rill erosion and some small gullies or sheet erosion may occur. Sheet erosion is indicated by some soil pedestals and observable accumulation of soil materials along the upslope edge of rocks and debris. This is accompanied by a probable fertility loss.

High - Considerable loss of surface soil materials can be expected. Rill erosion, numerous small gullies or evidence that considerable loss from sheet erosion may occur. Sheet erosion is indicated by frequent occurrence of soil pedestals and considerable accumulation of soil materials along the upslope edge of rocks and debris. This is accompanied by a fertility loss.

Severe - Large loss of surface soil material can be expected in the form of large losses from sheet erosion, numerous small gullies and rills. Sheet erosion loss is exhibited by numerous examples of soil pedestals and estensive accumulation of soil materials along the upslope edge of rocks and debris. This is accompanied by a fertility loss.

Gully Erosion Potential

This rating is based on the possibility of gullies to form. Most gullies form in concave drainageways where water accumulates. Factors considered are slope shape, infiltration, expected vegetation cover and soil chacteristics.

Low - Factors such as convex slopes and rapid infiltration indicate that gullies are not likely to form.

Moderate - Factors such as concave slopes and moderately deep soils with fair to good ground cover indicated the gullies may occasionally form.

High - Factors such as concave slopes with drainageways and deep soils with fair to poor ground cover indicate that gullies may develop, especially if ground cover is allowed to degrade.

Wind Erosion Potential

This rating is based on expected soil losses or movement from wind erosion when vegetation has been removed from an area. Factors considered are soil characteristics and landforms. It is not known at the present time when losses become significant.

Low - No loss or movement expected.

Moderate - Some loss or movement can be expected.

High - Loss or movement can be expected.

Dry Ravel Potential

Dry Ravel Potential on Natural Slope

This is a prediction of the dry ravel potential on natural slopes of a soil that is subjected to vehicular, hoof, and/or foot traffic during the period of the year when the soils are dry. Factors taken into consideration are: slope gradients, vegetative cover (amount and kind); soil depth; amount, size, and shape of gravel and cobble; soil structural strength; and soil texture.

Low - Factors indicate that dry ravel will not be a problem.

Moderate - Factors indicate that a moderate amount of dry ravel will take place under moderate use such as livestock grazing.

High - Factors indicate that an excessive amount of dry ravel will take place under moderate use such as livestock grazing or logging activity.

Dry Ravel Potential on Road Cuts and Fills

This is a prediction of the dry ravel potential on road cuts and fills not subjected to livestock or vehicle traffic. Cut and fill slopes are generally steeper than the surrounding landtypes. This can create areas of high potential for dry ravel. This rating is based on cuts and fills greater than six feet in height. Factors considered were bedrock characteristics, soil depth, soil characteristics and aspect.

Low - Factors indicate that dry ravel will not be a problem.

Moderate - Factors indicate that a moderate amount of dry ravel will take place with some detrimental effects downhill and some ditch cleanout necessary.

High - Factors indicate that an expressive amount of dry ravel will take place. There will be detrimental effects below fillslopes and much ditch cleanout necessary below cutslopes.

Potential for Rapid Water Runoff

This is a prediction for rapid water runoff based on the depth, water storage capacity, infiltration and permeability of a soil. Shallow rocky soils with impermeable subsoils or bedrock will generally have a high runoff potential. Glacial soils over dense till will also have a high runoff potential. Deep soils with rapid infiltration and permeabilities such as Soil Group A will have a low potential. This interpretation does not take into consideration water repellancy which can occur on most of the soils of the Forest during the dry July and August period.

Low - Rapid water runoff occurs only rarely during intense storms or frozen soil conditions.

Moderate - Rapid water runoff occurs occasionally during moderate storms, spring runoff periods, or when soil is frozen.

High - Rapid water runoff commonly occurs during moderate storms, spring runoff periods and when the soil is frozen.

Cold Air Drainage

This is a prediction of the potential for cold air to drain into or accumulate in an area during the summer. The cold air drainage occurs during the night time hours and causes much lower temperatures than would be expected. Basins, drainageways, and flats are most apt to have this problem. The cold air can damage young seedlings if temperatures are low enough.

Low - Cold air drainage is generally not a problem. Slopes are generally convex.

Moderate - Cold air drainage will occasionally cause damage to young seedlings of less tolerant species (ponderosa pine).

High - Cold air drainage will commonly occur and cause damage to all except the most tolerant tree species (lodgepole pine).

Frost Heave Potential

This is a prediction of the frost heave potential in the surface soil of a landtype. Excess amounts of water are necessary in the surface soil for frost heave to occur. The surface soil then must be subjected to several freeze-thaw cycles such as cold nights and warm days. Also, ground vegetation and litter should be sparse so that there is very little insulating effect.

We have two conditions on the Forest that meet the above criteria. Pumice and ash soils hold an extra amount of water, but generally have fair ground cover. When the ground cover is removed, conditions exist for frost heave. The other condition is very shallow (less than 18 inches), gravelly or cobbly soils over bedrock that drains slowly so that the soils are saturated for a period of time when the freeze-thaw cycles occur.

Low - Frost heave is generally not a problem. When extreme frost heave conditions exist, some frost heave damage can occur.

Moderate - Frost heave will occasionally be a problem and some damage to seedlings will occur.

High - Frost heave will commonly occur, with damage to young seedlings.

Natural Stability

This rating is based on the relative stability of the mapping units as they occur in the natural state. This includes any movement or loss by slumps, slides, and all kinds of deep-seated failures. Surface erosion is not included. This rating applies throughout Region 6.

I. Very stable - no evidence of failure.

II. Stable - Occasional failures are observed.

III. Moderately stable - Several failures are observed.

IV. Unstable - Many failures are observed.

V. Very unstable - Entire area shows evidence of recent and past failures.

Detrimental Compaction Hazard

This is a relative prediction of soil behavior under the physical influence of foot, hoof, vehicular, or log traffic. It is a combined rating of the length of time a soil is at optimum moisture for compaction and the comparative force necessary to get compaction. Factors considered are soil texture, amount of coarse fragments, soil mineralogy, soil structure, soil drainage, evidence of seasonal saturation, soil aggregate strength, pore size, and distribution and soil consistence. Soils with more than 60 percent coarse fragments or a narrow optimum moisture range for compaction are rated low. Soils high in clay which have a wide moisture range over which they can be compacted are rated high.

Low - Facotrs indicate that detrimental compaction will be a minor problem.

Moderate - Factors indicate that compaction will be a problem in the spring and early summer.

High - Factors indicate that compaction will be a problem for a large part of the spring and summer.

Engineering Classification (Unified System)

Each soil is classified as to its Unified Soil Classification. Those soils with significant layers of different soil materials will have a classification for each layer designated. Those soils not tested will be classified by comparing their properties to those tested, or interpreted from soil textures.

Hydrologic Group

This interpretation is a grouping of soils into four classes, indicating the general infiltration and water movement ability of the soil and bedrock materials. This method of rating has been developed by the Soil Conservation Service. The four groups are the standard SCS groupings and definitions.

Group A - Soils having high infiltration rates even when thoroughly wetted, consisting chiefly of deep, well to excessively drained sands and/or gravel. These soils have a high rate of water transmission and would result in a low runoff potential.

Group B - Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately deep to deep, moderately well to well drained soils, with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Group C - Soils having slow infiltration rates when thoroughly wetted, consisting chiefly of (1) soils with a layer that impedes the downward movement of water, or (2) soils with moderately fine to fine texture and a slow infiltration rate. These soils have a slow rate of water transmission.

Group D - Soils having very slow infiltration rates when thoroughly wetted, consisting chiefly of (1) clay soils with high swelling potential, (2) soils with a high permanent water table, (3) soils with claypan or clay layer at or near the surface, and (4) shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

Sedimentation Yield Potential

This interpretation indicates the potential for water sedimentation and pollution from silt and clay particles carried in suspension following timber harvest, road construction, or other activities. Factors considered in making ratings are soil texture and structure, drainage patterns, landforms, and climate.

Low - Sedimentation levels of silt and clay particles are not expected to be significant following management activities. Soils are generally moderately coarse-textured.

Moderate - Sedimentation levels of silt and clay particles may be significantly increased following activities with moderate loss of water quality and damage to fisheries. Soils are generally medium-textured.

High - Sedimentation levels of silt and clay particles are expected to be high following management activities. Streams become turbid and there is considerable loss of water quality and damage to fisheries. Soils are generally fine to moderately fine-textured.

Expected Sediment Size

This interpretaiton indicates the expected sediment size reaching the streams resulting from erosion of each unit. This interpretation is a statement of the two dominate separates expected (gravel, sand, silt, or clay) from each soil unit. The ratings are presented in two columns. The first column indicates the separates expected from the surface soils, and the second indicates separates expected from the subsoils.

Mixing and Displacement Hazard

This interpretation rates the landtypes as to the ease with which its soil material can be loosened and moved after its vegetation and litter are removed. Mixing and displacement can be done by hoof, foot, vehicular, or log traffic. Factors considered are soil texture, soil structural strength, bulk density, organic matter, coarse fragments, and root size and distribution.

Low - Factors indicate that these soils are not easy to loosen and/or displace.

Moderate - Factors indicate that these soils are moderately easy to loosen and/or displace.

High - Factors indicate that these soils are easy to loosen and/or displace.

Dustiness Hazard

This interpretation is a relative prediction of soil behavior, assuming that the soils will be subjected to vehicular, hoof, foot, or logging traffic during the dry season. Factors considered are soil texture, soil structure, amount of coarse fragments, and individual soil particle characteristics.

Low - Factors indicate dust will be a minor problem.

Moderate - Factors indicate that under normal conditions dust will be a minor problem, but under heavy use and extremely dry conditions, dust will be a problem.

High - Factors indicate that dust will be a major problem. Dust abatement measures will be necessary for some uses under normal conditions.

Muddiness Hazard

This is a relative prediction of surface soil behavior when subjected to vehicular, hoof, and/or foot traffic during periods of time when the soil moisture is at or above field capacity. Factors considered are soil texture, percent of coarse rock material, clay content, and soil parent material.

Low - Factors indicate that muddiness is not likely to be a problem.

Moderate - Factors indicate that muddiness will occasionally be a problem for intensive use. Special restructions or surfacing may occasionally be necessary for intensive use.

High - Factors indicate that muddiness will be a problem for intensive use, with restrictions and surfacing necessary.

Potential for High Surface Soil Temperatures

This is a relative prediction of the effect on the surface soil temperatures when vegetative cover and litter are removed. This will have an effect on the survival of seedlings. Factors considered are general aspect of the landtype, climatic zone, soil texture, soil color, water-holding capacity, and insulating effect of the soil material.

Low - Factors indicate that excessively high surface soil temperatures will not occur.

Moderate - Factors indicate that excessively high surface soil temperatures will occasionally occur which will result in some mortality.

High - Factors indicate that high surface soil temperature will occur with definite mortality.

Interpretaions Based on Coarse Fragment Content

These interpretations were made to emphasize the importance of coarse fragment content in the Landtypes of Soil Groups H, R, and X. Each Landtype has a wide range in coarse fragment content. These interpretations pertain to nonporous or hard coarse fragments or rocks in Soil Group H, R, and X.

Predicted Planting Success

Low - Area will be difficult to plant, will have low plant available water and site prep will be difficult. Expected planting success - 50% or less.

Moderate - Area will not be difficult to plant. Rocks may give some problems. South aspects and moderate plant available water will decrease planting success. Expected planting success - 50 to 80%.

High - Area will be easy to plant, will have high plant available water and site prep will be easy. Expected planting success - 80% or better.

Ease in Ripping

Easy - Very little interference from coarse fragments when ripping. Few large stones may end up on the soil surface.

Moderate - Some interference from coarse fragments when ripping. Large stones may end up on the soil. Some interference in the operation of the ripper.

Difficult - Coarse fragments will severely limit ripping. Excessive amounts of stones will end up on the surface. Also actual operation of the ripper is in question.

Inches of Water in Surface Foot of Soil

Data for this interpretation was derived from lab data and miscellaneous research data for this area. The surface foot of soil is extremely important from a reforestation standpoint.

Taxonomic Classification

A basic system of soil classification for making and interpreting soil surveys. Systems was set up by the United States Department of Agriculture - Agriculture Handbook - Number 436.

APPENDIX IV

LANDTYPE FEATURES AND QUALITIES DEFINITIONS

These terms are found in the Table of Landtype Features and Qualities. They describe properties of the Soil Group or Landtype that result from soil characteristics, bedrock characteristics, topography, and site.

Landform - refers to the shape and configuration of a specific, identifiable part of the landscape common to the landtype.

Aspect - refers to the general direction of slope exposure.

Percent Slope Range - range of slope of the landtype.

Effective Rooting Depth - Depth to which 80 to 90 percent of the root activity (includes all species) takes place. It is influenced by the depth of the bedrock, lack of aeration, water table, root penetration, and type of vegetation.

Estimated Soil Bulk Density - The mass of dry soil per unit bulk volume. The bulk volume is determined before drying to constant weight at 105° centigrade. In common useage it relates to pounds per cubic foot or grams per cubic centimeter.

Permeability - Water or air movement in and through the soil material. The classes are based on soil texture, rock fragment content, porosity, and bulk density.

Class:

Very slow - Generally fine textured soils - clay. Less than .05 inch/hour.

Slow - Generally moderately fine textured soils - clay loams and silty clay loams. .05 inch/hour to 1 inch/hour.

Moderate - Generally medium textured soils - loams, silt loams. 1 inch/hour to 5 inches/hour.

Rapid - Generally moderately coarse textured soils - sandy loams, gravelly loams. 5 inches/hour to 20 inches/hour.

Very Rapid - Very porous soils. Generally coarse textured soils - sand and gravels. Greater than 20 inches/hour.

Infiltration Rate - Rate of entry of water into soil surface. The rate is dependent upon the type of surface soil texture, rock fragment content, structure, porosity, bulk density, and organic matter content. If soils are dry and are water repellant, soil will have a temporary slow rating.

Infiltration Rate Classes

Slow - Water stands on surface for long periods. Soils are fine-textured, poorly aggregated, puddle easily, or water repellant.

Moderate - Water enters soils at commensurated rates of normal rainfall or water application. Water may pond for short periods (a few days) following very intensive rainfall. Soils are medium-textured and well aggregated.

Rapid - Water rarely ponds; enters soil surface very rapidly. Soils are coarse-textured, porous, loose, and usually single-grained.

Drainage Classes - The rapidity and extent of removal of water form the soil, based on soil permeability, infiltration, internal drainage, and topographic position:

Poorly drained - Water table at or near the surface a considerable part of the time. Soils of this class usually occupy level or depressed sites and are frequently ponded. Water is removed so slowly that soil remains wet almost all the time.

Somewhat poorly drained - Water removed so slowly that the soil remains wet for significant periods, but not all the time.

Moderately well drained - Soil remains wet for a period somewhat longer (up to one month) than the wet season. May be due in part to a slowly permeable layer, high water table, or lateral seepage.

Well drained - Water is removed from soil readily and these soils are saturated only during the wet season for short periods.

Excessively drained - Water is removed from soil rapidly and these soils are rarely ever saturated. Commonly, these soils are coarse-textured or shallow, stony, and/or occur on steep slopes.

Elevation - Altitude above mean sea level expressed in feet.

Natural fertility - This is a general rating of the nutrient status of the soil. Soil analysis may show low levels of some nutrients (phosphorus) but sufficient levels are present for normal productivity. More intensive management may require additional nutrients.

Plant Community Data - Plant community data has been determined from Plant unities of the Central Oregon Pumice Zone, R-6 Area Guide 4-2, January 1976, U.S.D.A. Forest Service, Pacific Northwest Region; and Plant Associations of South Chiloquin and Klamath Ranger Districts - Winema National Forest -, U.S.D.A. Forest Service, Pacific Northwest Region, R6-Ecol-79-005.

APPENDIX V

SOIL CHARACTERISTICS DEFINITIONS

These terms are found in the Range of Soil Characteristics and Modal Site Descriptions. They describe morphological properties of the soil.*

Soil - Any and all loose, unconsolidated, weathered material on the earth's surface resting on solid, consolidated, unweathered bedrock, regardless of origin, mode of formatin, or type of weathering or deposition. Generally includes any material that may be manipulated by handtools or heavy equipment without the need of blasting except soft unweathered bedrock. In soil horizon designation, soil materials included A, B, and C horizons.

Depth of Soil to Bedrock - Depth from soil surface to consolidated bedrock. Depth is in inches.

Litter - Total depth in inches of decomposed and undecomposed organic matter on the mineral soil surface.

Surface Rock (Percent Ground Cover) - Percent on an area basis of the soil surface that is rock fragments.

A Horizon - The mineral horizon at the surface or below the litter layer. This horizon is the one in which living organisms are most active and therefore is marked by an accumulation of humus. The horizon may have lost one or more of the soluable salts, clay, and iron and aluminum oxides.

AC Horizon - A horizon transitional between A and C horizons, having subordinant properties of both A and C, but not dominated by either.

B Horizon - The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A and underlying C horizon. The B horizon has distinctive characteristics caused by; accumulations of clay, iron, and aluminum oxides and some humus or combination of these; blocky structure; and redder colors.

C Horizon - A horizon of weakly weathered material underlying either an AC or B horizon.

Buried Soil or II B - Former soil surface before the pumice and ash was deposited.

Horizon Thickness - Thickness of each soil layer in inches.

Color - Stated in narrative Munsel notations for each soil layer.

Texture - Relative proportions of sand (2.0 mm - .05 mm), silt (.05 mm - .02 mm), and clay (less than .002 mm). Standard USDA textural classes are used for each soil layer.

*Standard USDA Handbook 18 Definitions.

Rock Fragment Quality and Size - Percent by volume occupied by consolidated fragments larger than sand size (larger than 2 mm).

Size Classes - Gravel, 2 mm - 3 inches; cobble, 3 inches to 10 inches; stone, greater than 10 inches; stone, greater than 10 inches.

Rock Fragment Classes - Used as an adjective to textural classes. Includes gravel, cobble, and stone sizes.

0 - 15% - not noted
15 - 35% - gravelly, cobbly, or stony
35 - 80% - very gravelly, very cobbly, or very stony
80%+ - extremely gravelly, extremely cobbly or extremely stony

Soil Structure - includes grade, size, and type of structure for each soil layer. If no structure exists, then the soil is massive or single-grained. Applies to aggregate structural units (aggregates and peds).

Grade - Degree of aggregation and expression of the differential between cohesion within aggregates and adhesion between aggregates.

Weak - Indistinct peds, barely observable in place.

Moderate - Distinct peds, moderately durable and evident.

Stong - Distinct peds in place, durable.

Size - Refers to size of aggregates according to five size classes.

Very fine - less than 5 mm.

Fine - 5 mm to 10 mm.

Medium - 10 mm to 20 mm.

Coarse - 20 mm to 50 mm.

Very Coarse - greater than 50 mm.

Type - Refers to relative shape of individual aggregates. There are four primary basic shapes:

Platy - Soil plarticles arranges around a plane, generally horizontal.

Prism-like - Soil particles arranged around a vertical line and bounded by a relatively flat surface (prismatic, columnar).

Block-Like - Soil particles arranged around a point and bounded by flat or rounded surfaces (angular blocky, subangular blocky).

Spheroidal - Soil particles arranged around a point and bounded by curved or very irregular surfaces (granular, crumb).

Structureless - No observable aggregation or no definite orderly arrangement of natural lines of weakness.

Massive - the soil material is coherent.

Single-grain - The soil material is incoherent.

Consistence - Degree of cohesion and adhesion as indicated by the resistance of the soil aggregate to deformation or rupture under various moisture conditions.

Dry:

Loose - Noncoherent.

Soft - crushes easily to powder or single-grain.

Slightly hard - easily broken between thumb and forefinger.

Hard - can be broken in the hands without difficulty but difficult to break between thumb and forefinger.

Very Hard - can be broken in hands without difficulty.

Extremely hard - cannot be broken in hands.

Moist:

Loose - noncoherent.

Very friable - crushes under gentle pressure between thumb and forefinger.

Very firm - crushes under strong pressure; barely crushable between thumb and forefinger.

Extremely firm - crushes under very stong pressure, cannot be crushed between thumb and forefinger.

Wet:

Stickiness - is measured by pressing wet soil between fingers.

Nonsticky - is practically no adherence when pressure is released.

Slightly Sticky - after pressure, soil adheres to both thumb and finger,

Sticky - after pressure, soil adheres to both thumb and finger and tends to stretch somewhat before pulling apart from either digit.

Very Sticky - after pressure, soil adheres strongly to both digits, and is markedly stretched when they are separated.

Plasticity - is measured by rolling wet soil and observing wire.

Nonplastic - no wire is formable.

Slightly plastic - wire forms, but soil mass easily deformed.

Plastic - wire forms, moderate pressure required to deform soil mass.

Very Plastic - wire forms, much pressure required to deform soil mass.

Soil pH 1/ - intensity of soil acidity or alkalinity expressed on a scale from 1 to 14:

	pH
Extremely acid -	below 4.5
Strongly acid -	4.6 - 5.5
Slightly acid -	5.6 - 6.4
Neutral Neutral -	6.5 - 7.3
Slightly alkaline -	7.4 - 8.4
Stongly alkaline -	8.5 - 9.0
Very strongly alkaline -	Above 9.0

1/ All pH values were taken by the Hellige-Truog.

APPENDIX VI

GLOSSARY

Alluvium - Material laid down in recent times in riverbeds, flood plains, lakes, and fans at the foot of mountains.

Andesite - A dark gray to black, dense, fine-grained extrusive igneous rock. Very similar to basalt.

Ash - Volcanic ejecta less than 2 millimeters in diameter as used in this report. Mostly dacite in composition.

Basalt - A dark gray to black, dense, fine-grained extrusive igneous rock. Very similar to andesite.

Basic scoria - Volcanic ejecta of basic composition generally greater than 2 millimeters in diameter. In this report it relates to gravel and cobble size material from the last stages of the avalanche flow out of Mt. Mazama.

Bedrock - The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface of the earth.

Breccia - Rock composed of angular fragments in the finer ground mass.

Cinders - When describing cinder cones it relates to highly frothy or porous materials of andesites or basaltic composition ejected from a volcano. When used in the modal soil description it relates to pumice material greater than 2 millimeters.

Cirque Basin - A half-amphitheater formed by alpine glaciation with three steep sides. Usually found at upper ends of valleys and along ridges.

Clay - A soil separate less than .002 millimeters in diameter. As a soil textural class, soil material that is 40 percent or more clay; less than 45 percent sand, and less than 40 percent silt.

Coarse fragment - Soil material greater than 2 mm in diameter including gravel, cobble, and stones.

Cobble - A soil separate between 3 and 10 inches in diameter. A size portion of the coarse fragment content.

Colluvium - Soil material or rock fragments moved downslope by gravitational force in the form of soil creep, slides, and local wash.

Compaction - The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

Complex - An association in which two landtypes or miscellaneous landtypes are so intricately mixed that it is not practical to show them separately at the scale of mapping used.

Dacite - A type of pumice or ash with a silicon dioxide composition of 65 to 70 percent.

Ejecta - Material thrown out by a volcano, such as ash, or pumice.

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.

Accelerated Erosion - Erosion much more rapid than normal, natural, or geologic erosion primarily as a result of hte influence of the activities of man, or, in some cases, of other animals or natural catastrophies that expose base surfaces; for example, fires.

Geological Erosion - The normal or natural erosion caused by geological processes acting over long geologic periods and resulting in the wearing away of mountains, the building up of flood plains, coastal plains, etc. Syn., natural erosion.

Gully Erosion - The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 4 inches to as much as 75 to 100 feet.

Natural Erosion - Wearing away of the earth's surface by water, ice, or other natural agents under natural environmental conditions of climate, vegetaion, etc., undisturbed by man Syn. geol. erosion.

Normal Erosion - The gradual erosion of land used by man which does not greatly exceed natural erosion. See natural erosion.

Rill Erosion - An erosion process in which numerous small channels less than 4 feet deep and 6 inches wide are formed.

Sheet Erosion - The removal of a fairly uniform layer of soil from the land surface by runoff water.

Splash Erosion - The spattering of small soil particles caused by the impact of raindrops on wet soils. The loosened and spattered particles may or may not be subsequently removed by surface runoff.

Erosion Pavement - Rock fragments left on the soil surface after part of the finer soil materials has been eroded away by water or wind.

Evapotranspiration - Water transpired by vegetation plus that evaporated from the soil.

Faulted - Movement which has produced relative displacement of adjacent rock masses along a fracture.

Geomorphology - The study of landforms as they relate to geologic composition and history.

Glacier - A mass of ice with definite lateral limits, with motion in a definite direction, and originating from the compacting of snow by pressure.

Glacial Outwash - Glacial material swept out, sorted, and deposited by water that originated from the melting of glacial ice.

Glacial Soils - Soils derived from materials transported or influenced by glaciers.

Glacial Till - Nonsorted, nonstratified sediment carried or deposited by a glacier.

Glaciated Valley & Trough - U-shaped valley formerly cut out and occupied by a glacier.

Gravel - A soil separate between 2.0 millimeters and 3 inches in diameter. A portion of the coarse fragment content.

Gully Erosion - See "Erosion."

Hydrophobic - Lacking a strong affinity for water, water repellant.

Inclusion - Landtype found within a mapped landtype that is not extensive enough to be mapped separately or as part of a complex.

Isohyetal Map - A map with lines along which all points receive the same amount of precipitation.

Landform - Structural configuration of the topography as a result of past and present geological activity.

Massive - Soil structure or bedrock condition in which there is no observable aggregation or no definite orderly arrangement of natural lines of weakness.

Mass Movement - All movement of soil and bedrock materials occurring below the soil surface such as landslips, landflows, rock slides, slumps, etc.

Natural Erosion - See "Erosion."

Normal Erosion - See "Erosion."

Physiographic Divisions - Broad groupings based on the physical features of the landscape.

Pumice - Volcanic ejecta greater than 2 millimeters in diameter of dacitic composition as used in this report.

Pumice flow - (pumice avalanche flow, nuee' ardente) - An avalanche of highly heated mixture of pumice fragments, gasses and ash that moves rapidly down the slopes of a volcano.

Pyroclastic - A general term applied to rocks formed from volcanic material that has veen explosively or aerially ejected from a volcanic vent.

Rill Erosion - See "Erosion."

Runoff - That part of the precipitation which appears in surface streams of either perennial or intermittent form.

Sand - A soil separate between .05 and 2.0 millimeters in diameter.

Sandstone - A rock composed primarily of cemented sand-size grains.

Scalping - The removal of a specified layer of the surface soil by mechanical means.

Scarification - The mechanical act of breaking and/or stirring the immediate soil surface in place. Term does not imply removal of soil or organic material.

Sedimentary Rock - A rock formed by deposition of soil and rock particles by water, ice, or wind that later solidifies through cementation, ionic exchange or compression.

Sheet Erosion - See "Erosion."

Silt - A soil separate consisting of particles between 0.002 and 0.05 millimeters in diameter.

Slump - A deep-seated, slow-moving rotational failure occurring in plastic materials, resulting in vertical and lateral displacement.

Soil - Any and all loose, incoherent, unconsolidated weathered material on the earth's surface resting on solid, consolidated, unweathered bedrock, no matter how formed, or origin, or method of weathering or deposition. Generally includes any material that may be moved or broken by hand tools or heavy equipment without the need of blasting except soft, unweathered bedrock. In soil horizon designation, soil materials included "A", "B", and "C" horizons.

Soil Texture - The relative proportions of the various soil separates in a soil as described by the classes of soil texture. The textural

classes may be modified by the addition of suitable adjectives when coarse fragments are present in substantial amounts; for example: "stony silt loam", or "silt loam, stony phase."

Soil Puddling - The act of destroying soil structure by manipulating a soil when it is in a wet and plastic condition. Puddling reduces porosity and permeability.

Splash Erosion - See "Erosion."

Stone - A soil separate greater than 10 inches in diameter. A portion of the coarse fragment content

Toeslope - That portion of a slope that is transitional between the valley floor and the upper slope.

Topography - The relief features or surface configuration of an area.

U-shaped Valley - Descriptive phase of the cross profile of a valley which has been carved out by glacial movement.

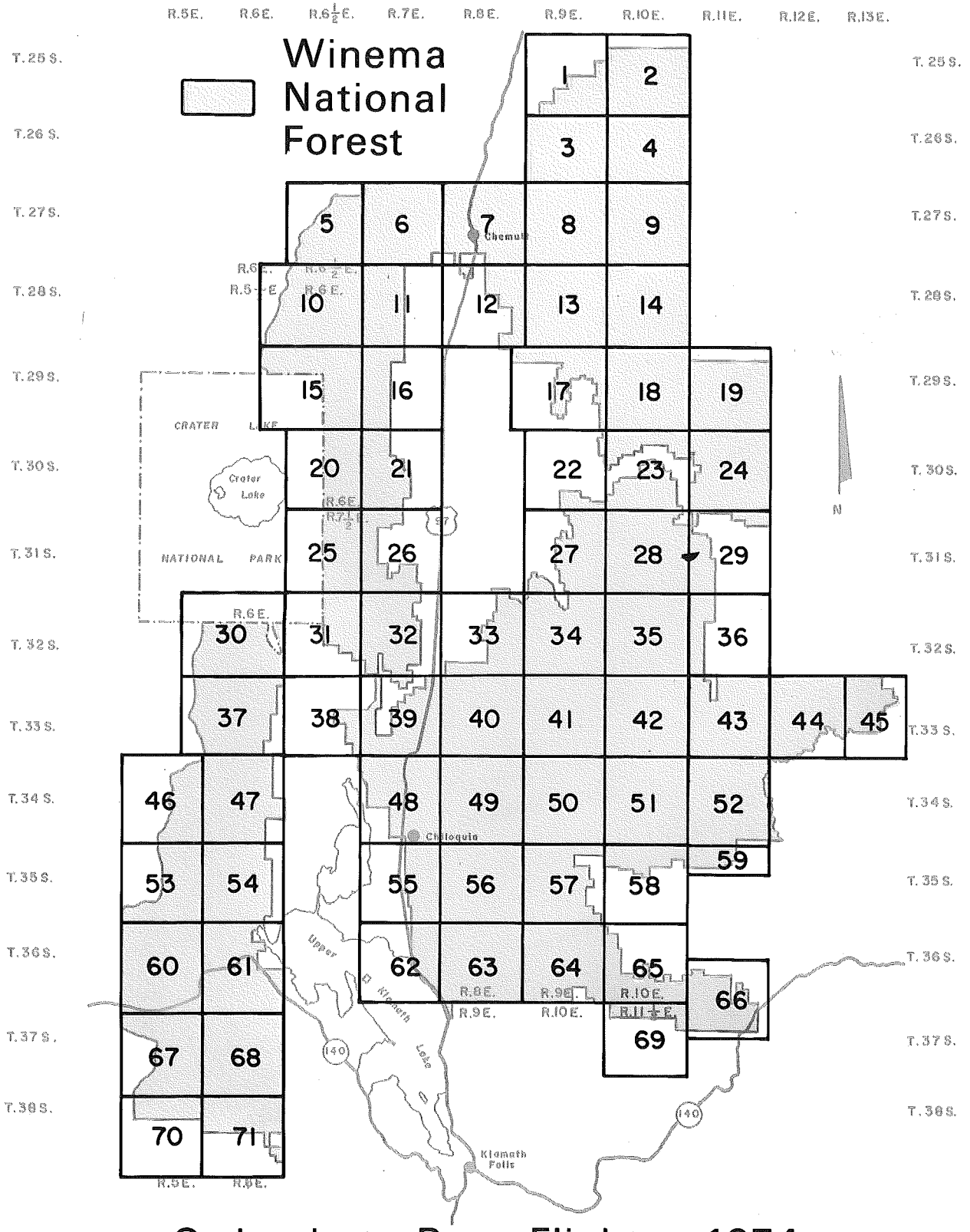
Volcanic Ejecta - Any and all material forcibly blown out of volcanic cones, fissures, and vents.

SOIL MAPS

Sheet No.

INDEX MAP

(Arranged by sheet no.)



Orthophoto Base Flight — 1974

T.25S.,R9E.

Sheet No. 1

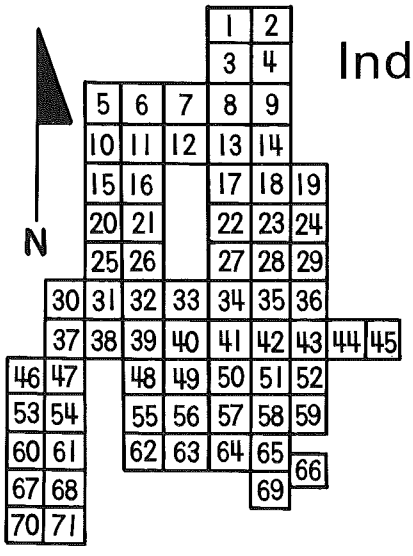
Deschutes National Forest

Deschutes National Forest



(sheet 2)

(sheet 3)



Index Map

Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

T.25S.,R.10E.

Sheet No. 2

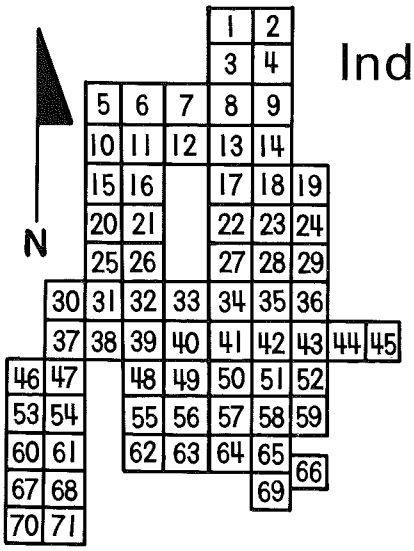
Deschutes National Forest



(sheet 1)

Fremont National Forest

(sheet 4)



Index Map

Scale

1 inch = 1 mile

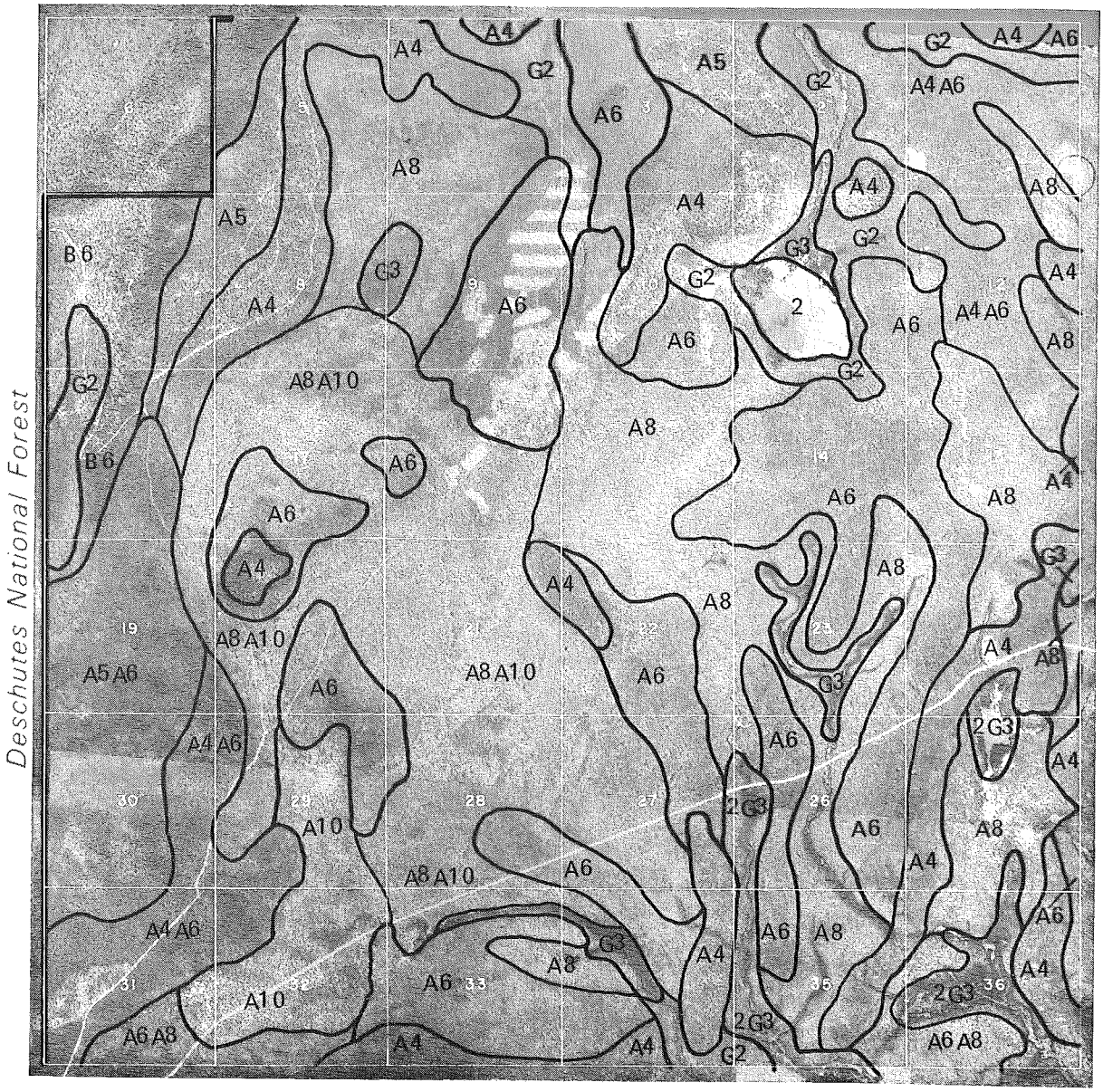
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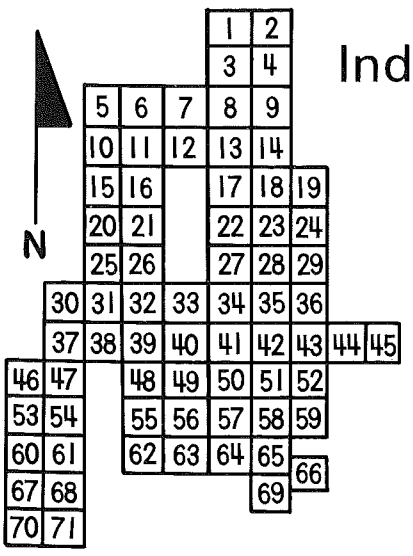
⊙ Soil Group Modal Location

T.26S.,R.9E.

Sheet No. 3

(sheet 1)





Index Map

Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

T.26S.,R.10E.

Sheet No. 4

(sheet 2)

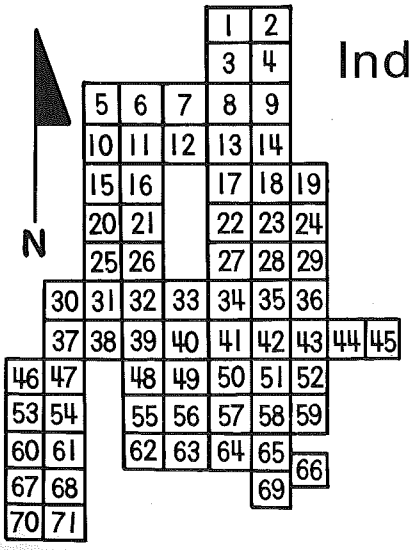
(sheet 3)



(sheet 9)

Fremont National Forest

Index Map



Scale

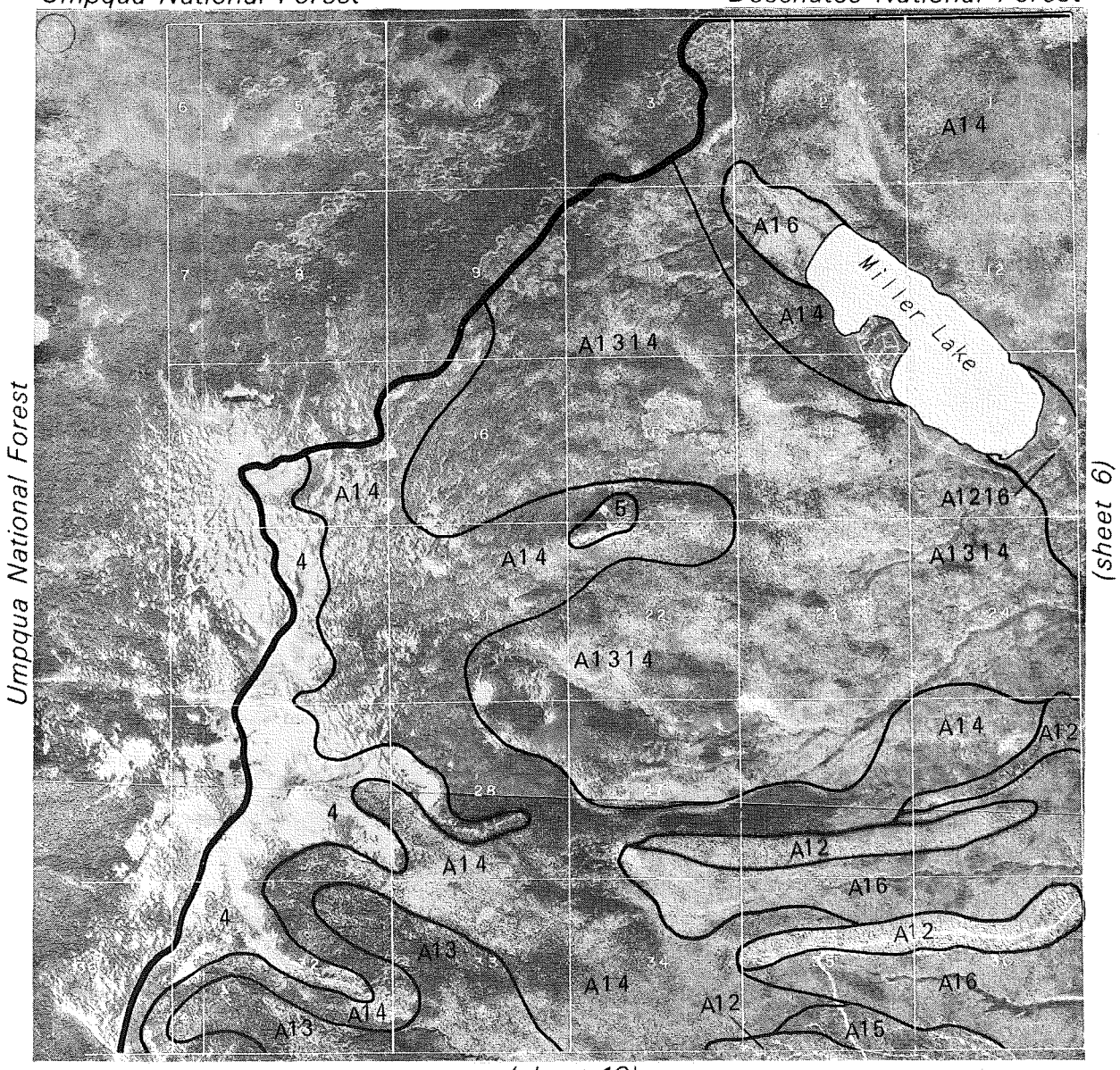
1 inch = 1 mile

Legend

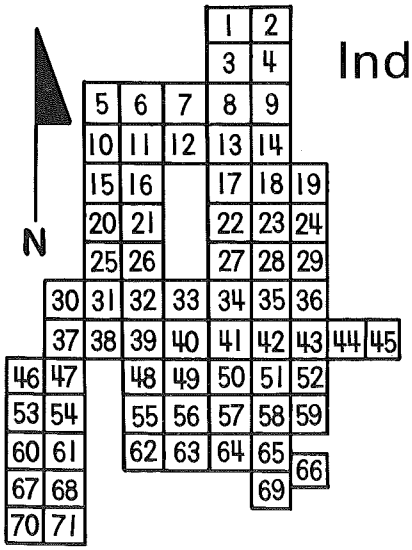
⊙ Soil Group Modal Location

T.27S.,R.6-1/2E.

Sheet No. 5



Index Map



Scale

1 inch = 1 mile

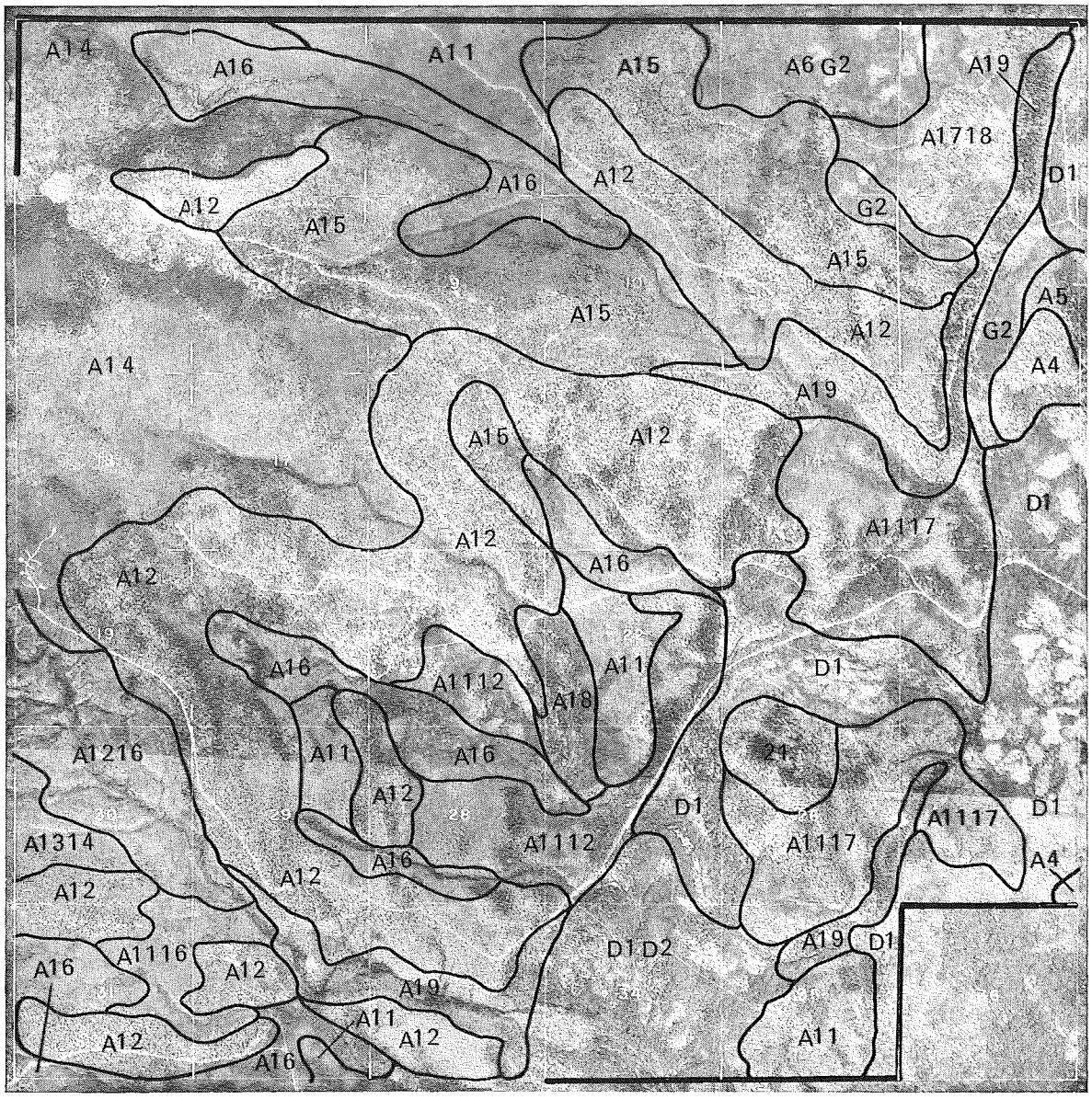
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⊙ Soil Group Modal Location

T.27S.,R.7E.

Sheet No. 6

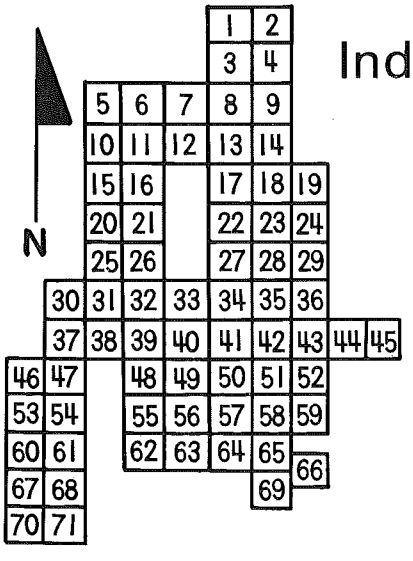
Deschutes National Forest



(sheet 5)

(sheet 7)

(sheet 11)



Index Map

Scale

1 inch = 1 mile

Legend

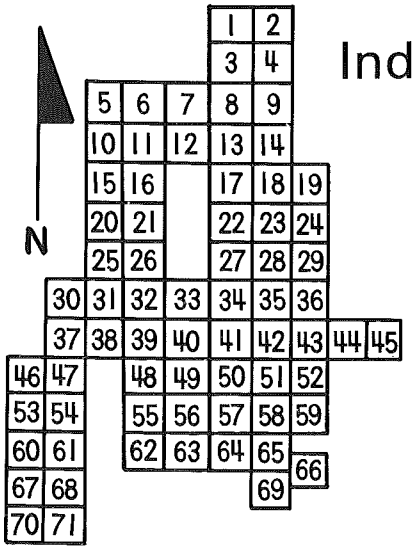
⊙ Soil Group Modal Location

T.27S.,R.8E.

Sheet No. 7

Deschutes National Forest





Index Map

Scale

1 inch = 1 mile

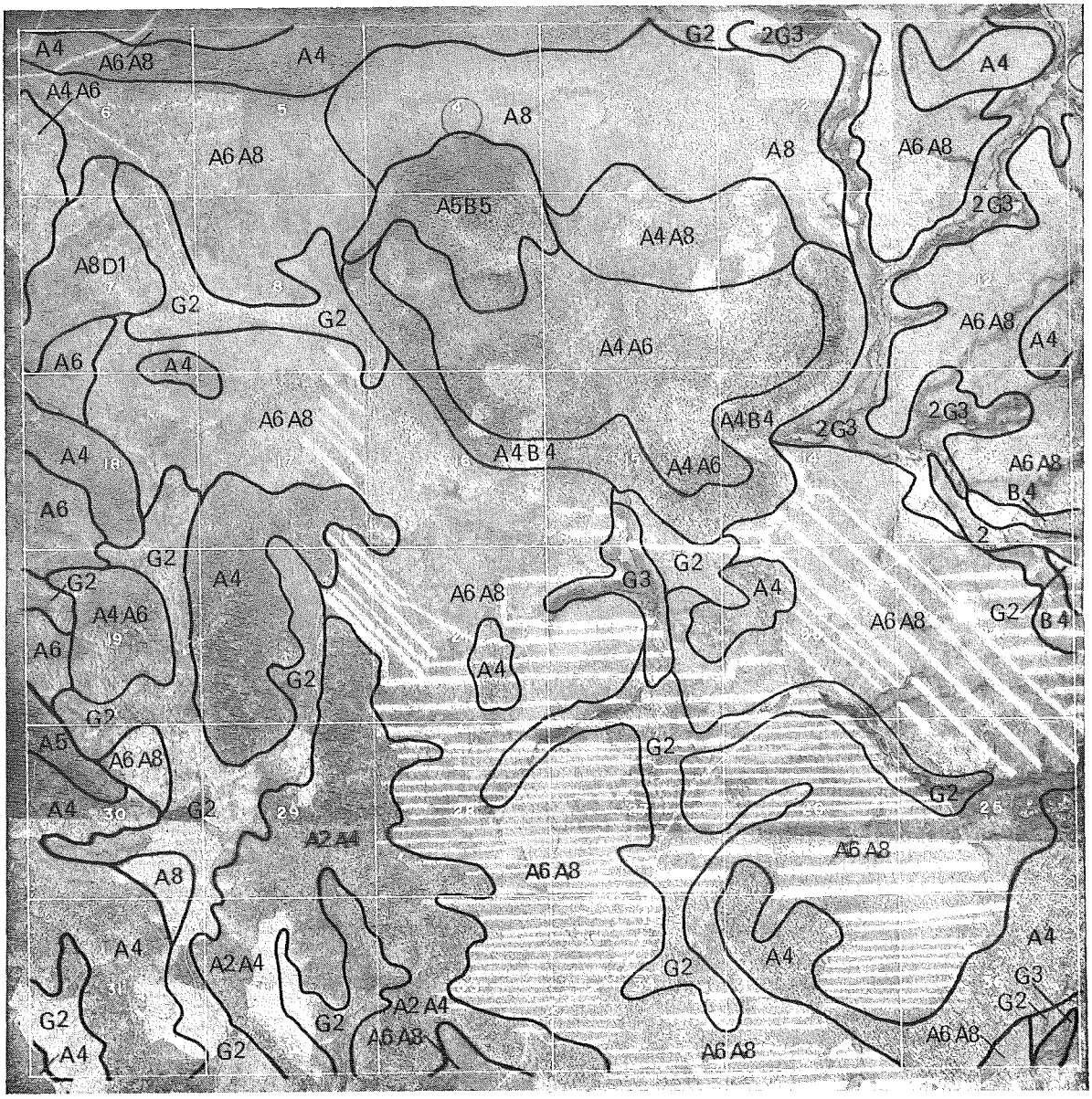
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⊙ Soil Group Modal Location

T.27S.,R.9E.

Sheet No. 8

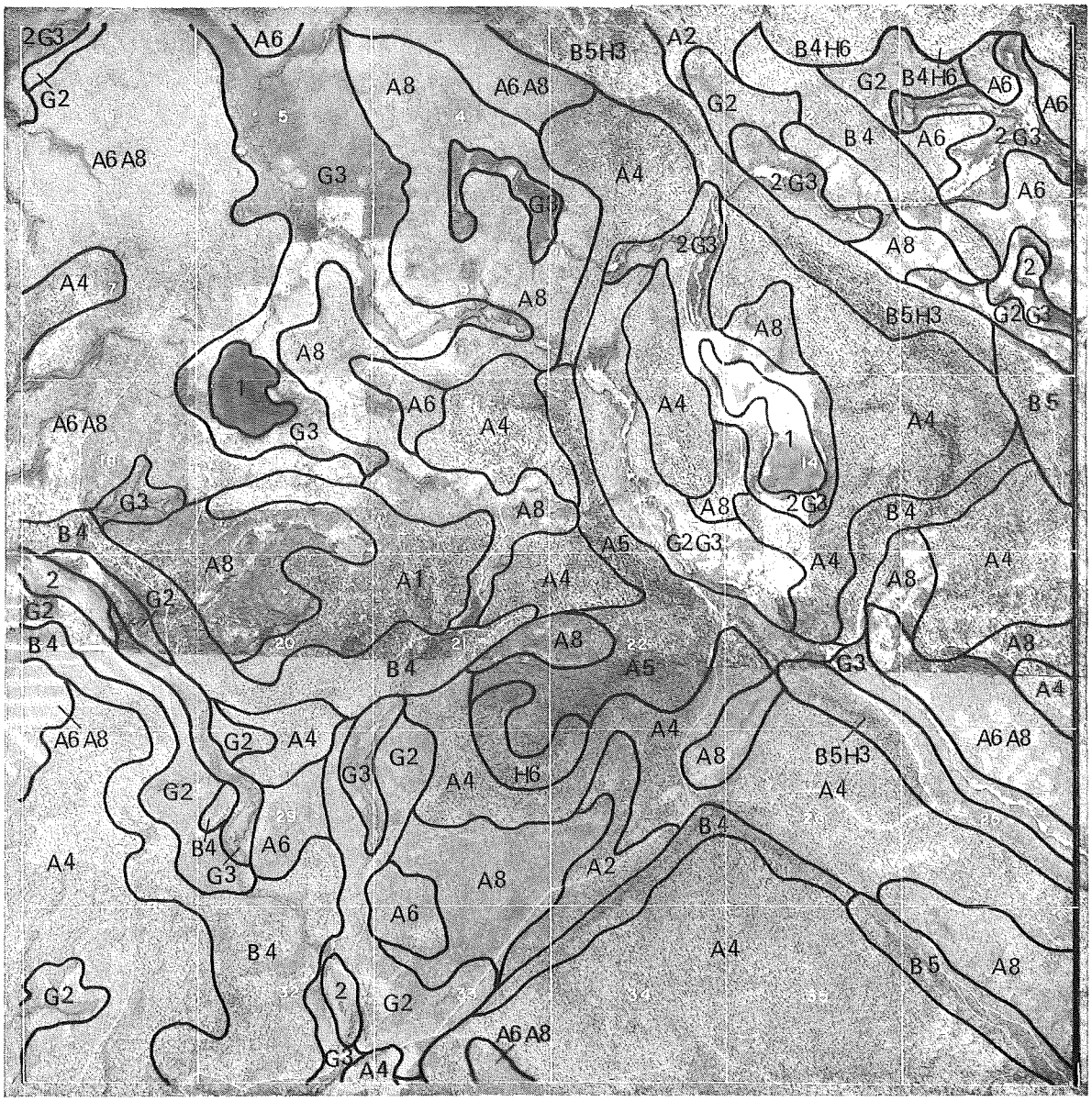
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A8
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A2 A4
A5
A3
G3
B4
A4 B4
A6 A8
A4 A6
A4
A6
A8
A5
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A4
A6 A8

T.27S.,R.10E.

Sheet No. 9

(sheet 4)

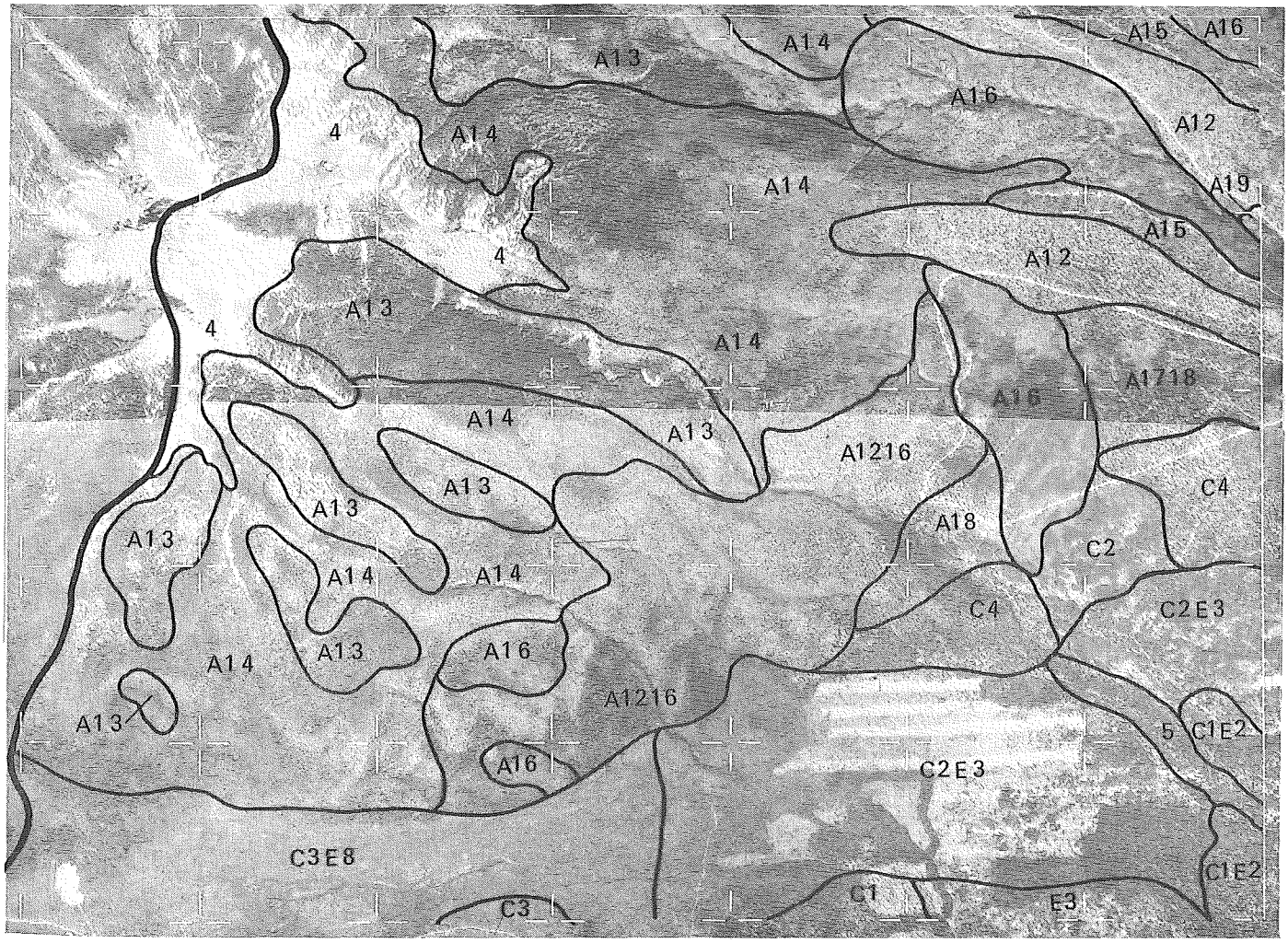

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A4

T.28S.,R.6E.

Sheet No. 10

(sheet 5)

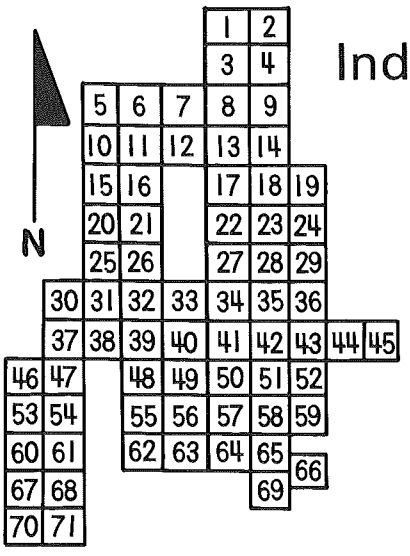
Umpqua National Forest



(sheet 11)

(sheet 15)

Index Map



Scale

1 inch = 1 mile

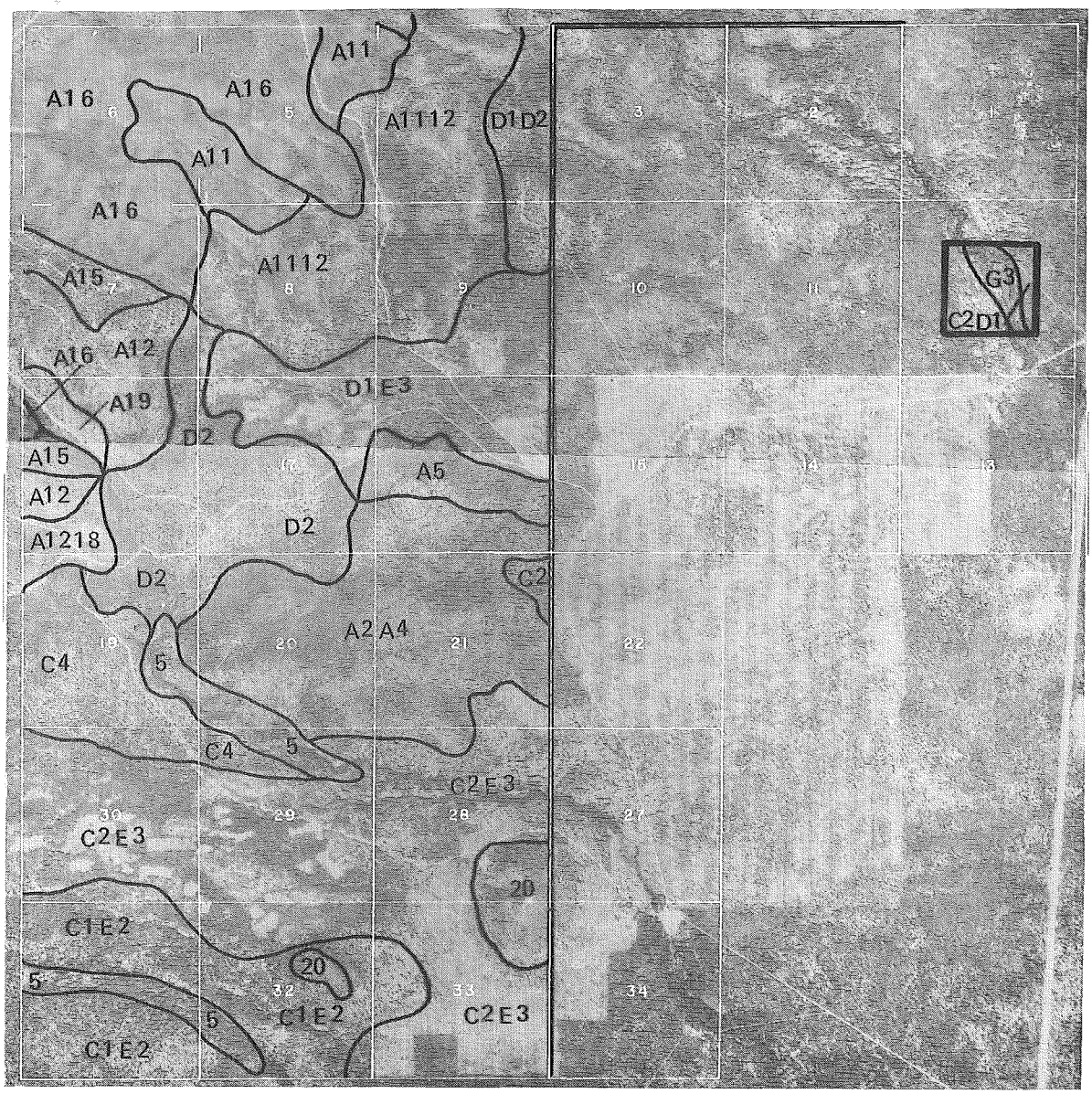
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⊙ Soil Group Modal Location

T.28S.,R.7E.

Sheet No. 11

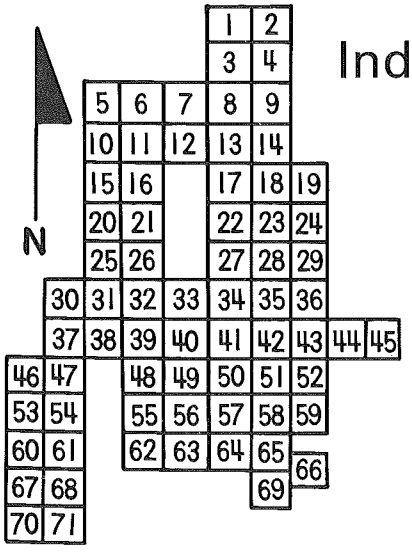
(sheet 6)



(sheet 10)

(sheet 12)

(sheet 16)



Index Map

Scale

1 inch = 1 mile

Legend

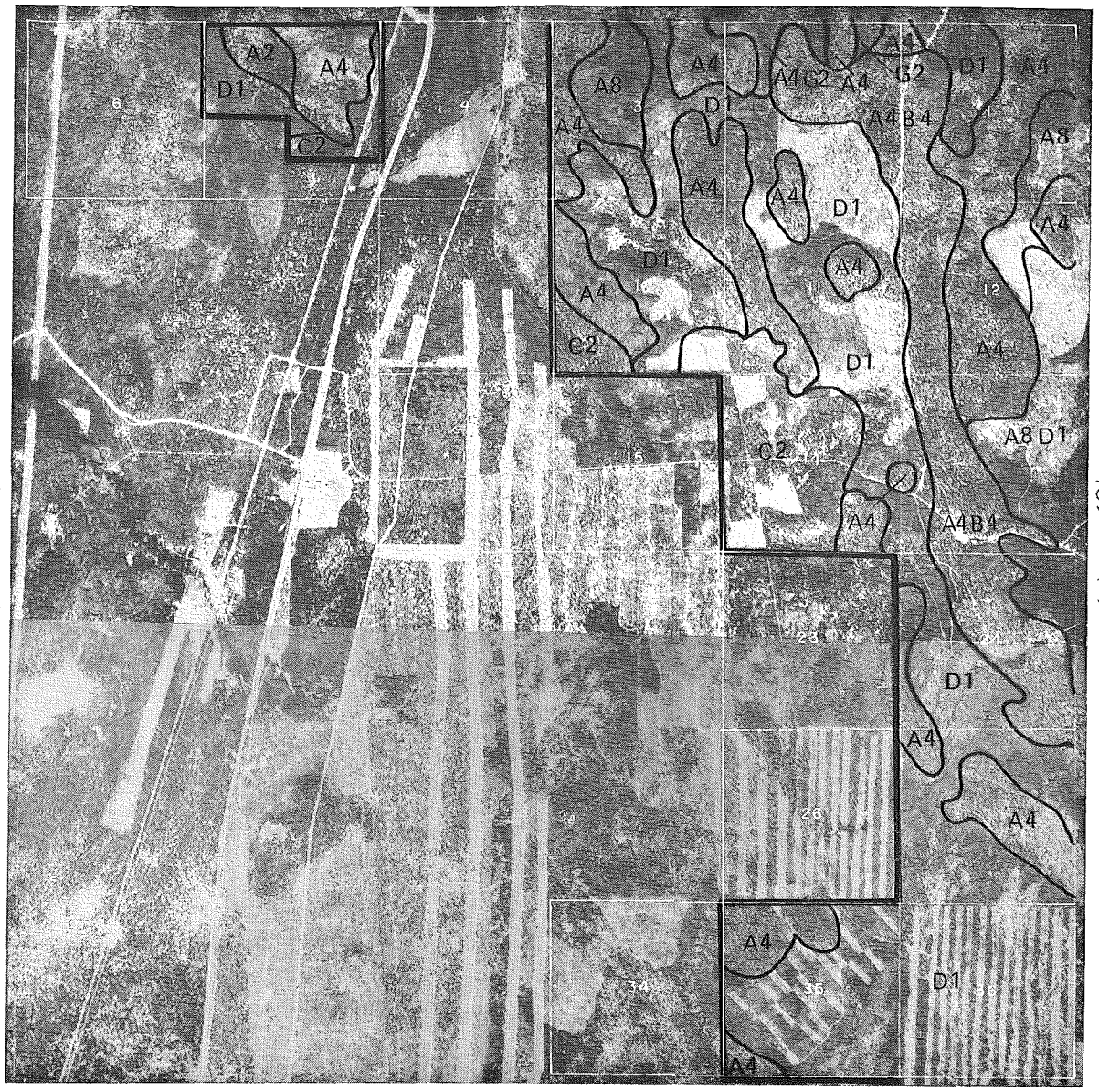
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T.28S.,R.8E.

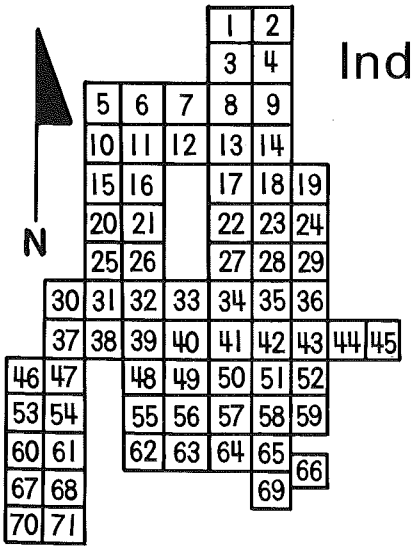
Sheet No. 12

(sheet 7)

(sheet 11)



(sheet 13)



Index Map

Scale

1 inch = 1 mile

Legend

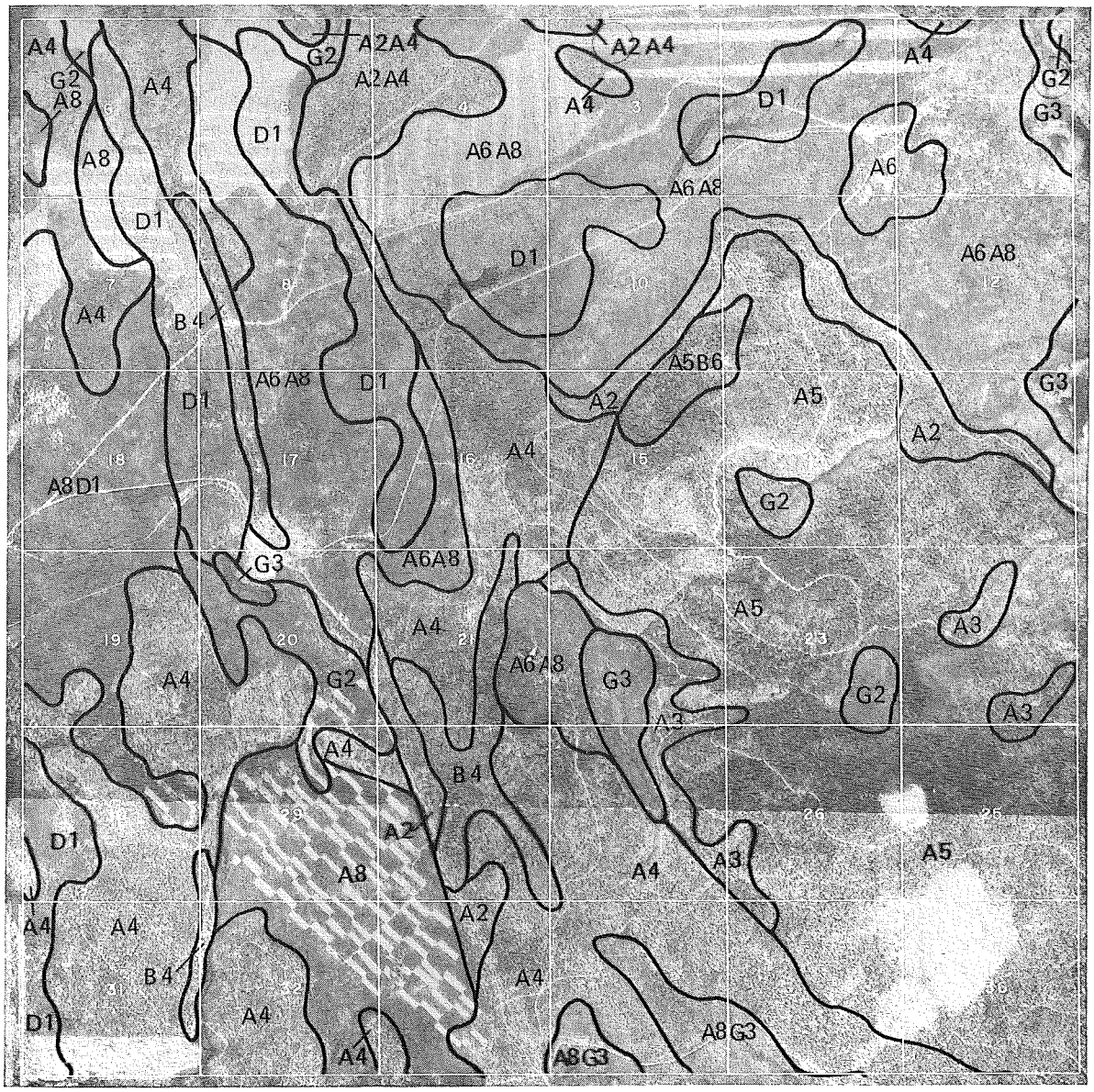
⊙ Soil Group Modal Location

T.28S.,R.9E.

Sheet No. 13

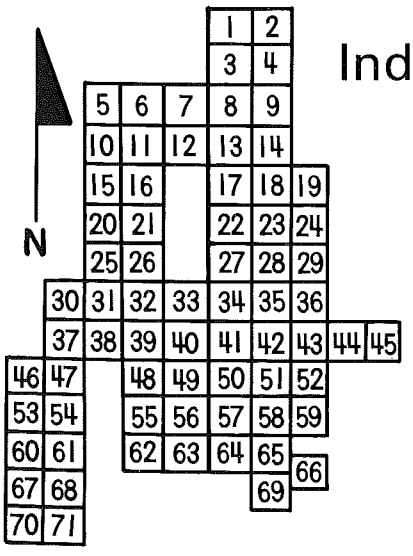
(sheet 8)

(sheet 12)



(sheet 14)

(sheet 17)



Index Map

Scale

1 inch = 1 mile

Legend

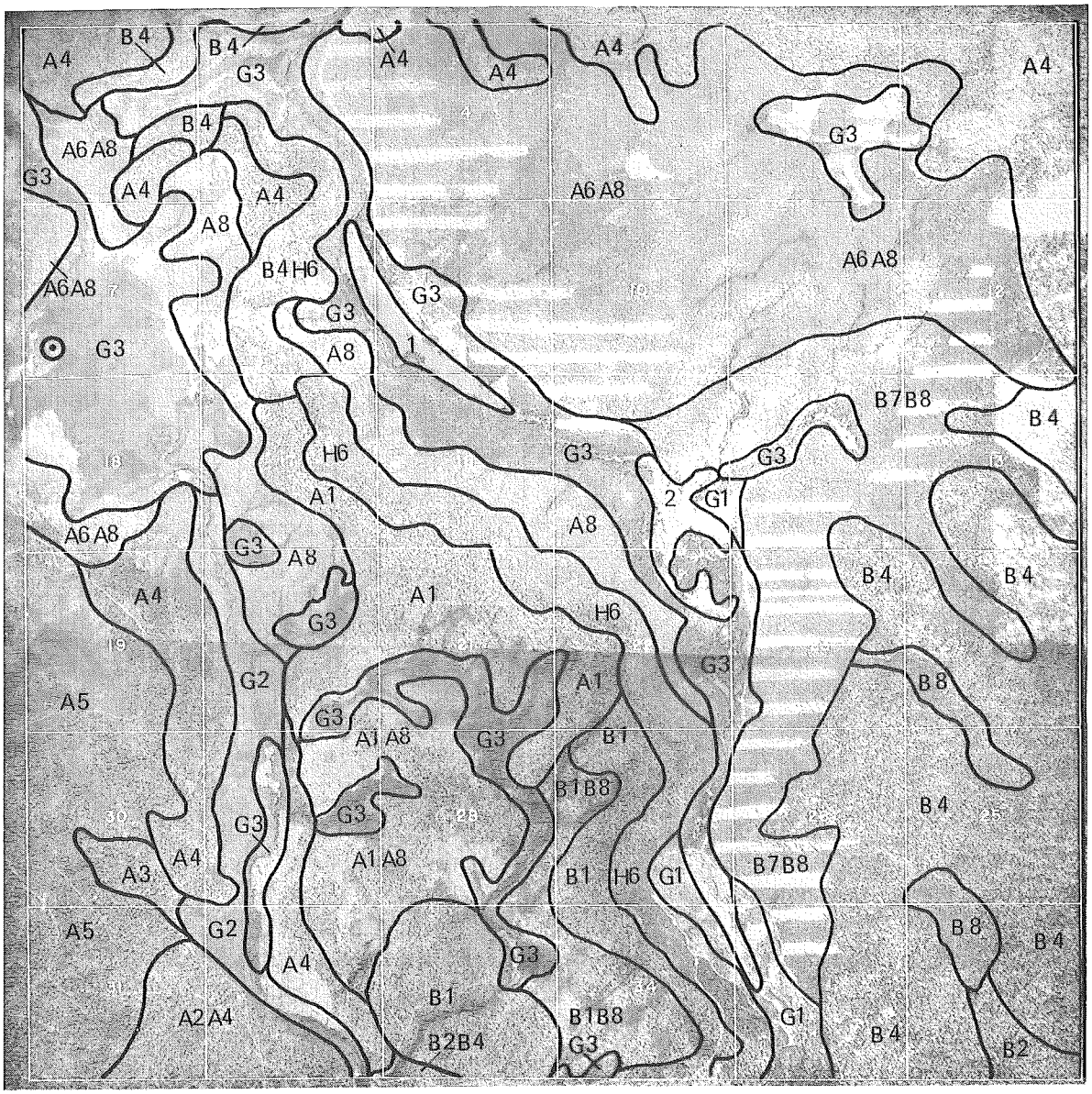
⊙ Soil Group Modal Location

T.28S.,R.10E.

Sheet No. 14

(sheet 9)

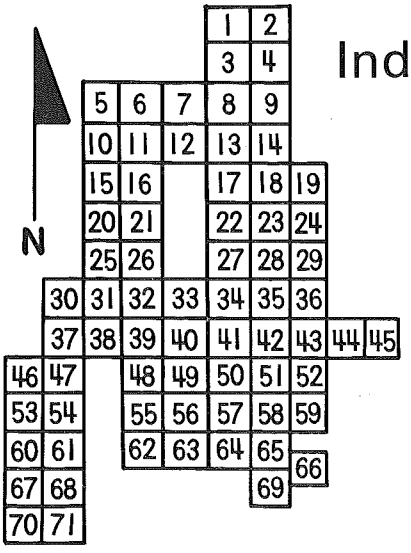
(sheet 13)



(sheet 18)

Fremont National Forest

Index Map



Scale

1 inch = 1 mile

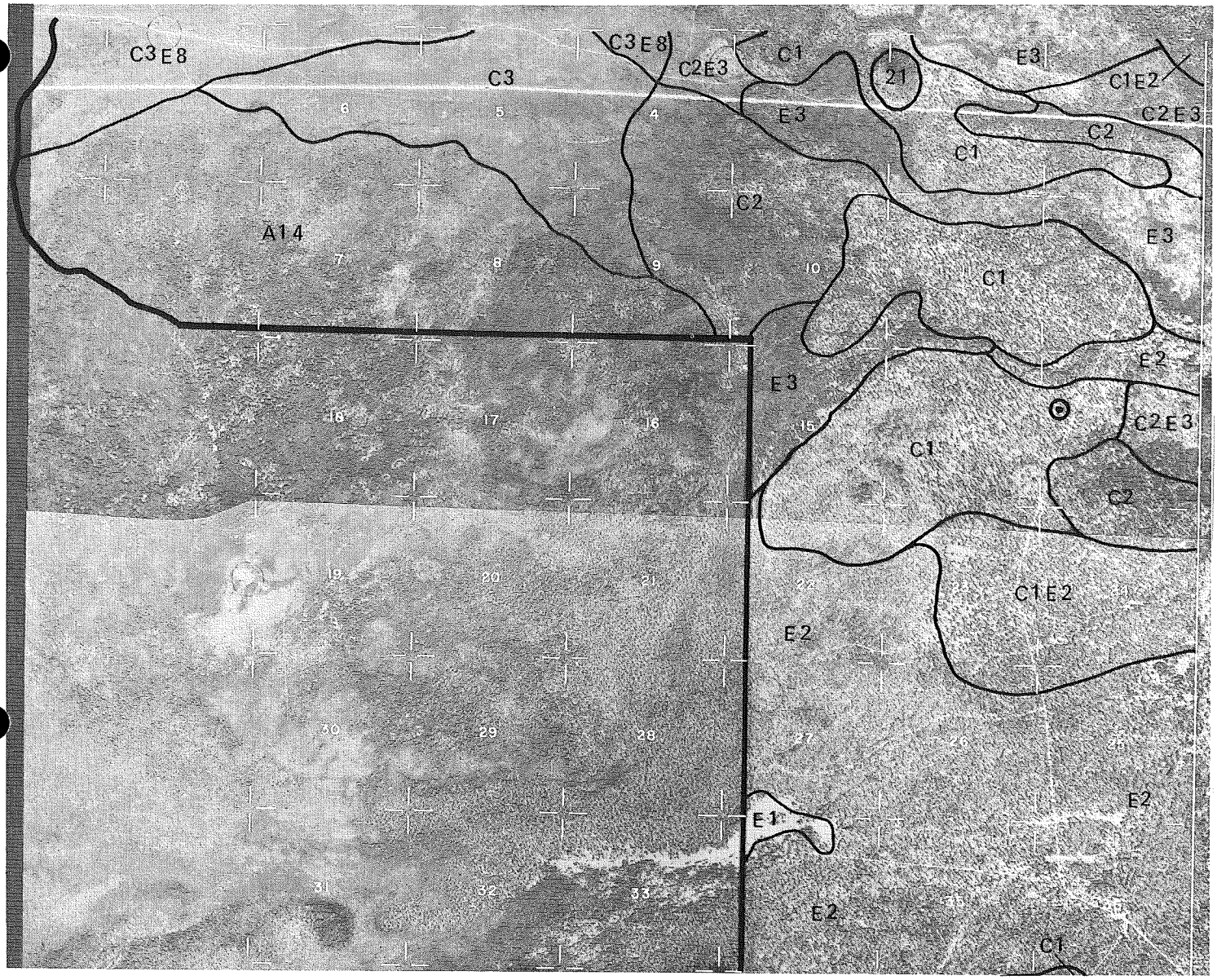
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⊙ Soil Group Modal Location

T.29S.,R.6E.

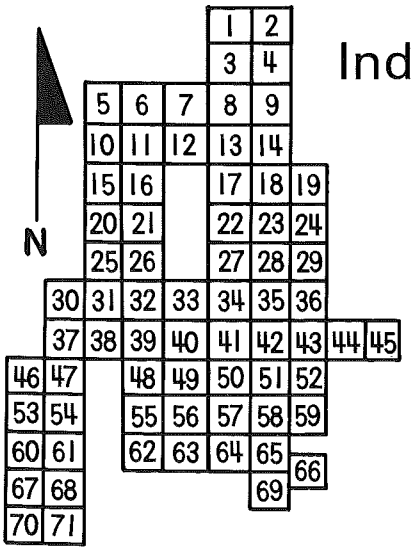
Sheet No. 15

(sheet 10)



(sheet 16)

(sheet 20)



Index Map

Scale

1 inch = 1 mile

Legend

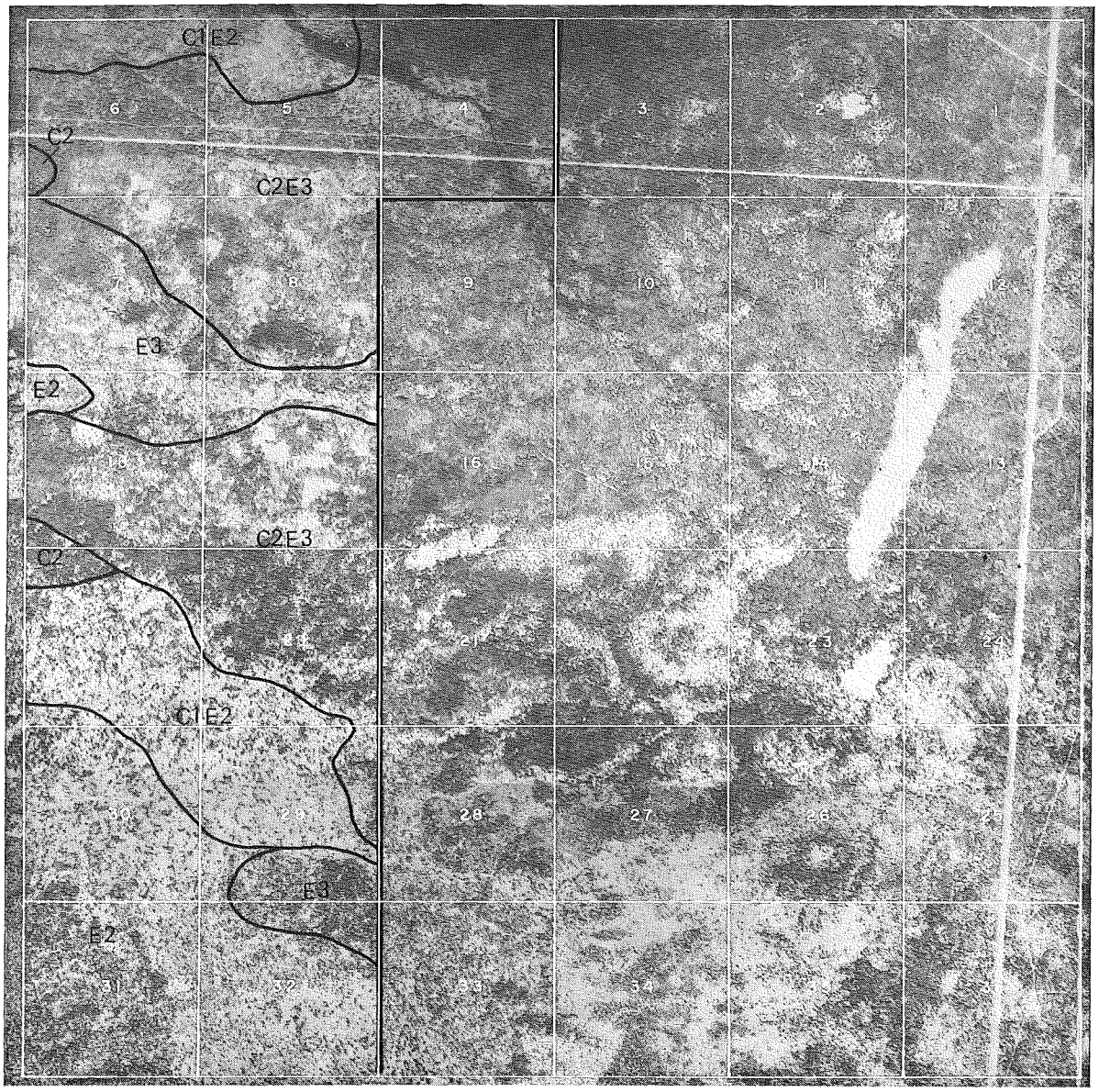
⊙ Soil Group Modal Location

T.29S.,R.7E.

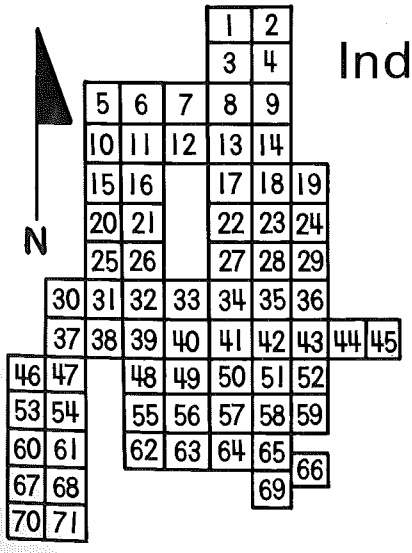
Sheet No. 16

(sheet 11)

(sheet 15)



(sheet 21)



Index Map

Scale

1 inch = 1 mile

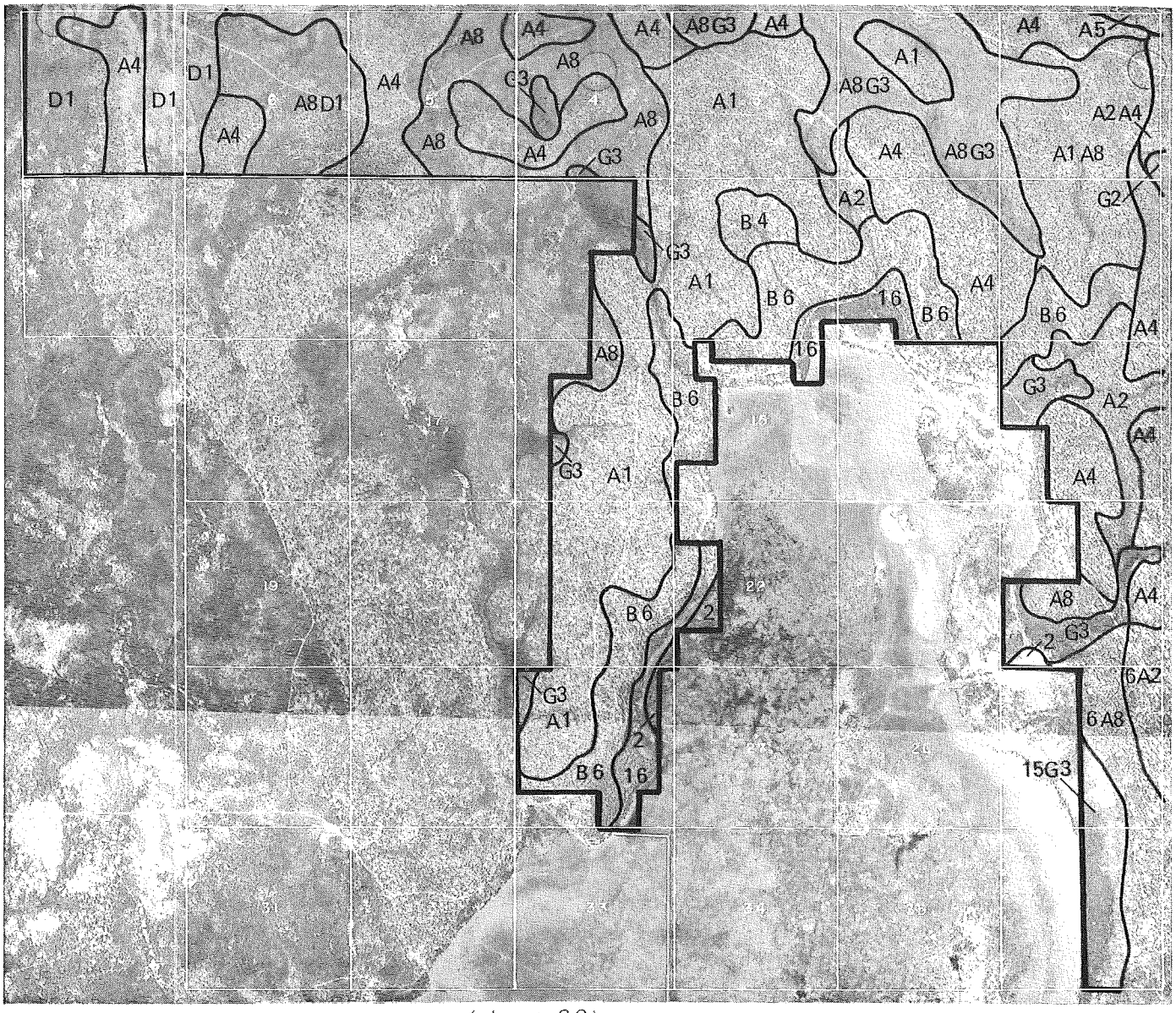
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⊙ Soil Group Modal Location

T.29S.,R.9E.

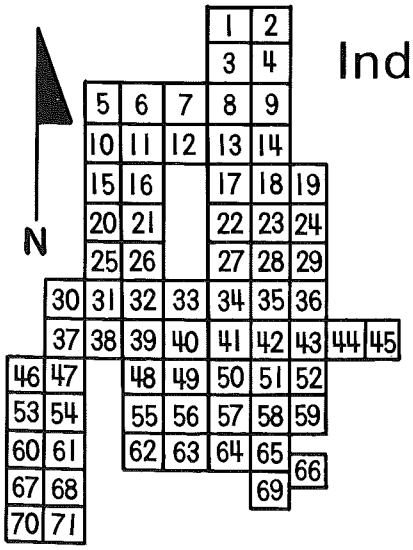
Sheet No. 17

(sheet 13)



(sheet 22)

(sheet 18)



Index Map

Scale

1 inch = 1 mile

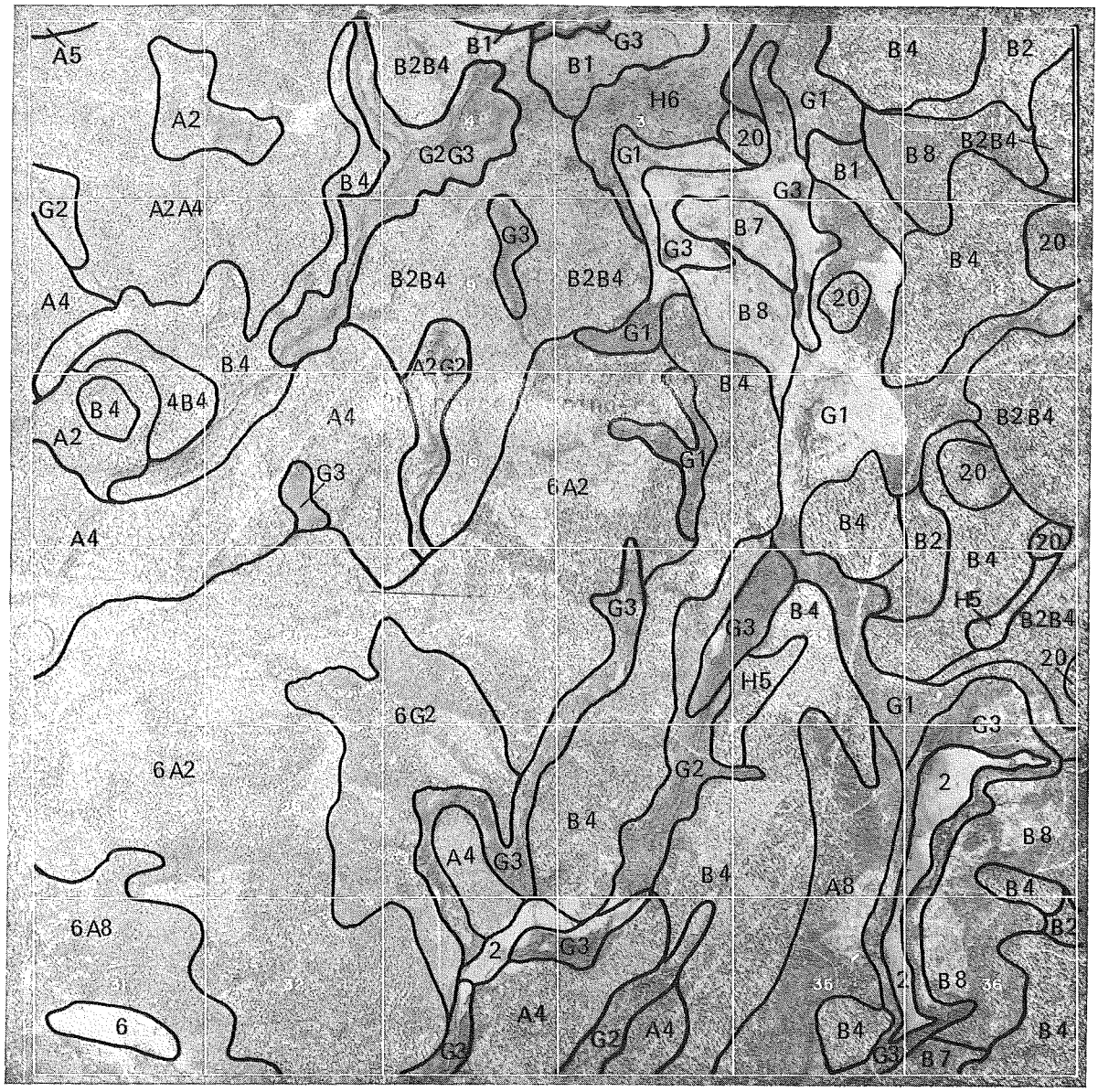
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⊙ Soil Group Modal Location

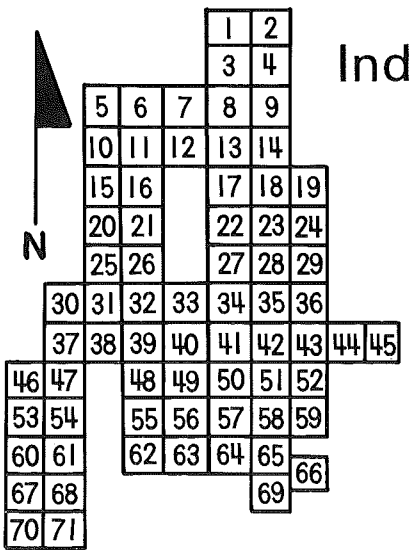
T.29S.,R.10E.

Sheet No. 18

(sheet 14)



Index Map



Scale

1 inch = 1 mile

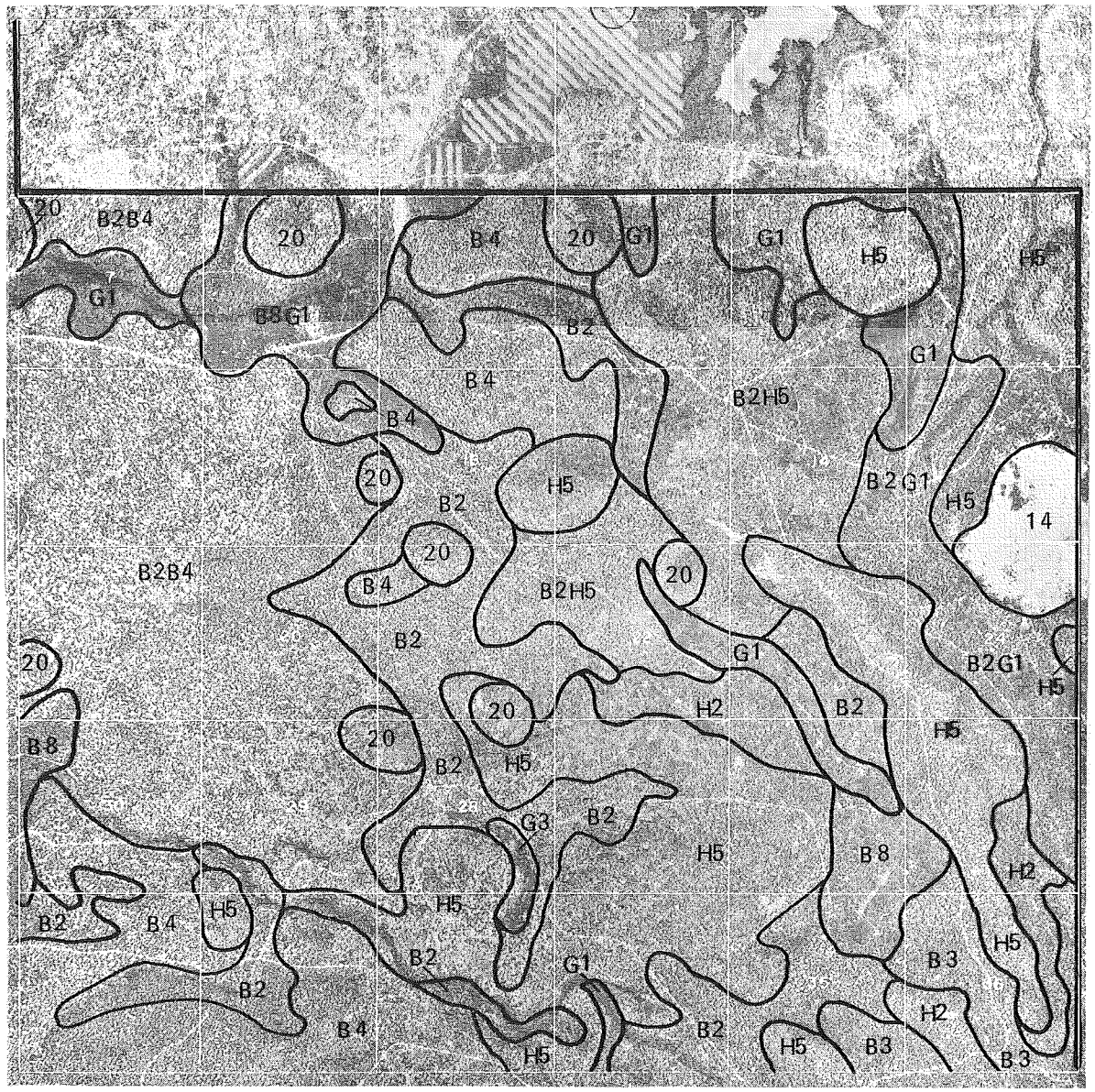
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⊙ Soil Group Modal Location

T.29S.,R.11E.

Sheet No. 19

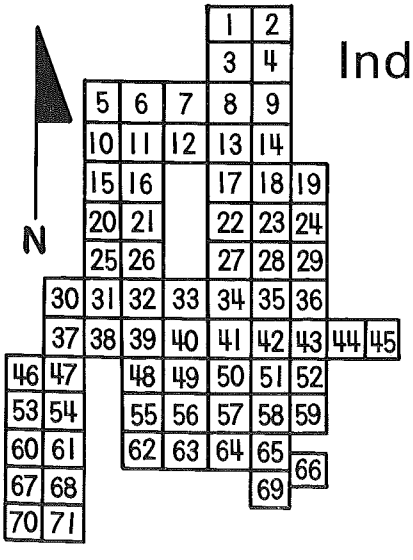
Fremont National Forest



(sheet 18)

Fremont National Forest

(sheet 24)



Index Map

Scale

1 inch = 1 mile

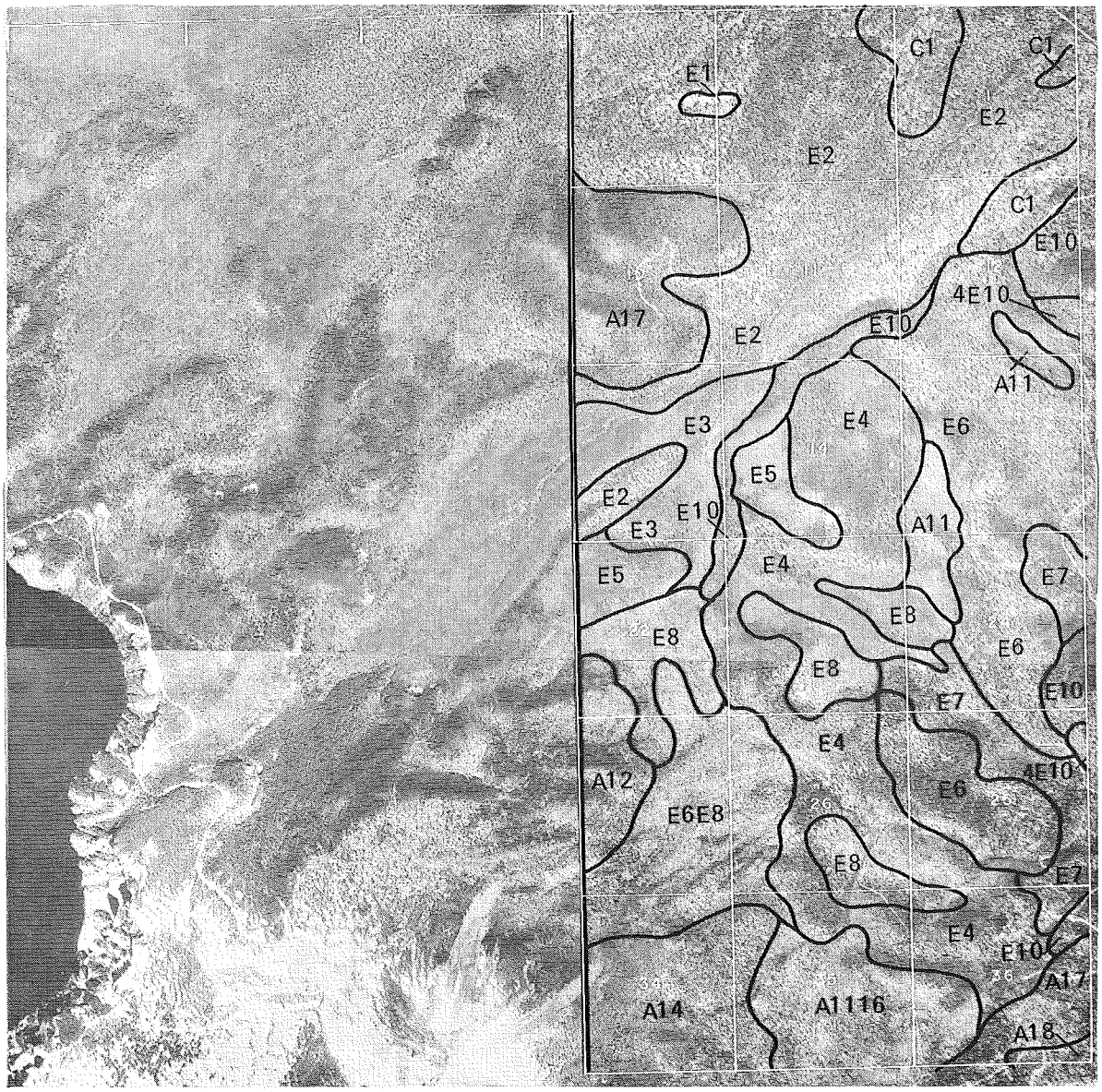
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⊙ Soil Group Modal Location

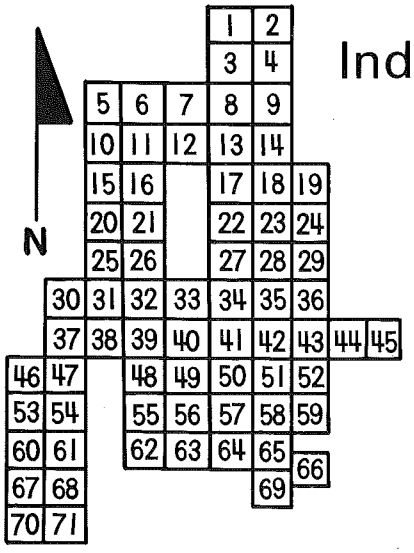
T.30S.,R.6E.

Sheet No. 20

(sheet 15)



(sheet 25)



Index Map

Scale

1 inch = 1 mile

Legend

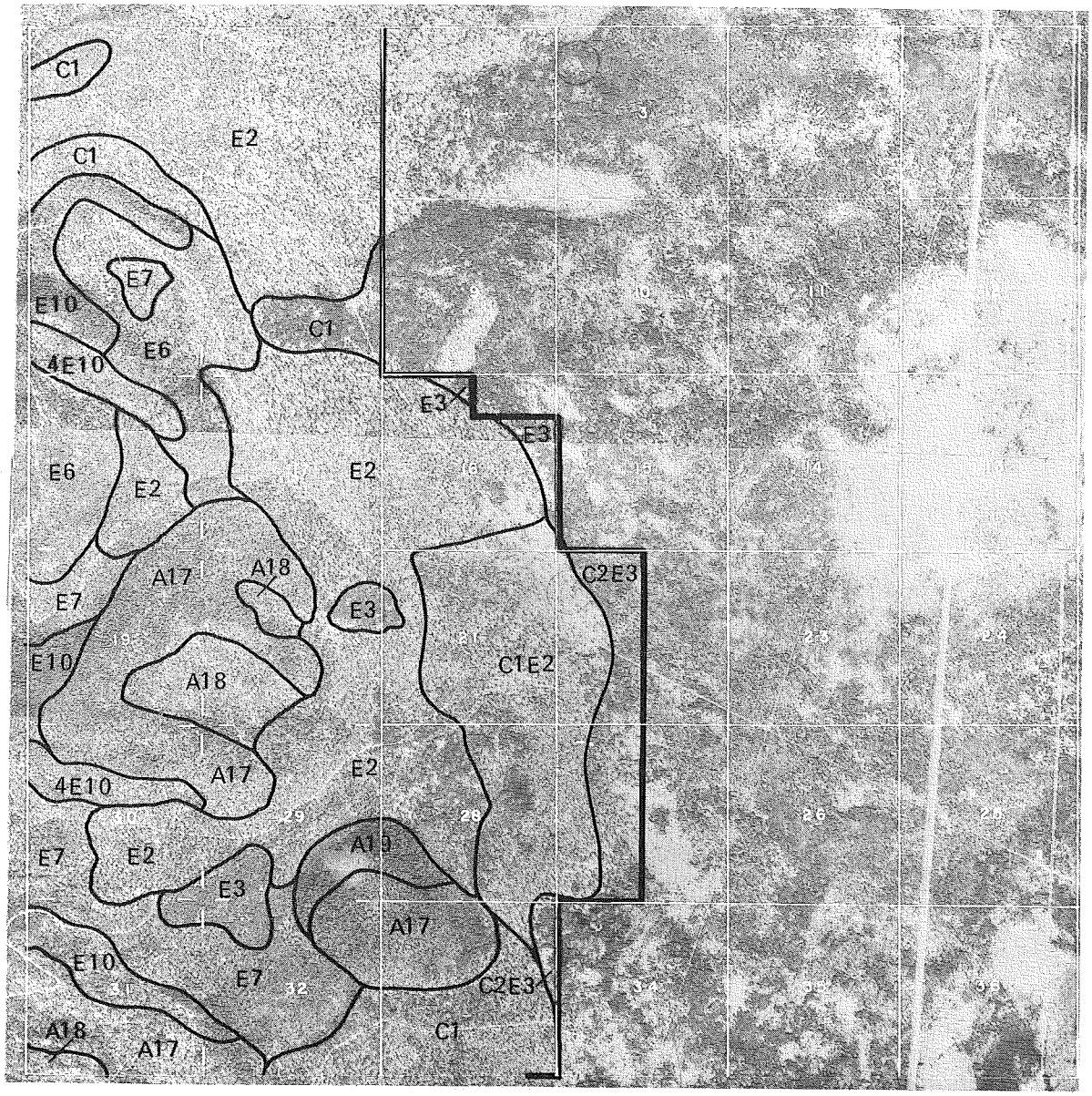
⊙ Soil Group Modal Location

T.30S.,R.7E.

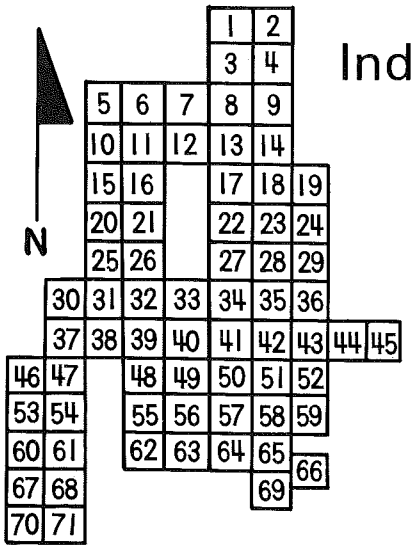
Sheet No. 21

(sheet 16)

(sheet 20)



(sheet 26)



Index Map

Scale

1 inch = 1 mile

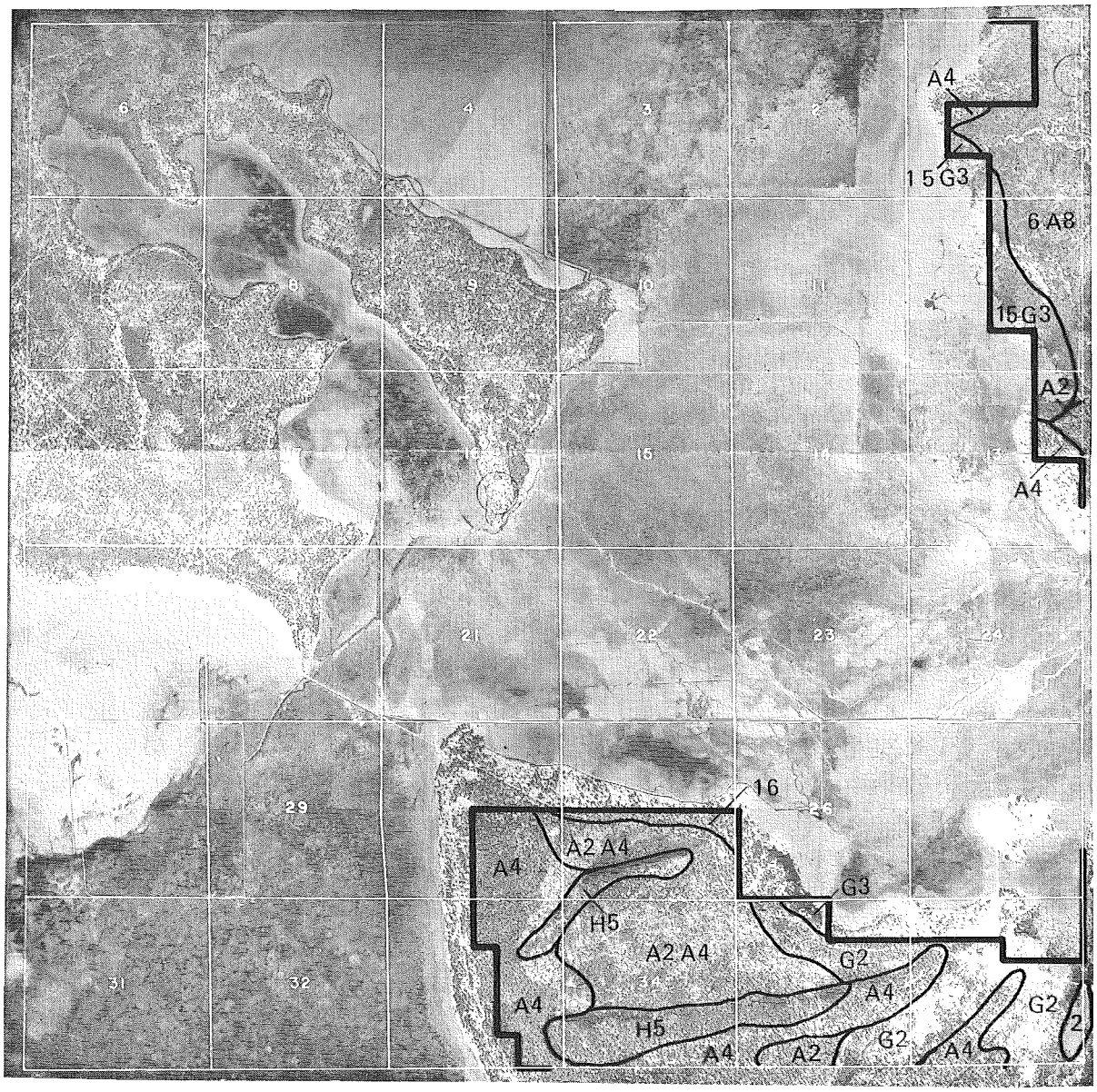
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⊙ Soil Group Modal Location

T.30S.,R.9E.

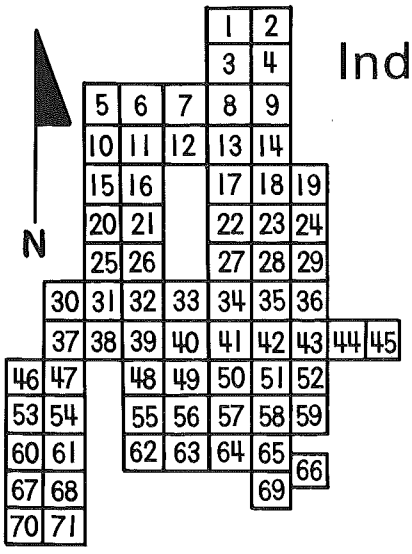
Sheet No. 22

(sheet 17)



(sheet 23)

(sheet 27)



Index Map

Scale

1 inch = 1 mile

Legend

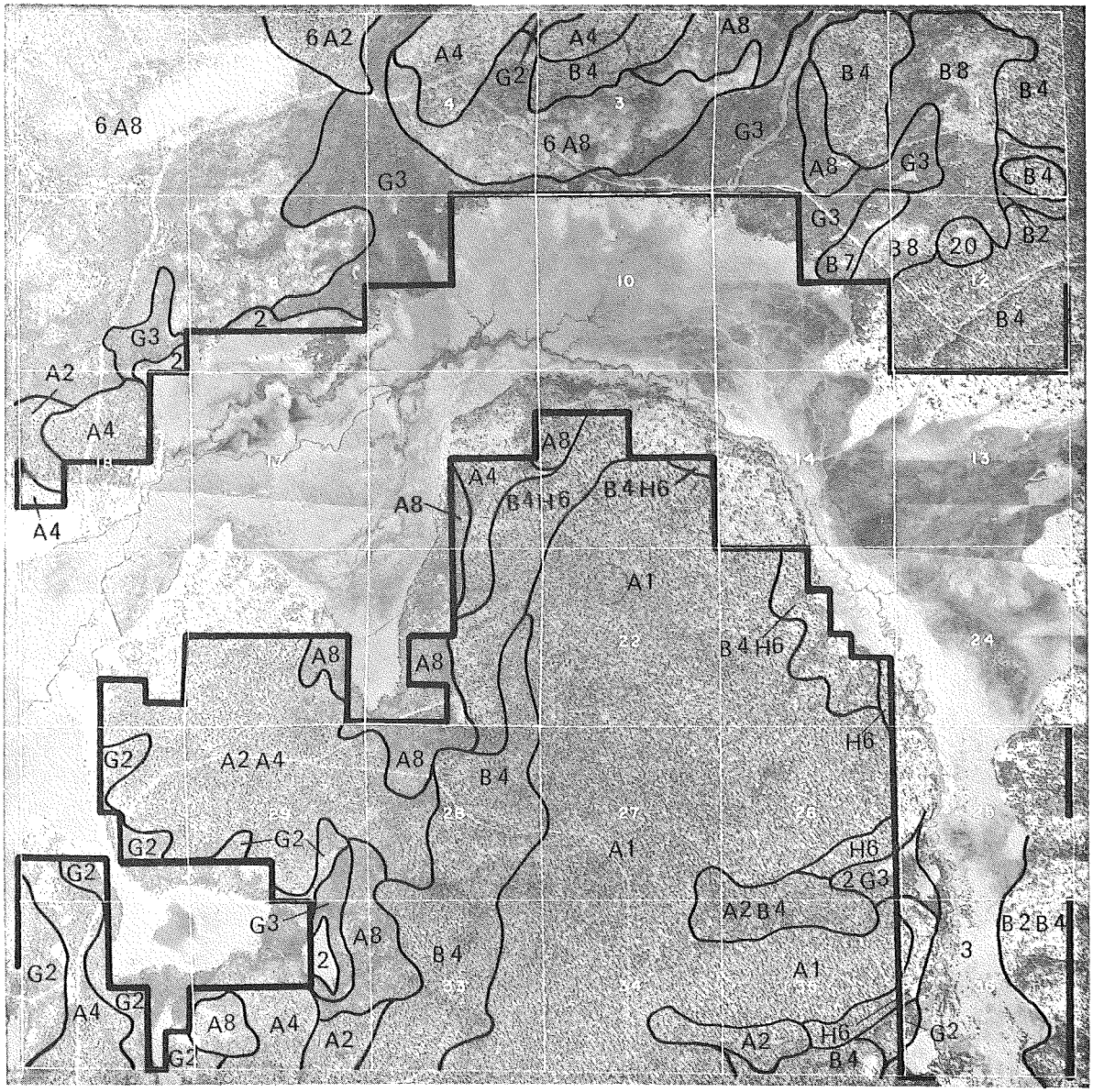
⊙ Soil Group Modal Location

T.30S.,R.10E.

Sheet No. 23

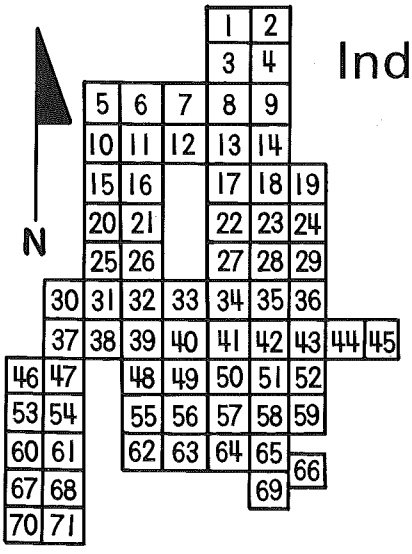
(sheet 18)

(sheet 22)



(sheet 24)

(sheet 28)



Index Map

Scale

1 inch = 1 mile

Legend

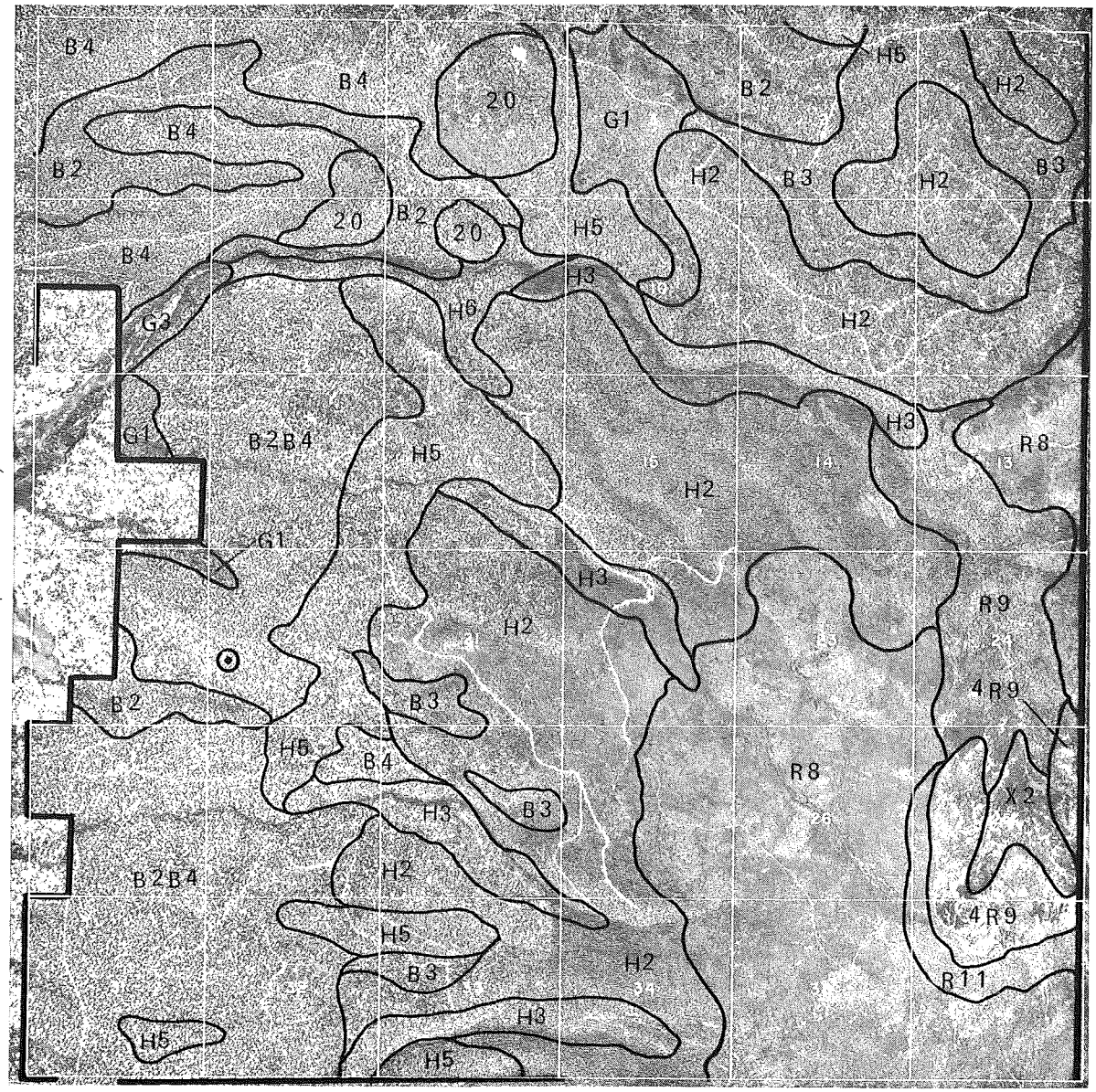
⊙ Soil Group Modal Location

T.30S.,R.11E.

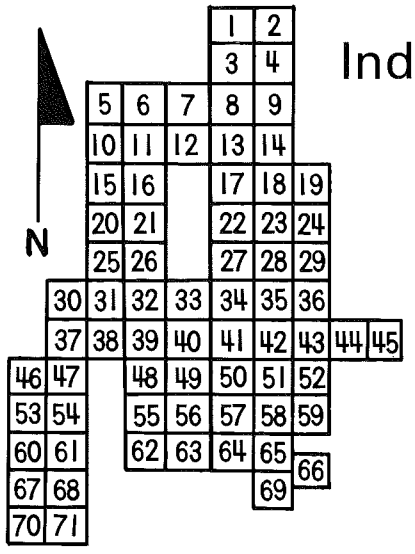
Sheet No.24

(sheet 19)

(sheet 23)



(sheet 29)



Index Map

Scale

1 inch = 1 mile

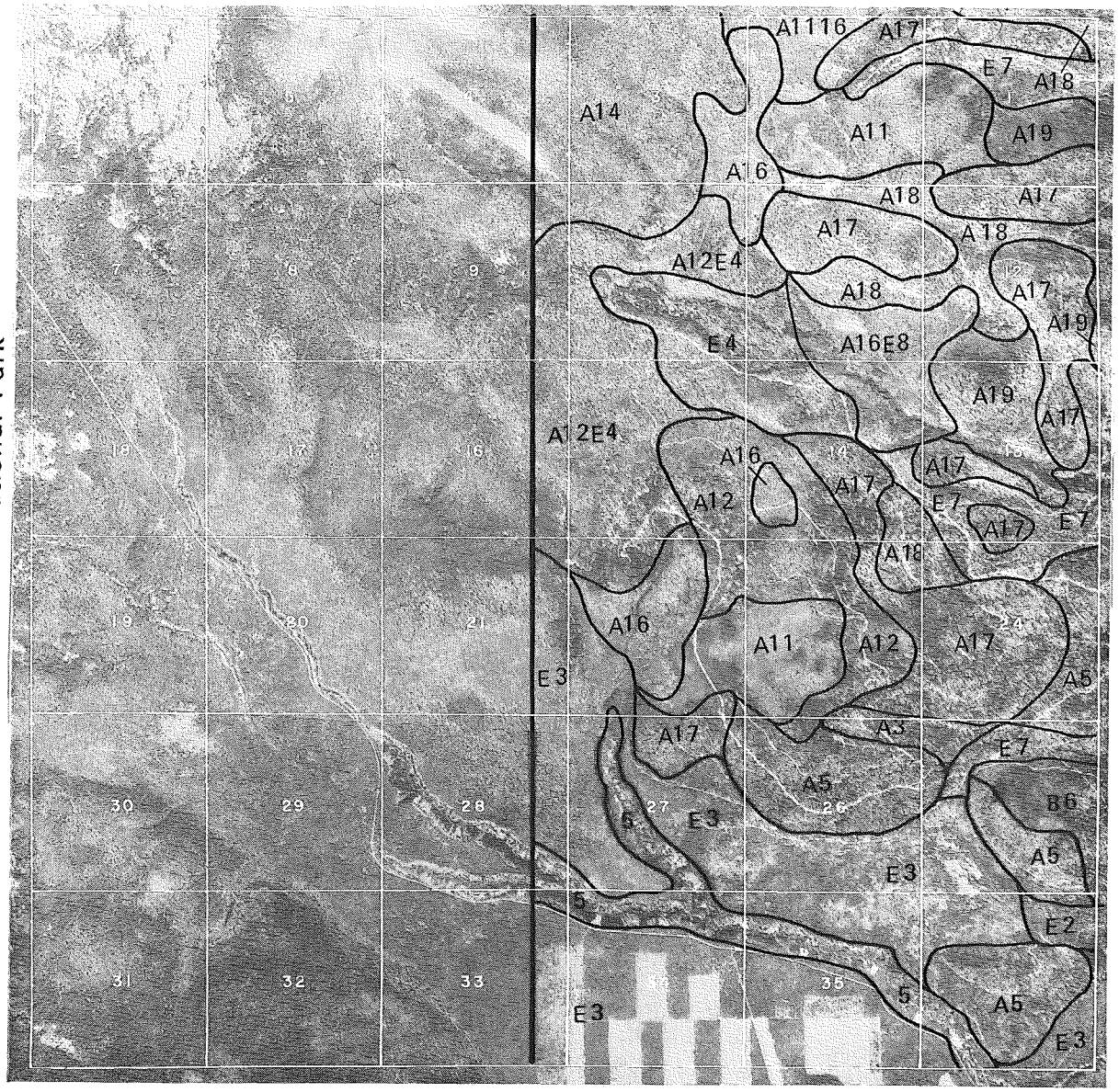
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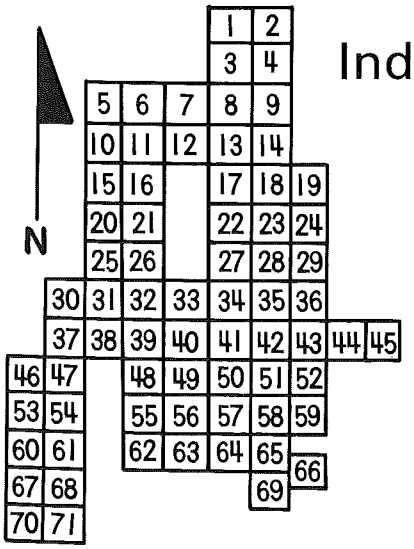
⊙ Soil Group Modal Location

T.31S.,R.7-1/2E.

Sheet No. 25

(sheet 20)





Index Map

Scale

1 inch = 1 mile

Legend

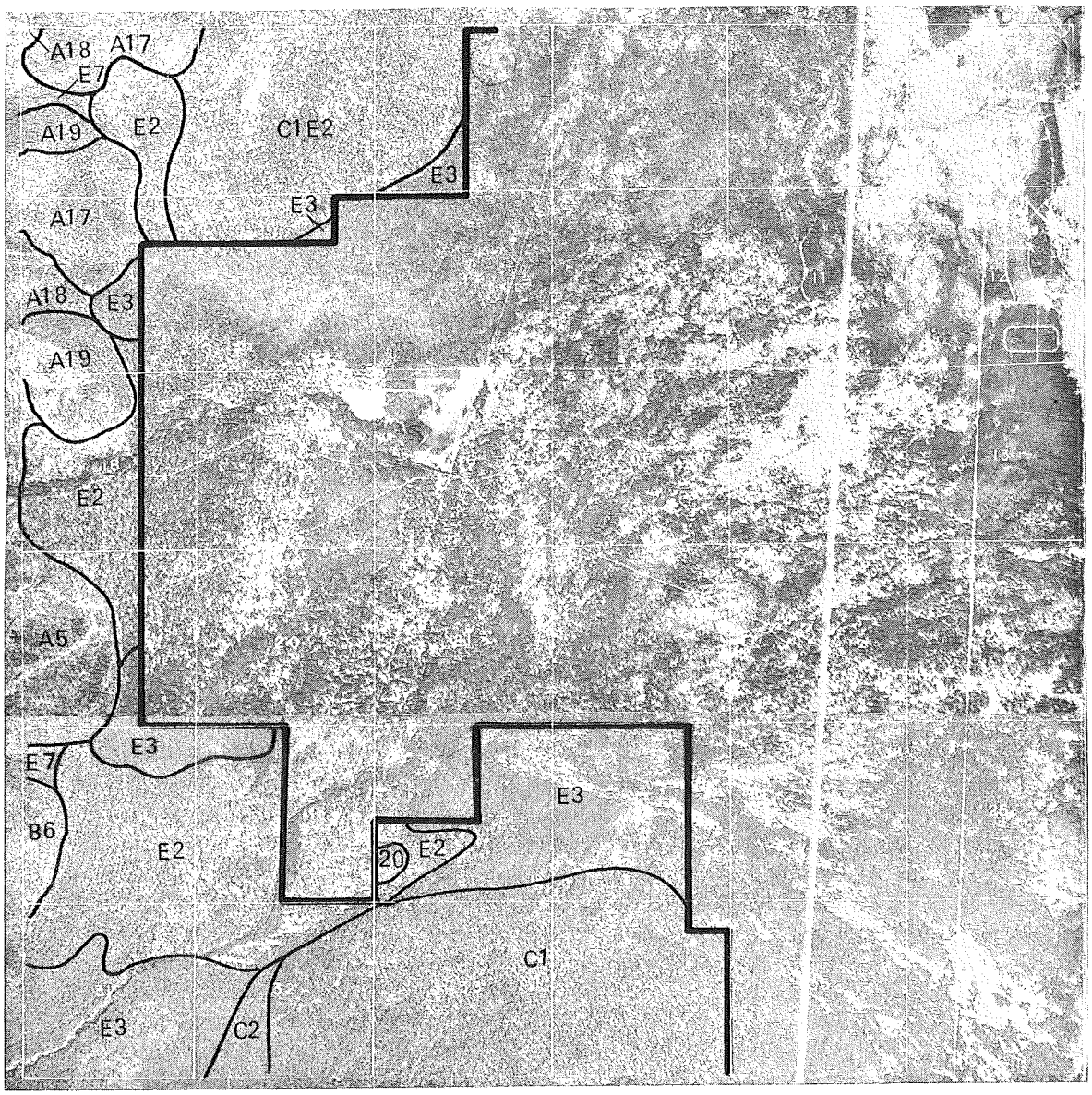
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T.31S.,R.7E.

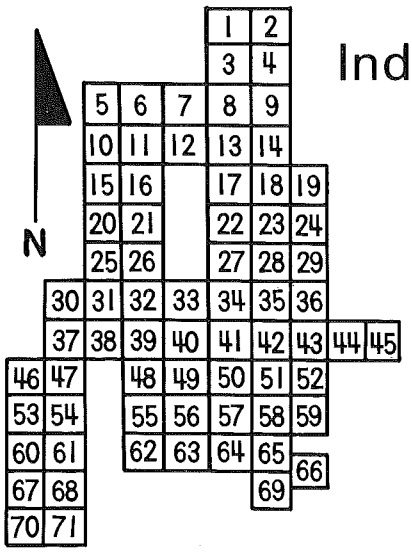
Sheet No.26

(sheet 21)

(sheet 25)



(sheet 32)



Index Map

Scale

1 inch = 1 mile

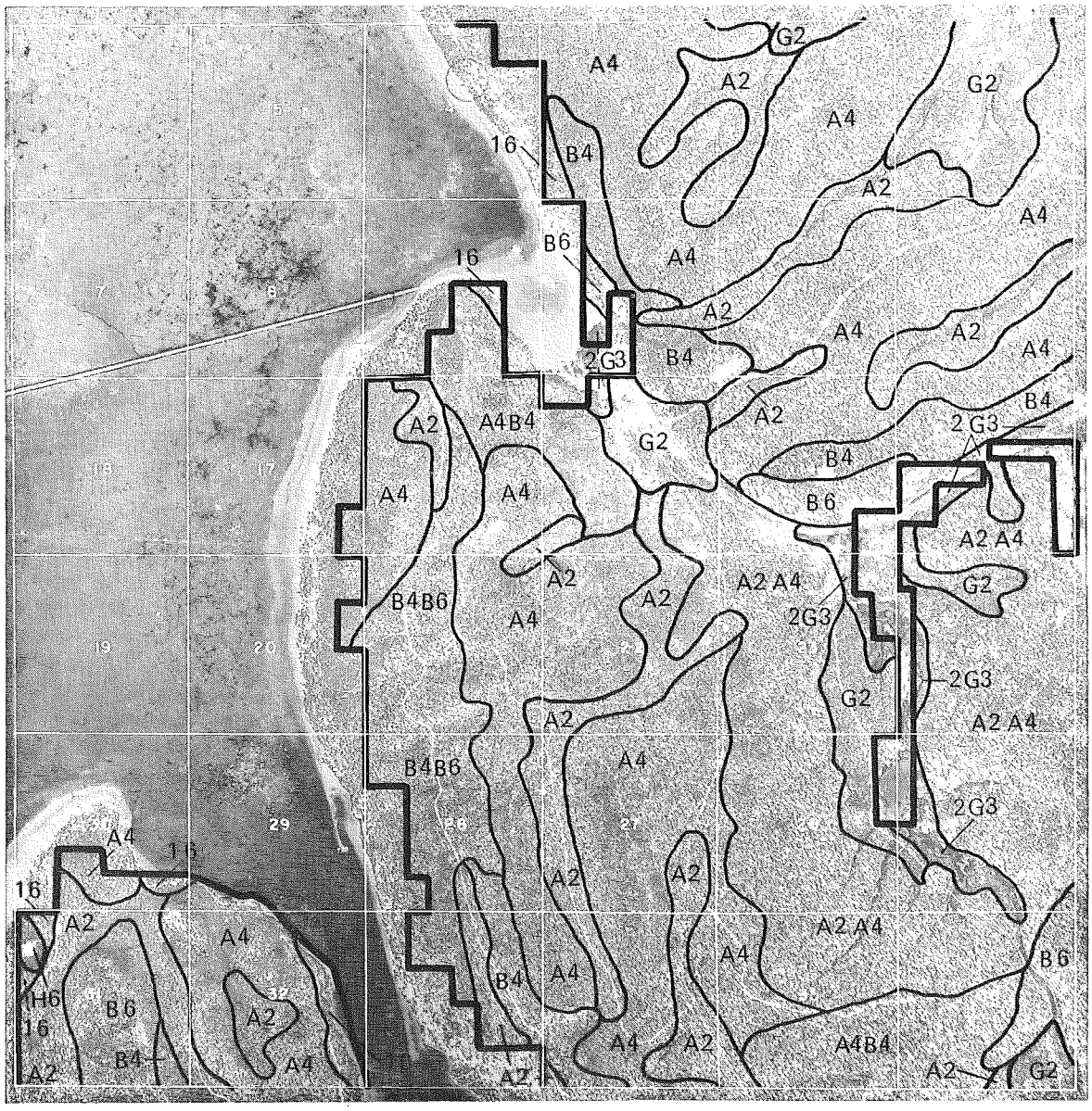
Legend

⊙ Soil Group Modal Location

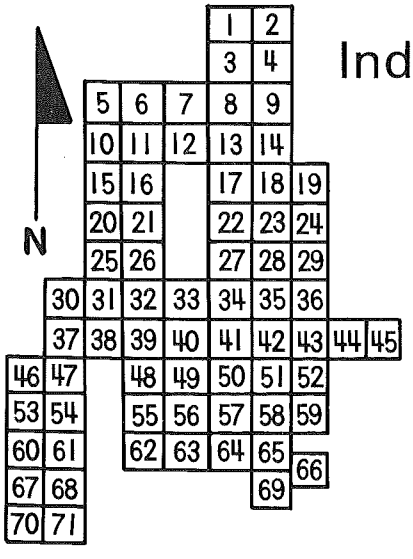
T.31S.,R.9E.

Sheet No. 27

(sheet 22)



Index Map



Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

T.31S.,R.10E.

Sheet No. 28

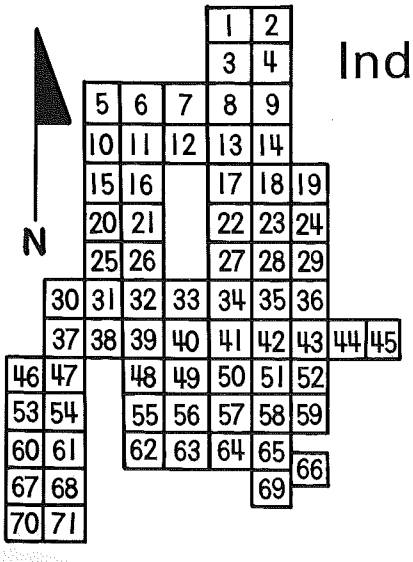
(sheet 23)

(sheet 27)



(sheet 29)

(sheet 35)



Index Map

Scale

1 inch = 1 mile

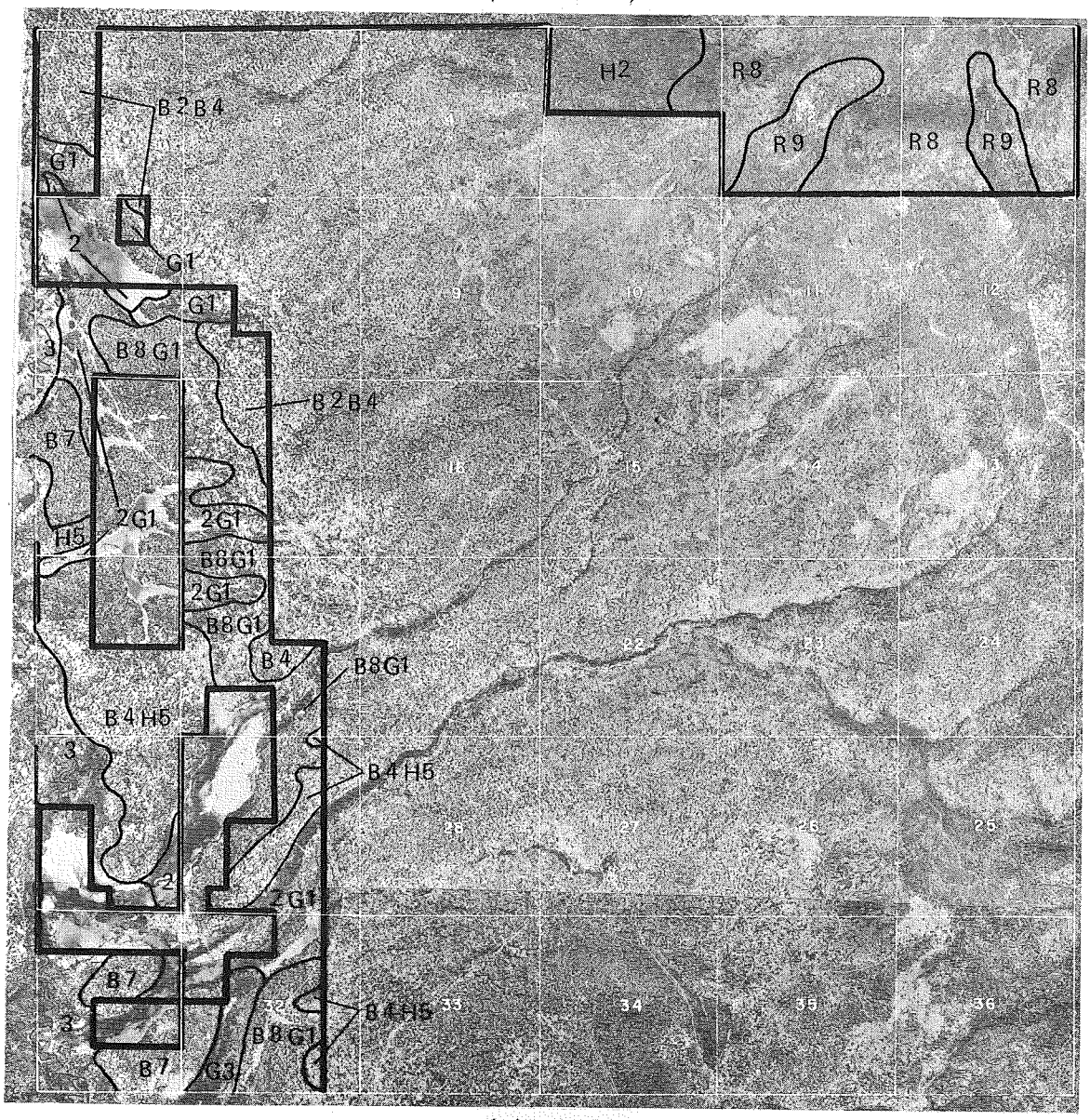
Legend

⊙ Soil Group Modal Location

T.31S.,R.11E.

Sheet No. 29

(sheet 24)



(sheet 28)

(sheet 36)

Index Map

Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

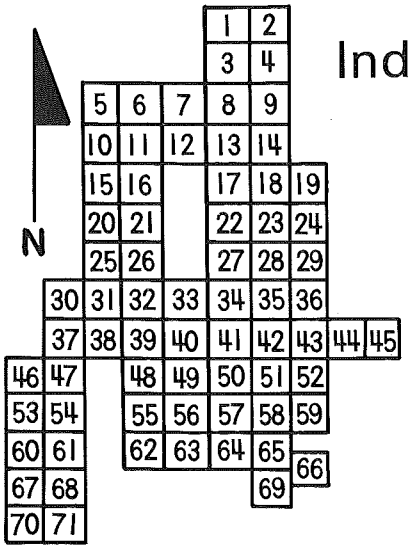
T.32S.,R.5,6E.

Sheet No. 30

Crater Lake National Park



Index Map



Scale

1 inch = 1 mile

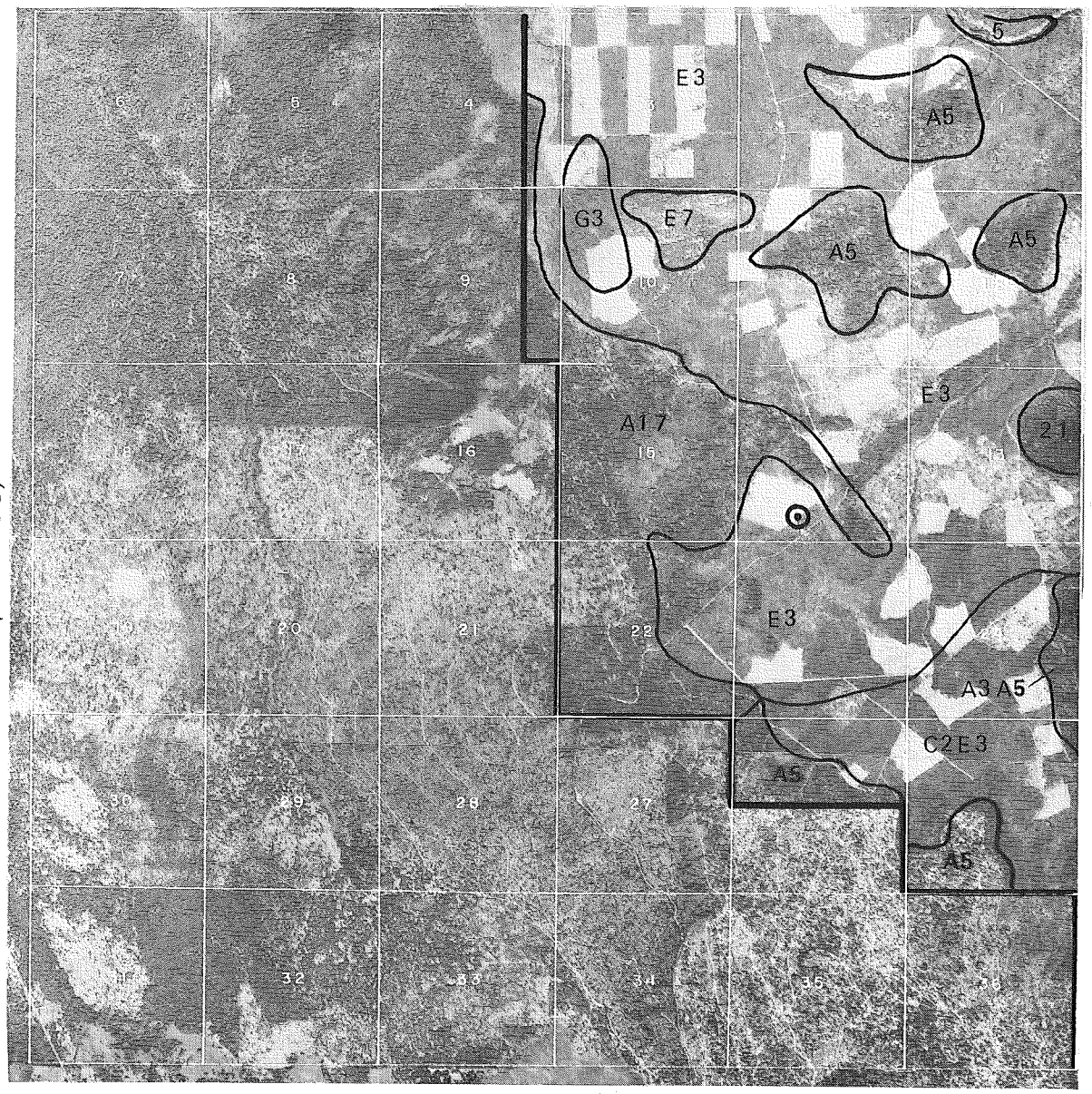
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⊙ Soil Group Modal Location

T.32S.,R.7-1/2E.

Sheet No. 31

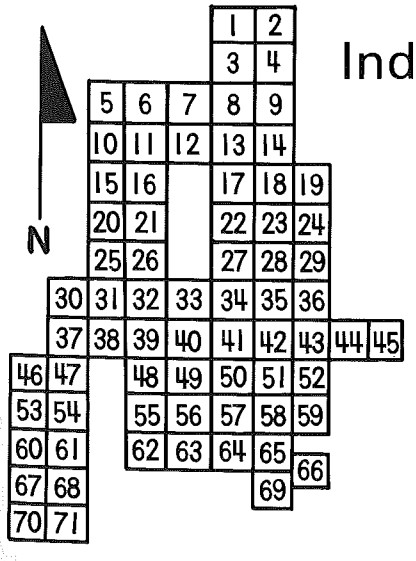
(sheet 25)



(sheet 30)

(sheet 32)

(sheet 38)



Index Map

Scale

1 inch = 1 mile

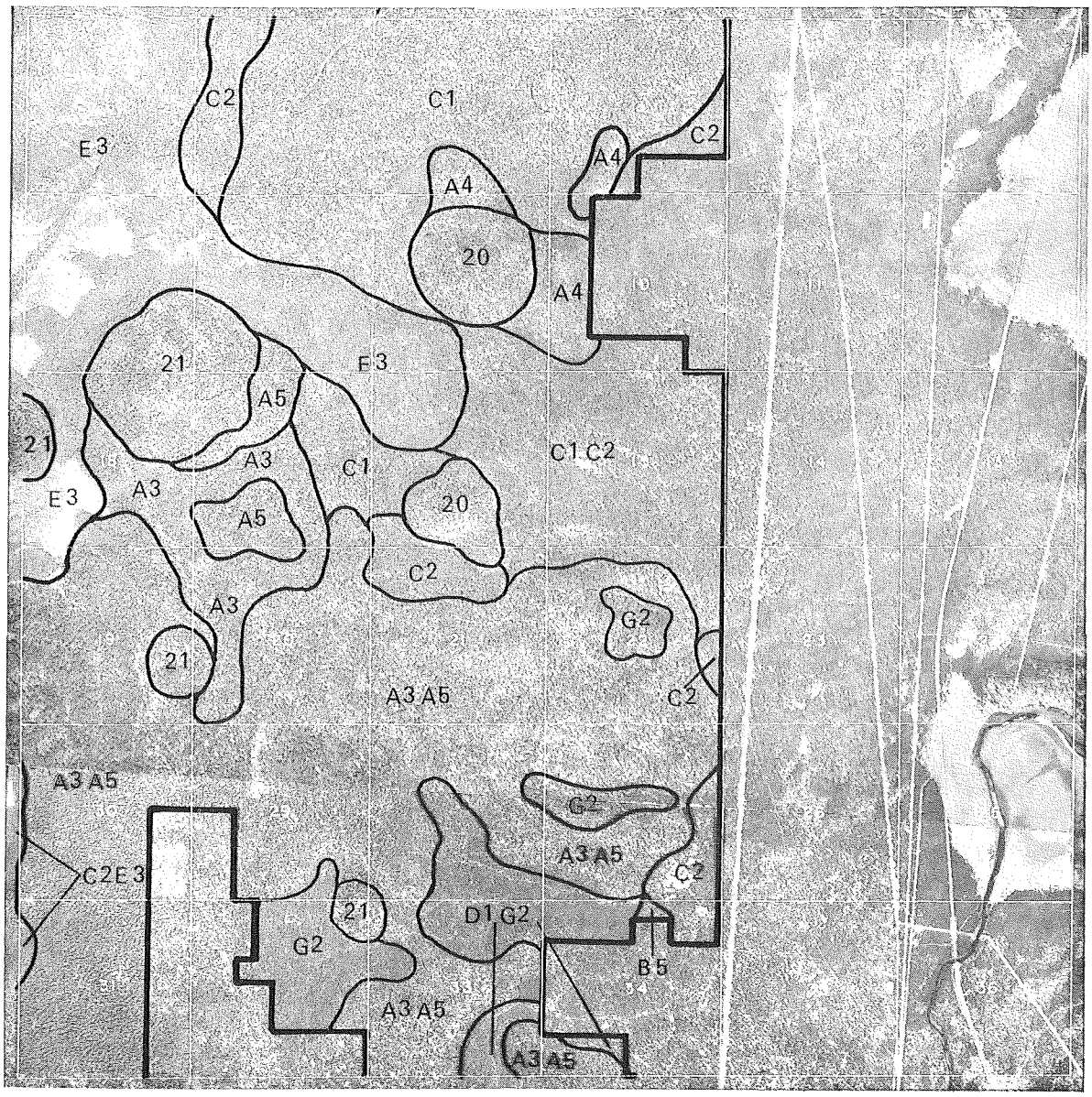
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⊙ Soil Group Modal Location

T.32S.,R.7E.

Sheet No.32

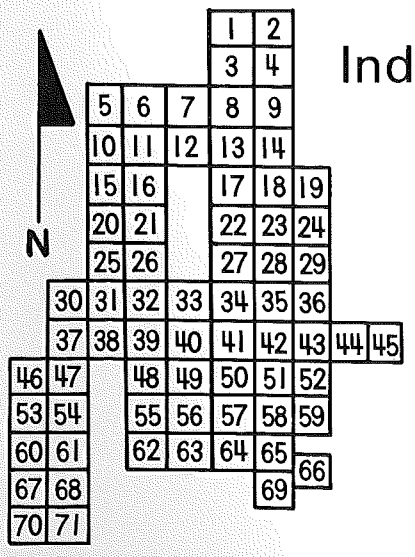
(sheet 26)



(sheet 31)

(sheet 33)

(sheet 39)



Index Map

Scale

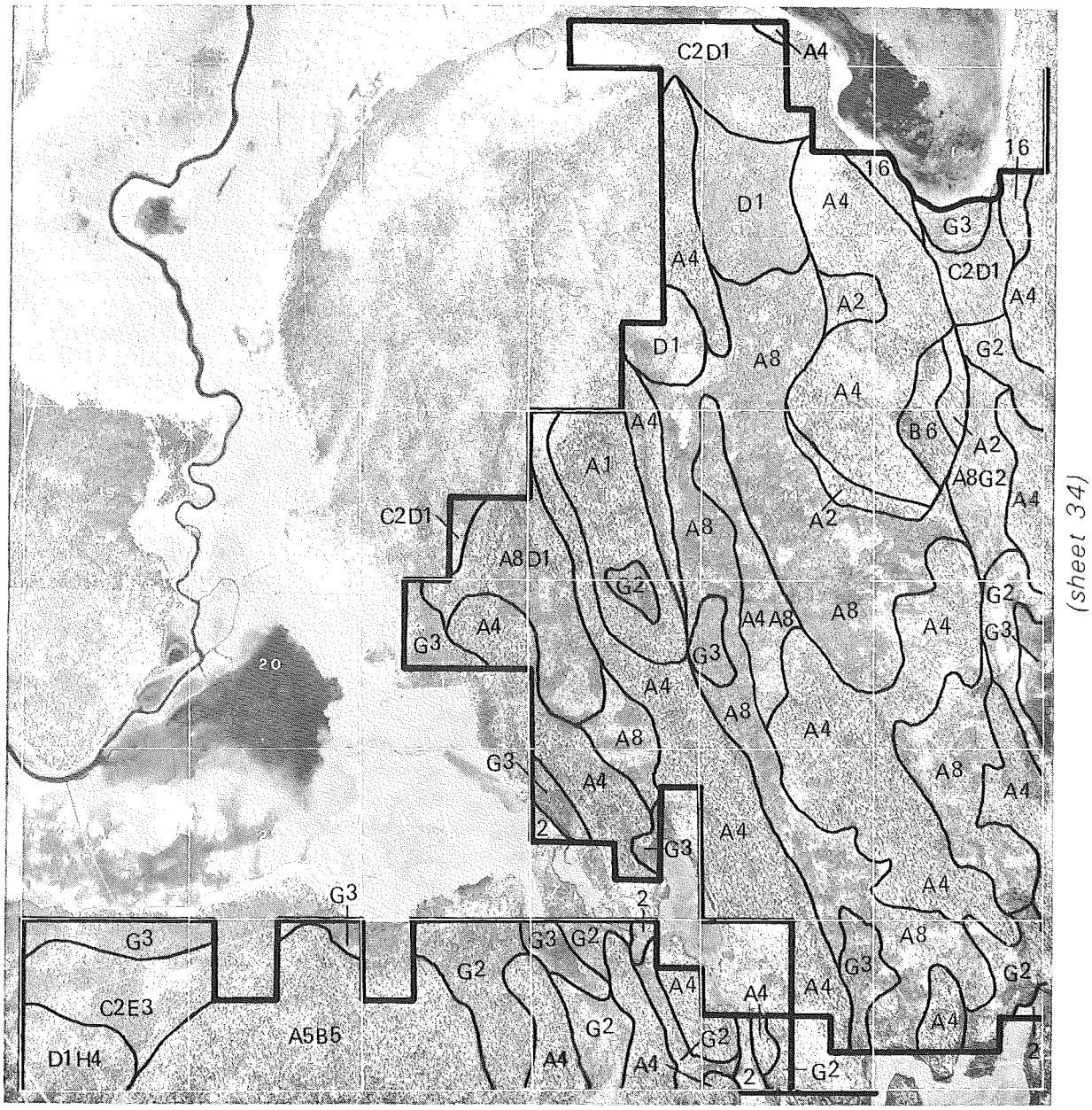
1 inch = 1 mile

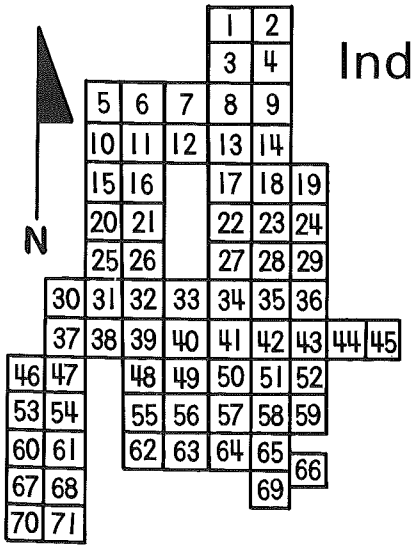
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⊙ Soil Group Modal Location

T.32S.,R.8E.

Sheet No. 33





Index Map

Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

T.32S.,R.9E.

Sheet No. 34

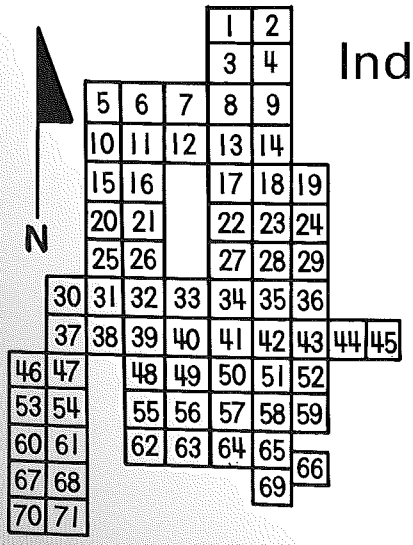
(sheet 27)

(sheet 33)



(sheet 35)

(sheet 41)



Index Map

Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

T.32S.,R.10E.

Sheet No. 35

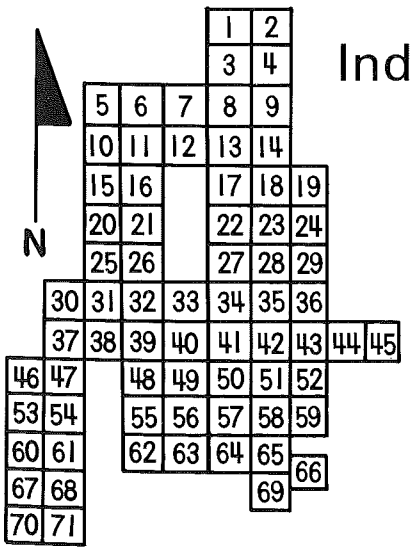
(sheet 28)

(sheet 34)



(sheet 42)

(sheet 36)



Index Map

Scale

1 inch = 1 mile

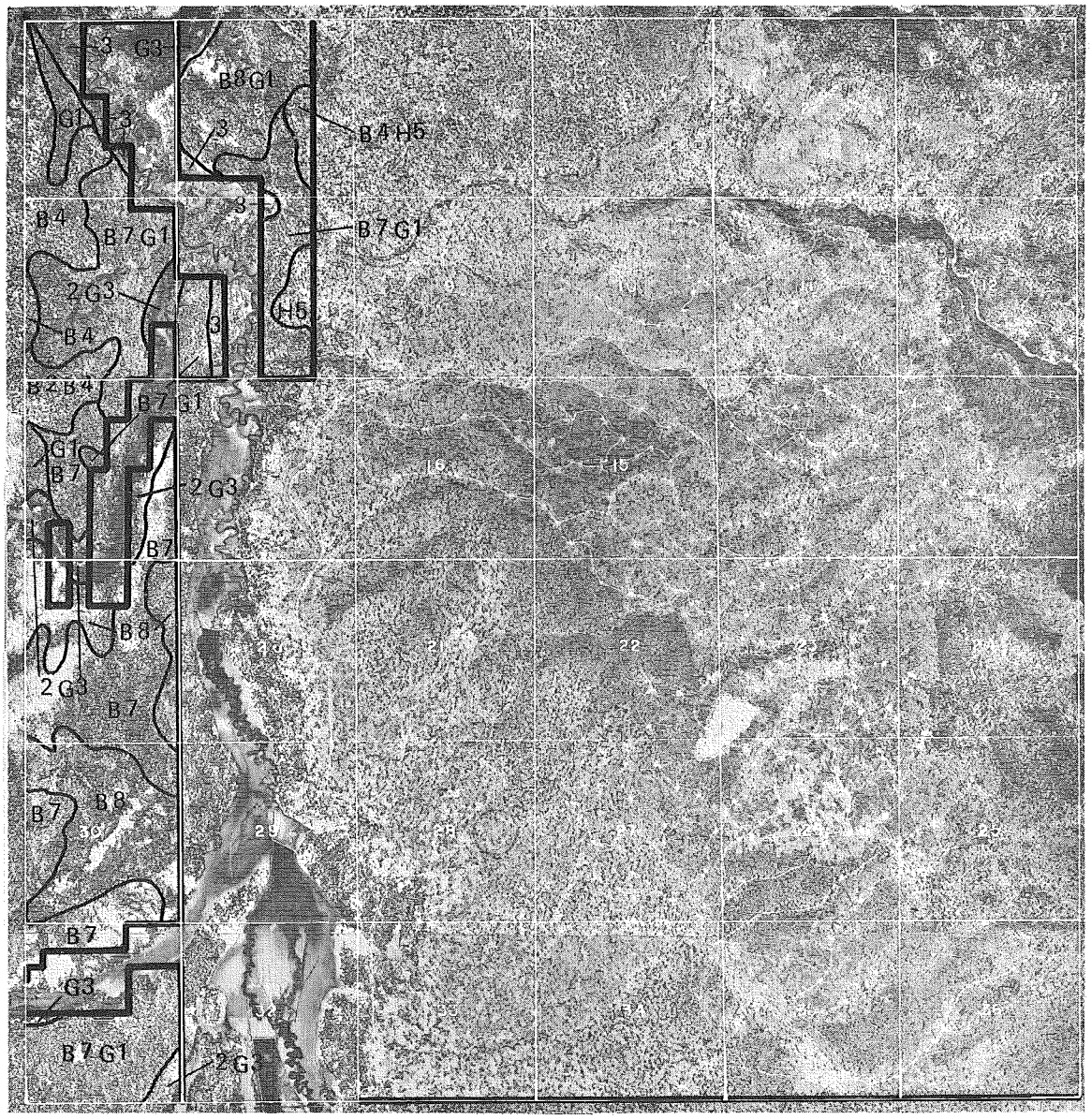
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⊙ Soil Group Modal Location

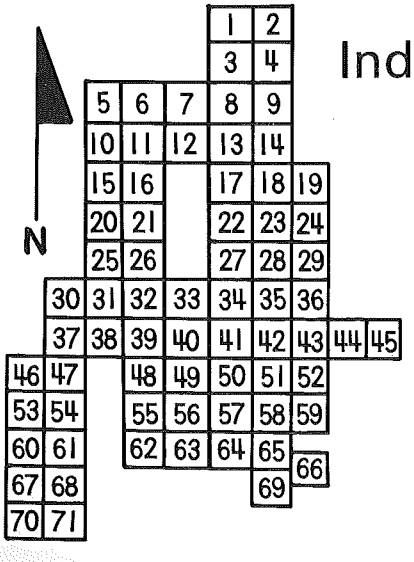
T.32S.,R.11E.

Sheet No. 36

(sheet 29)



Index Map



Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

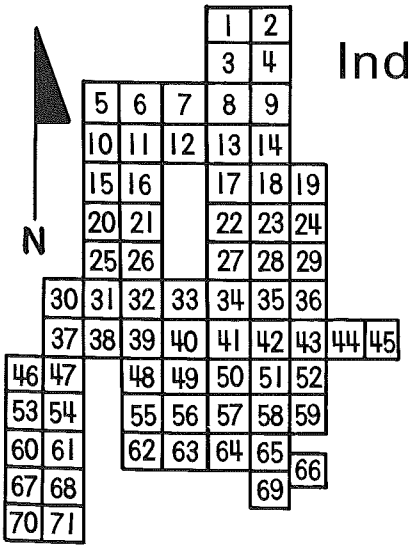
T.33S.,R.5,6E.

Sheet No. 37

(sheet 30)



Index Map



Scale

1 inch = 1 mile

Legend

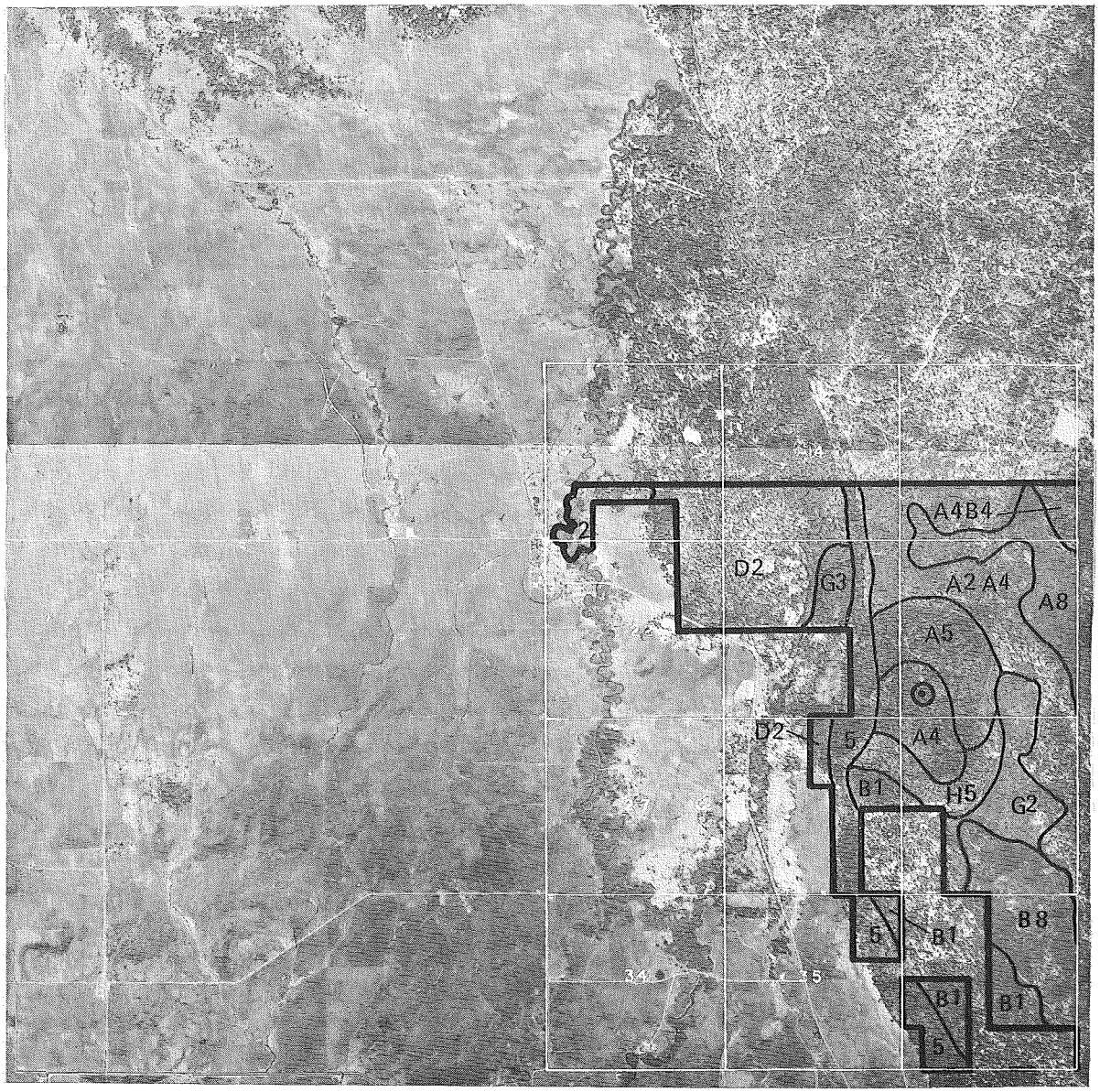
⊙ Soil Group Modal Location

T.33S.,R.7-1/2E.

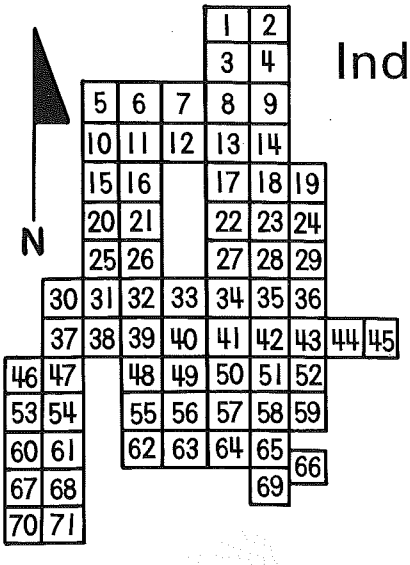
Sheet No. 38

(sheet 31)

(sheet 37)



(sheet 39)



Index Map

Scale

1 inch = 1 mile

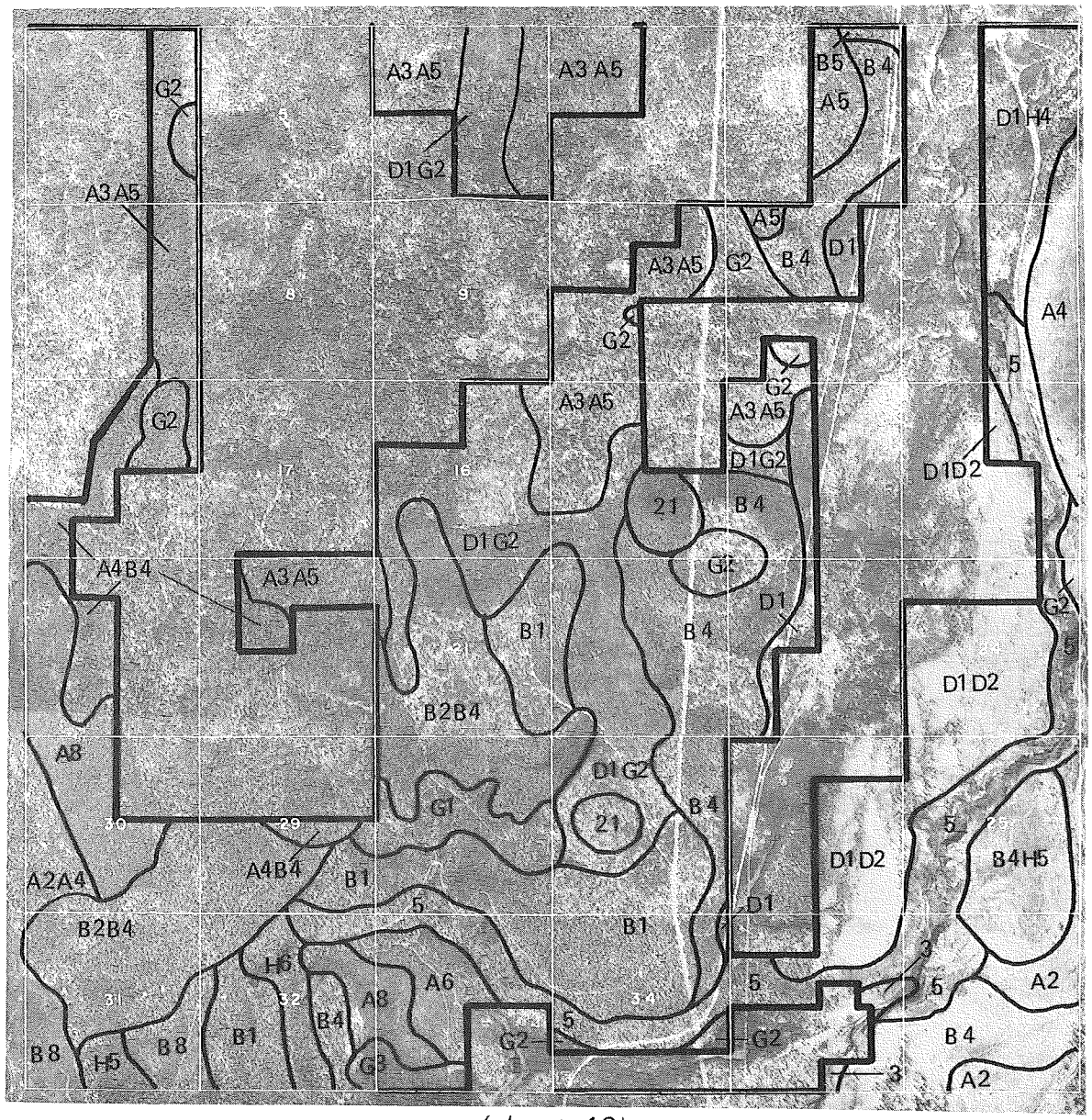
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⊙ Soil Group Modal Location

T.33S.,R.7E.

Sheet No. 39

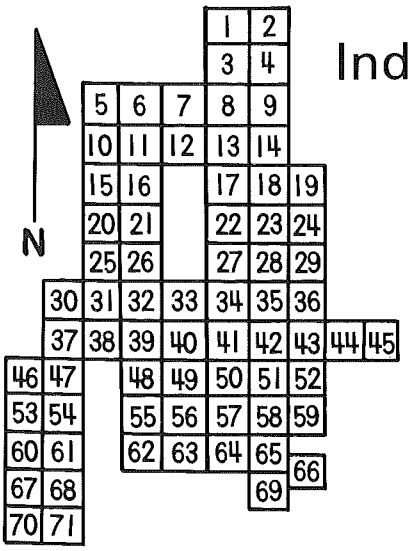
(sheet 32)



(sheet 38)

(sheet 40)

(sheet 48)



Index Map

Scale

1 inch = 1 mile

Legend

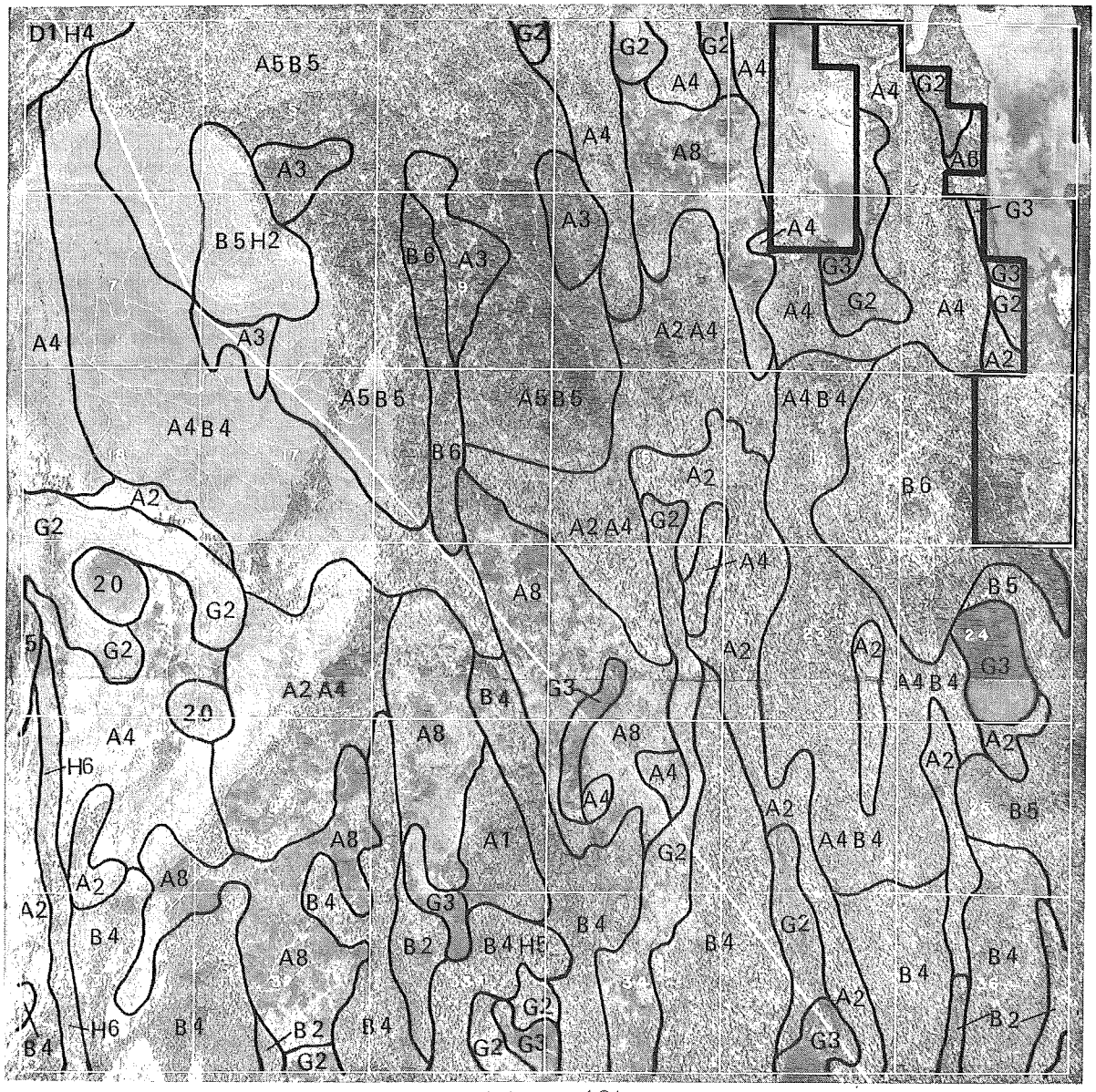
⊙ Soil Group Modal Location

T.33S.,R.8E.

Sheet No.40

(sheet 33)

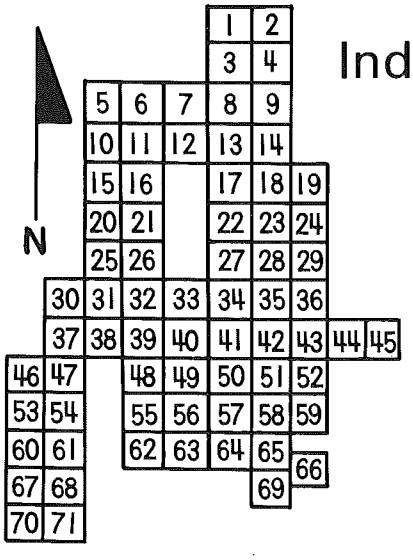
(sheet 39)



(sheet 41)

(sheet 49)

Index Map



Scale

1 inch = 1 mile

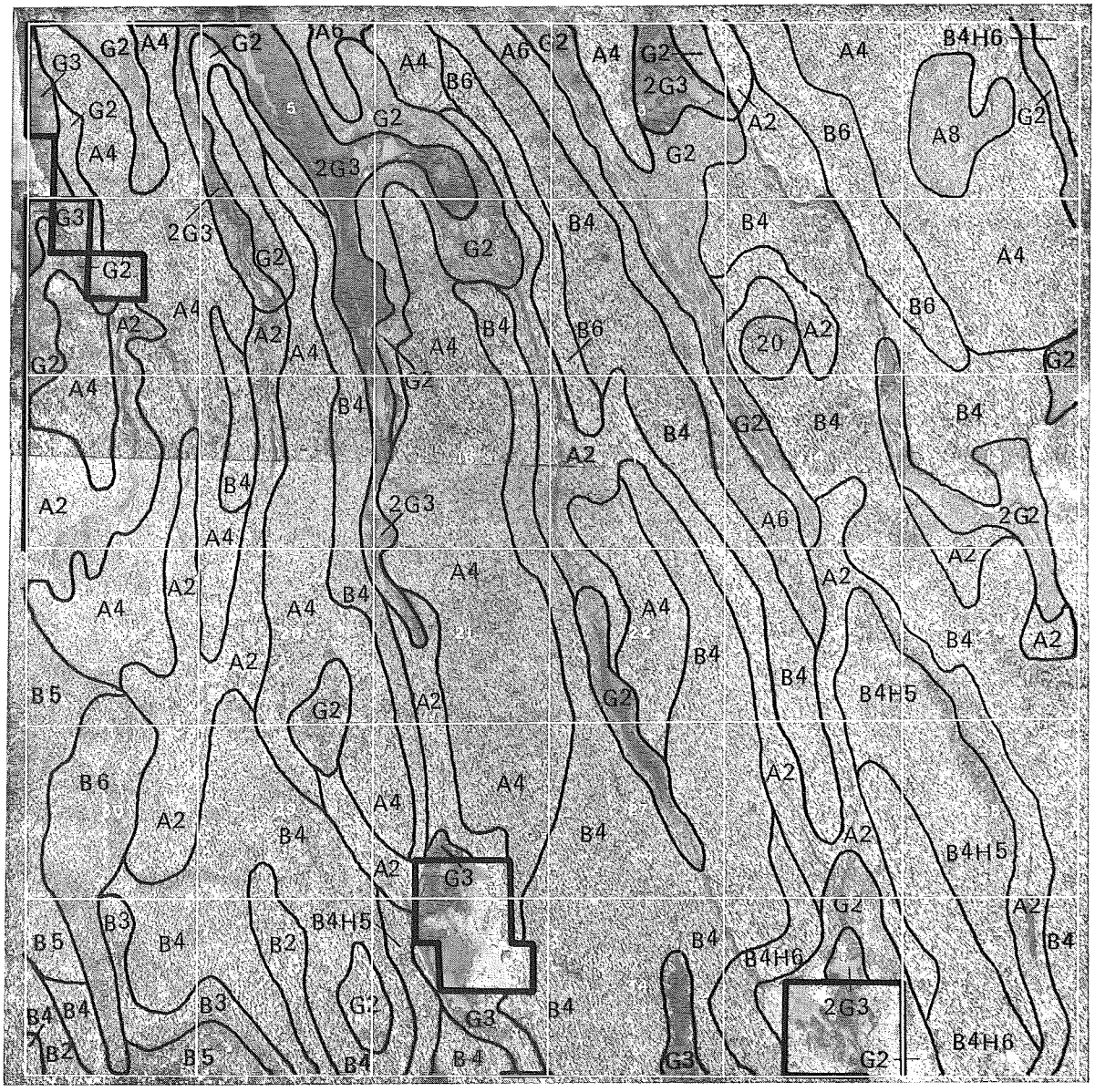
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⊙ Soil Group Modal Location

T.33S.,R.9E.

Sheet No. 41

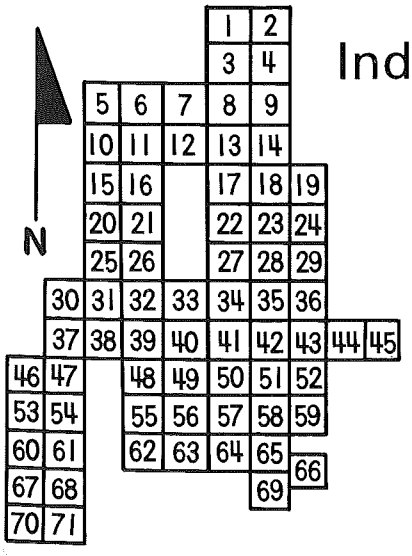
(sheet 34)



(sheet 40)

(sheet 42)

(sheet 50)



Index Map

Scale

1 inch = 1 mile

Legend

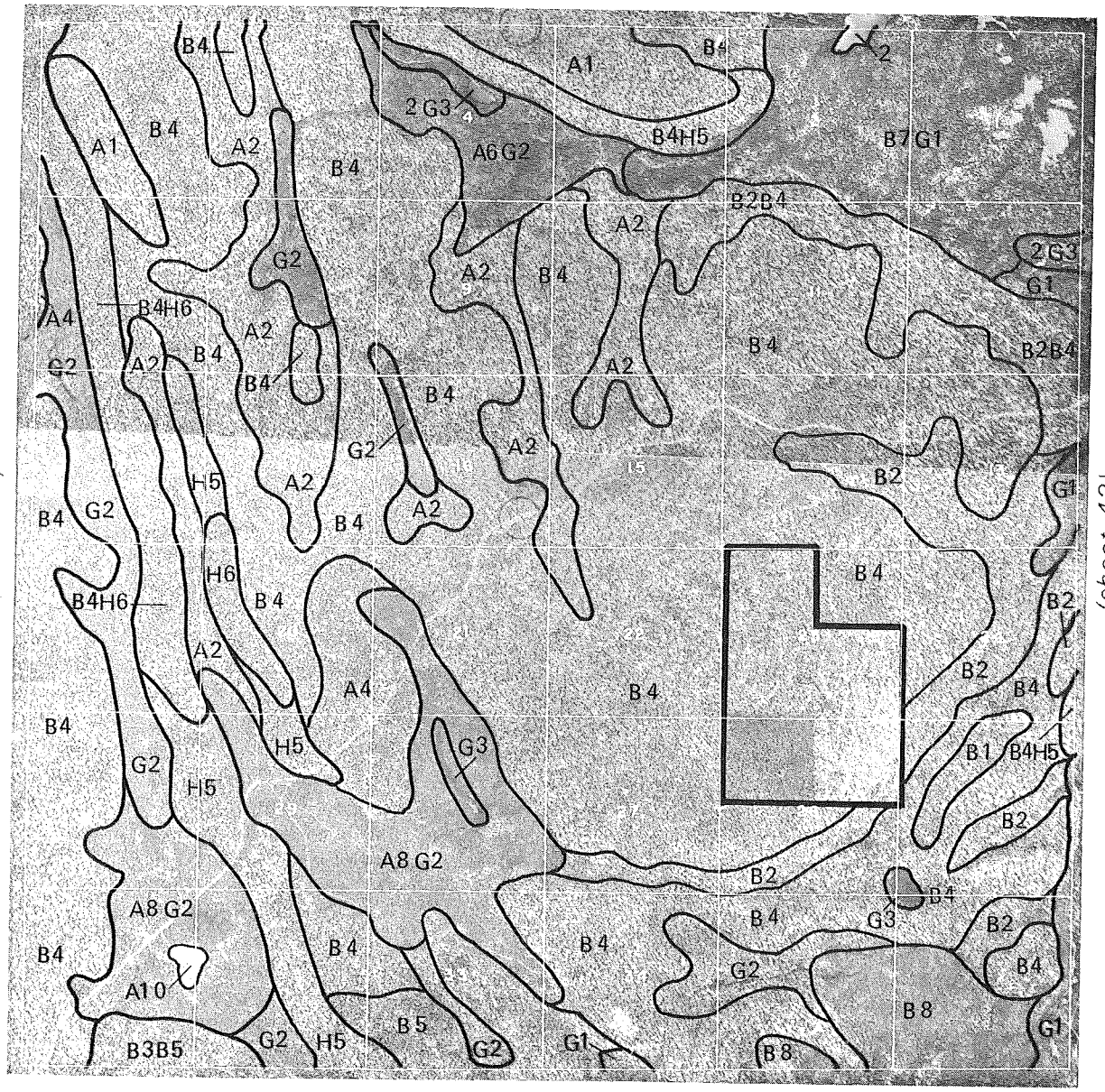
⊙ Soil Group Modal Location

T.33S.,R.10E.

Sheet No. 42

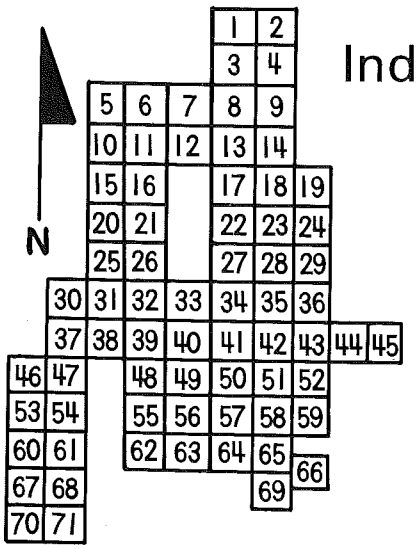
(sheet 35)

(sheet 41)



(sheet 43)

(sheet 51)



Index Map

Scale

1 inch = 1 mile

Legend

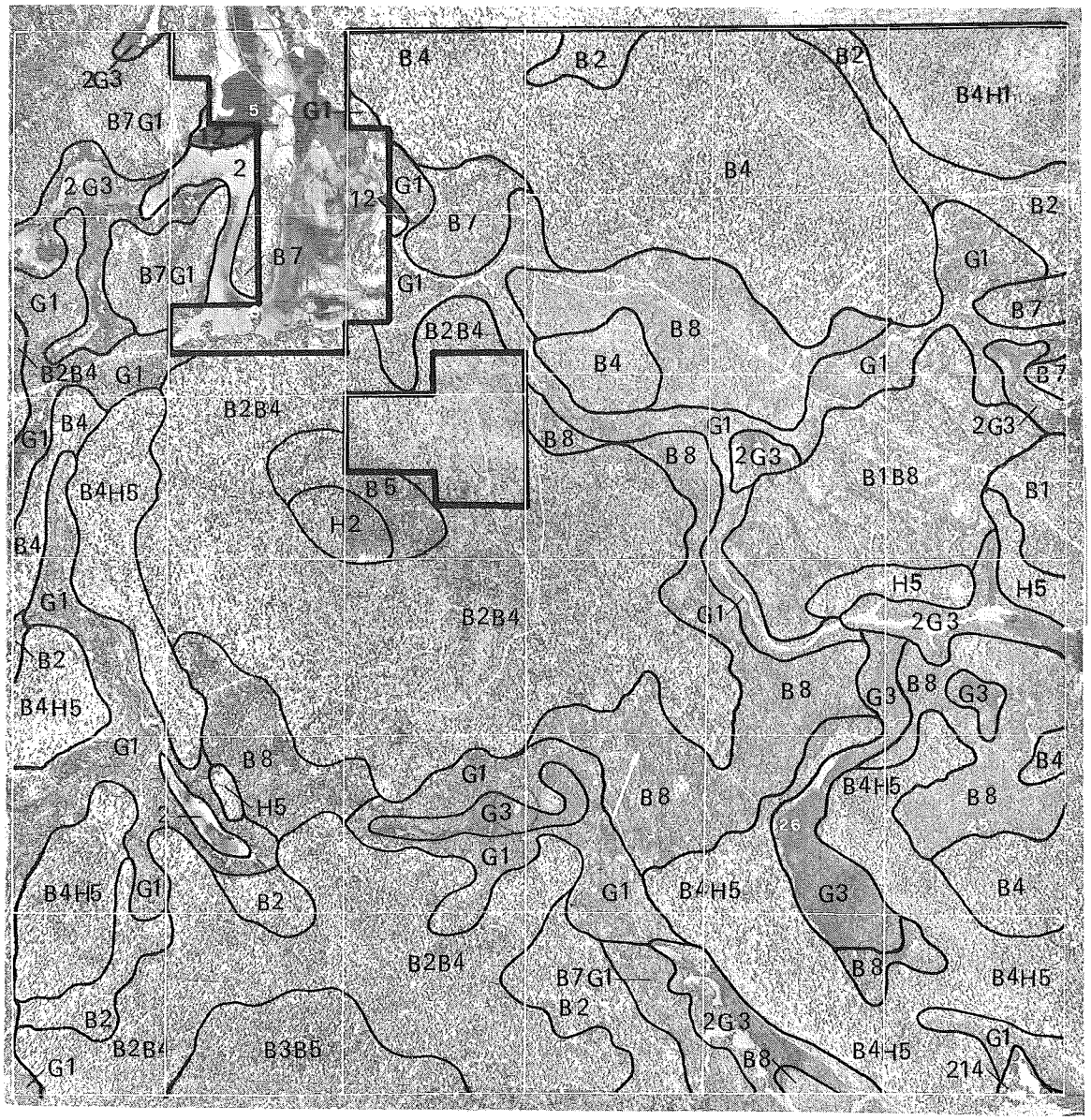
⊙ Soil Group Modal Location

T.33S.,R.11E.

Sheet No.43

(sheet 36)

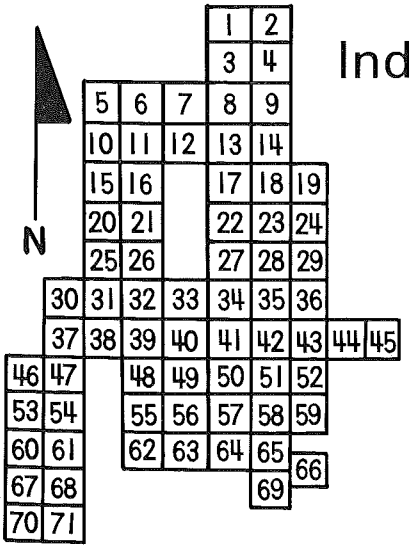
(sheet 42)



(sheet 44)

(sheet 52)

Index Map



Scale

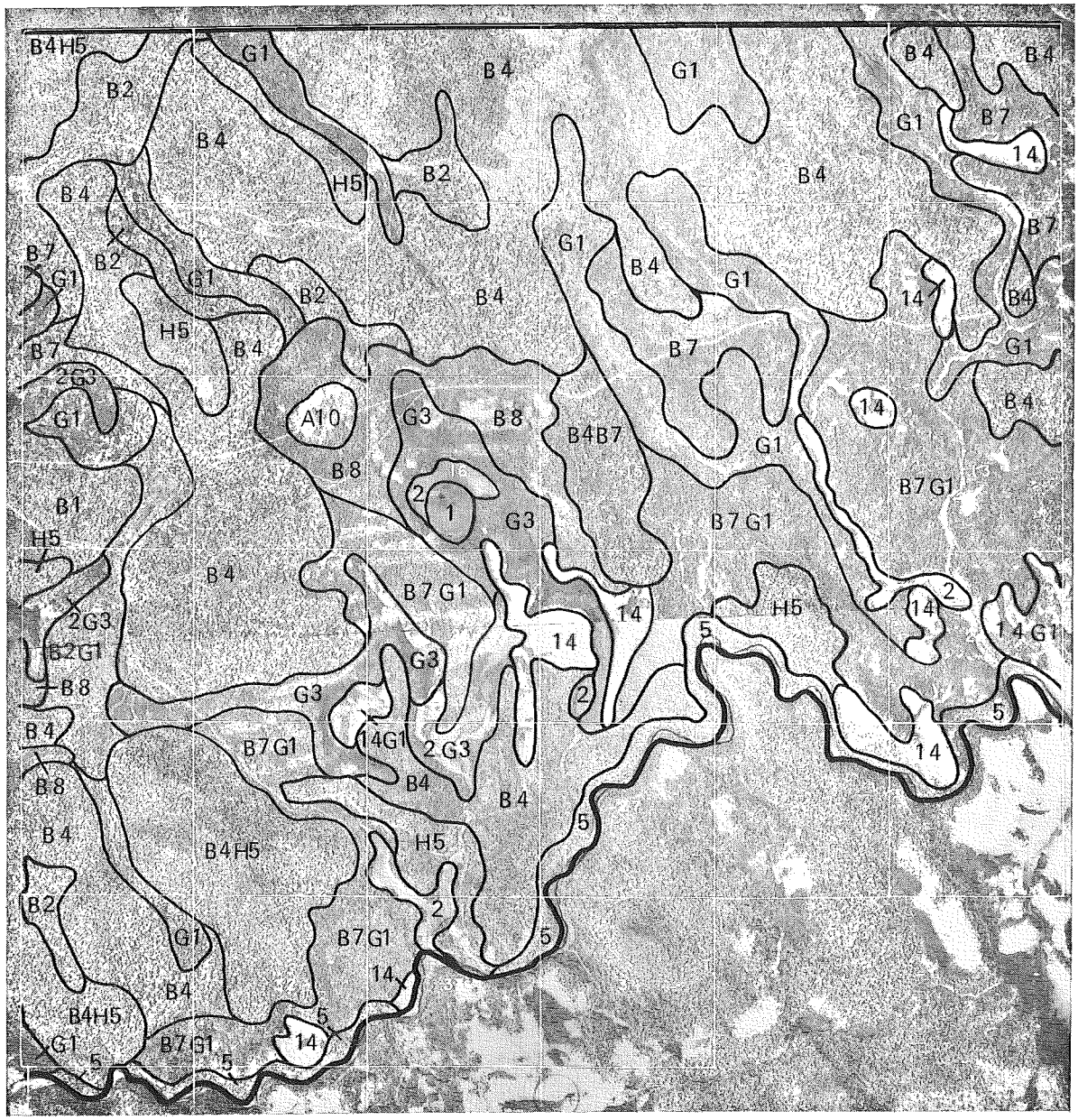
1 inch = 1 mile

Legend

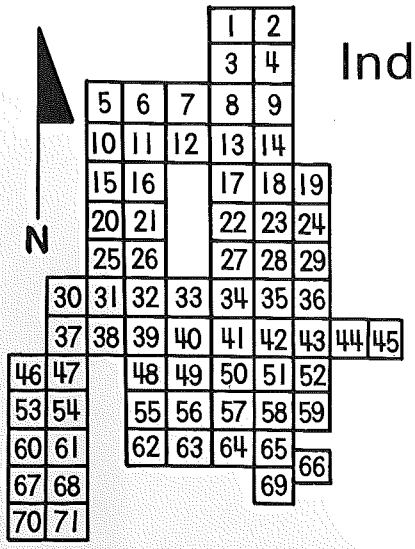
⊙ Soil Group Modal Location

T.33S.,R.12E.

Sheet No. 44



Fremont National Forest



Index Map

Scale

1 inch = 1 mile

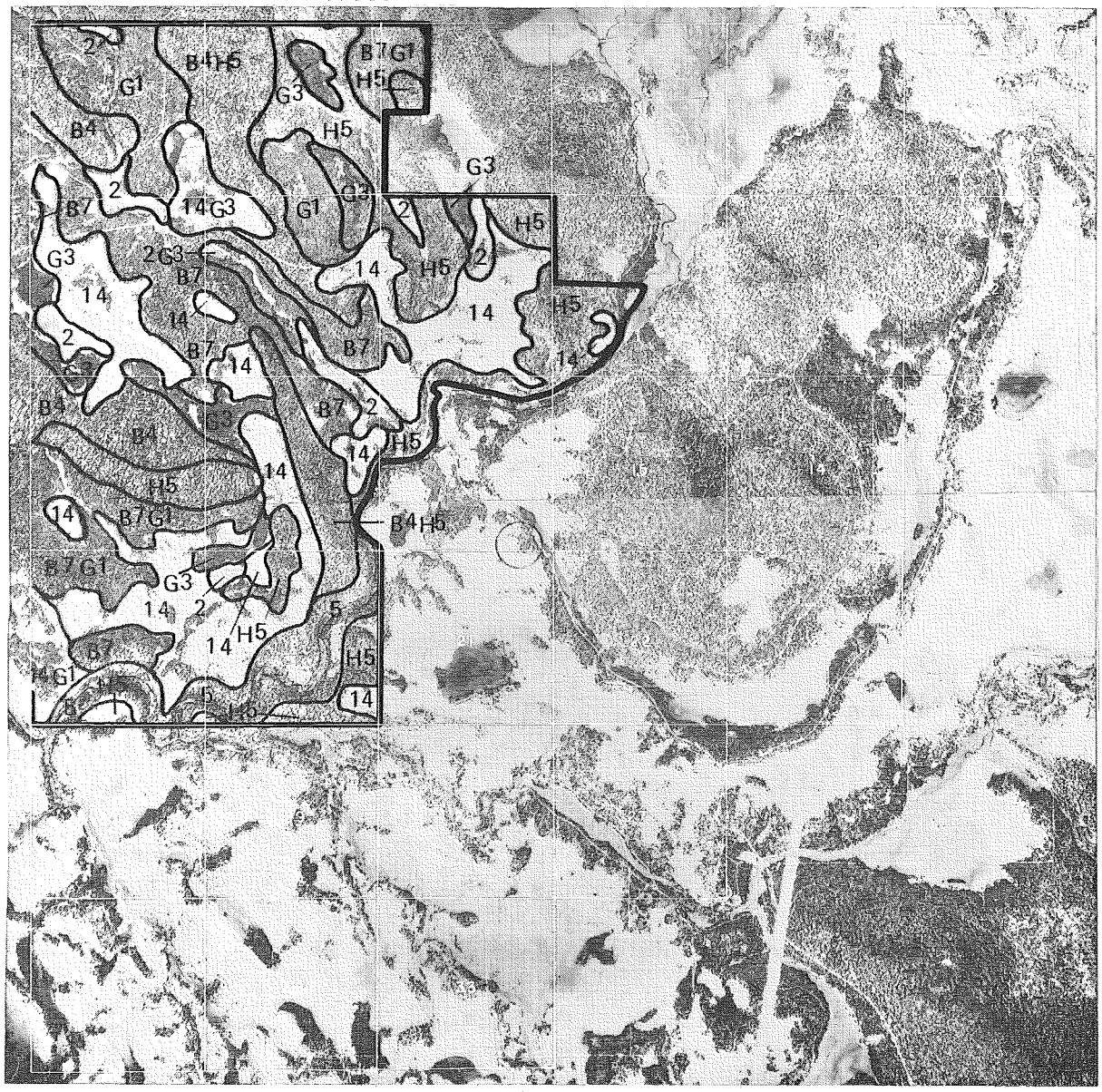
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⊙ Soil Group Modal Location

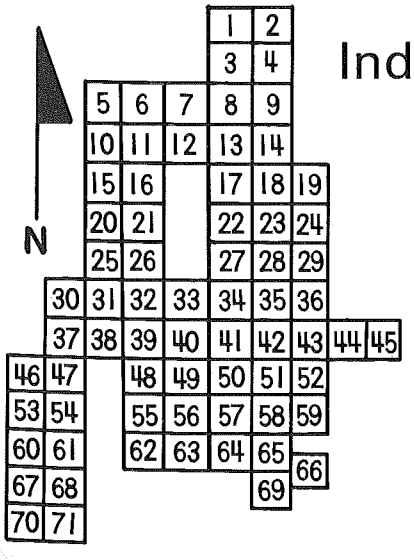
T.33S.,R.13E.

Sheet No. 45

Fremont National Forest



Index Map



Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

T.34S.,R.5E.

Sheet No. 46

Rogue River National Forest

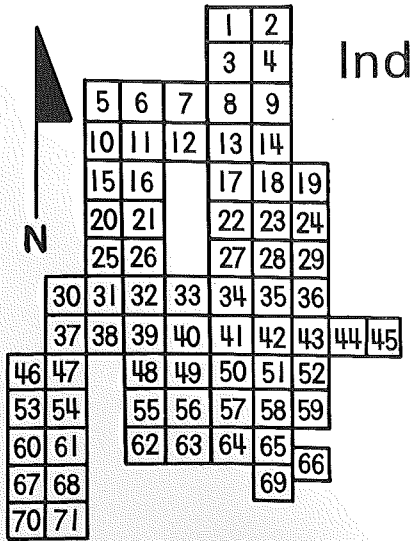


Rogue River National Forest

(sheet 47)

(sheet 53)

Index Map



Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

T.34S.,R.6E.

Sheet No. 47

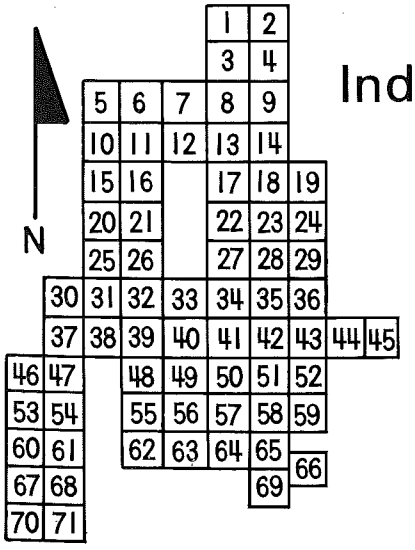
(sheet 37)

(sheet 46)



(sheet 54)

Index Map



Scale

1 inch = 1 mile

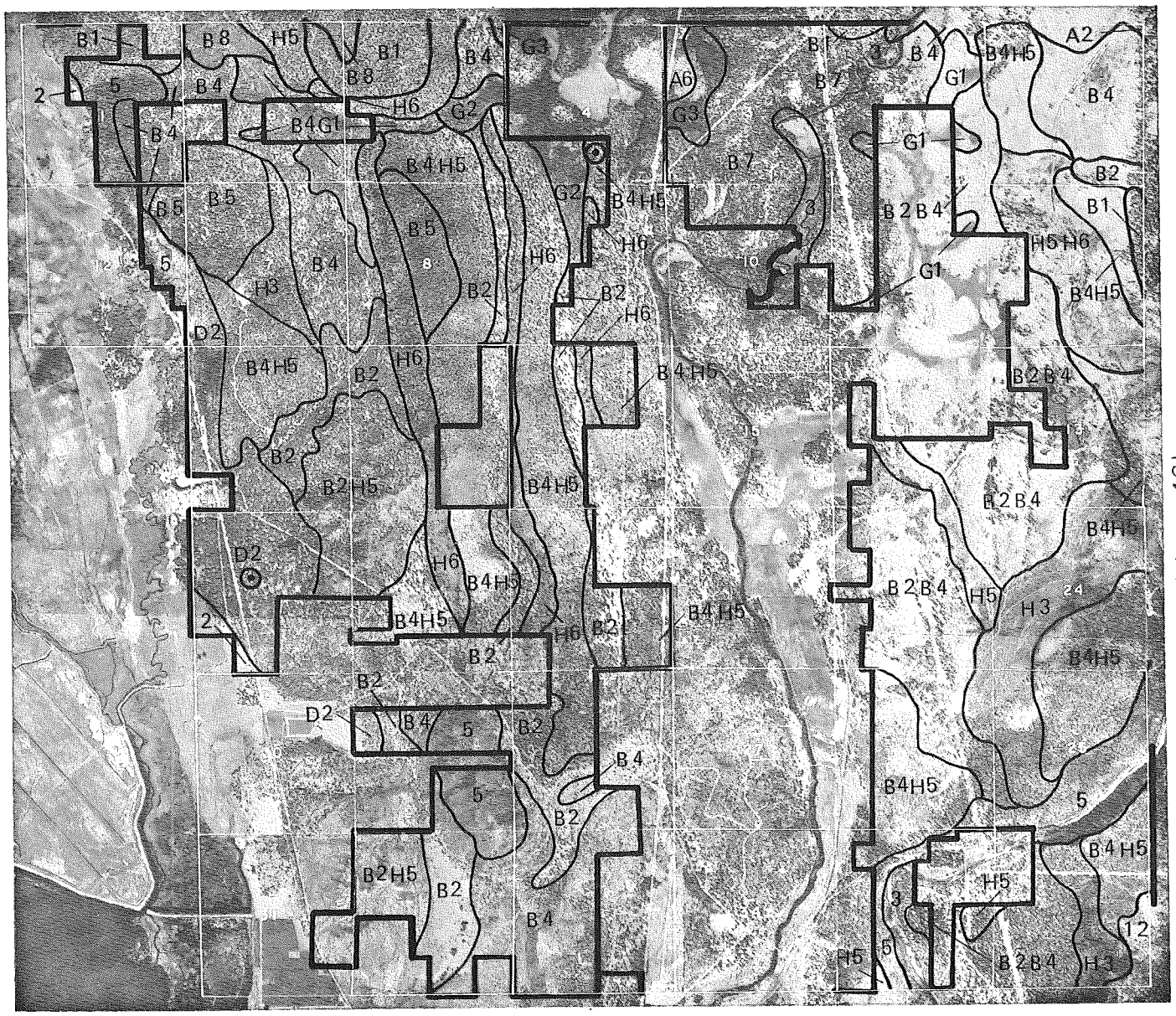
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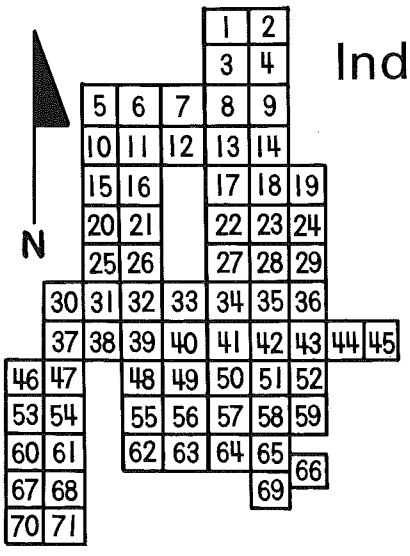
⊙ Soil Group Modal Location

T.34S.,R.7E.

Sheet No.48

(sheet 39)





Index Map

Scale

1 inch = 1 mile

Legend

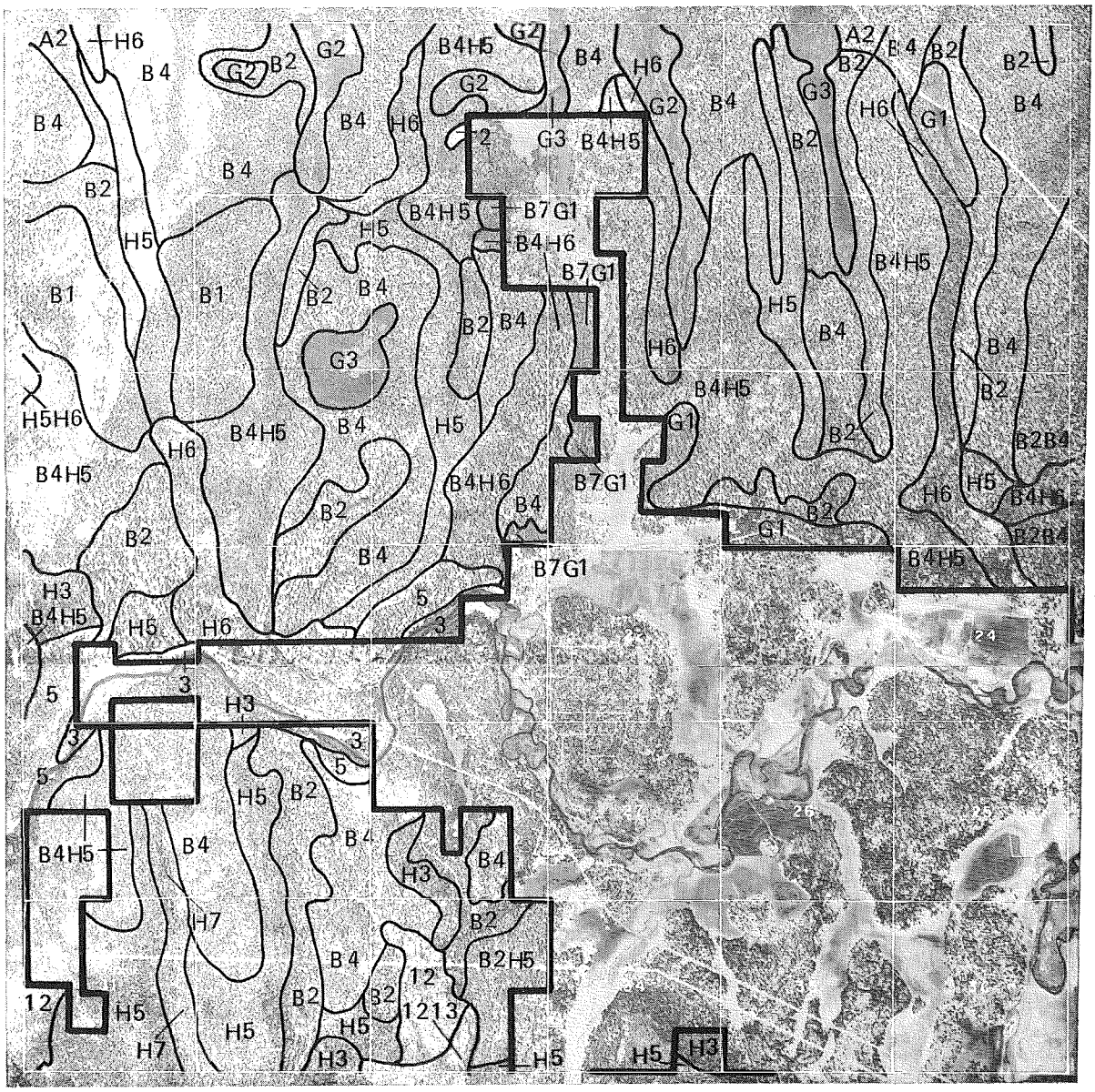
⊙ Soil Group Modal Location

T.34S.,R.8E.

Sheet No. 49

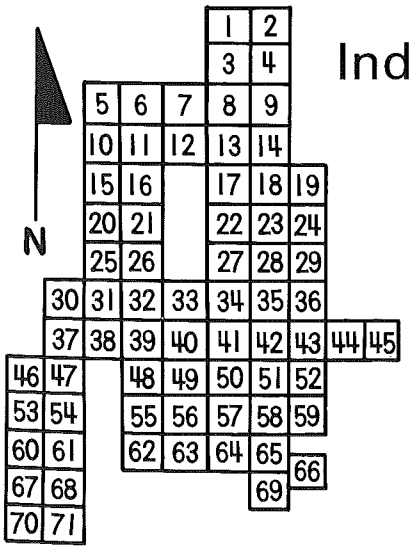
(sheet 40)

(sheet 48)



(sheet 50)

(sheet 56)



Index Map

Scale

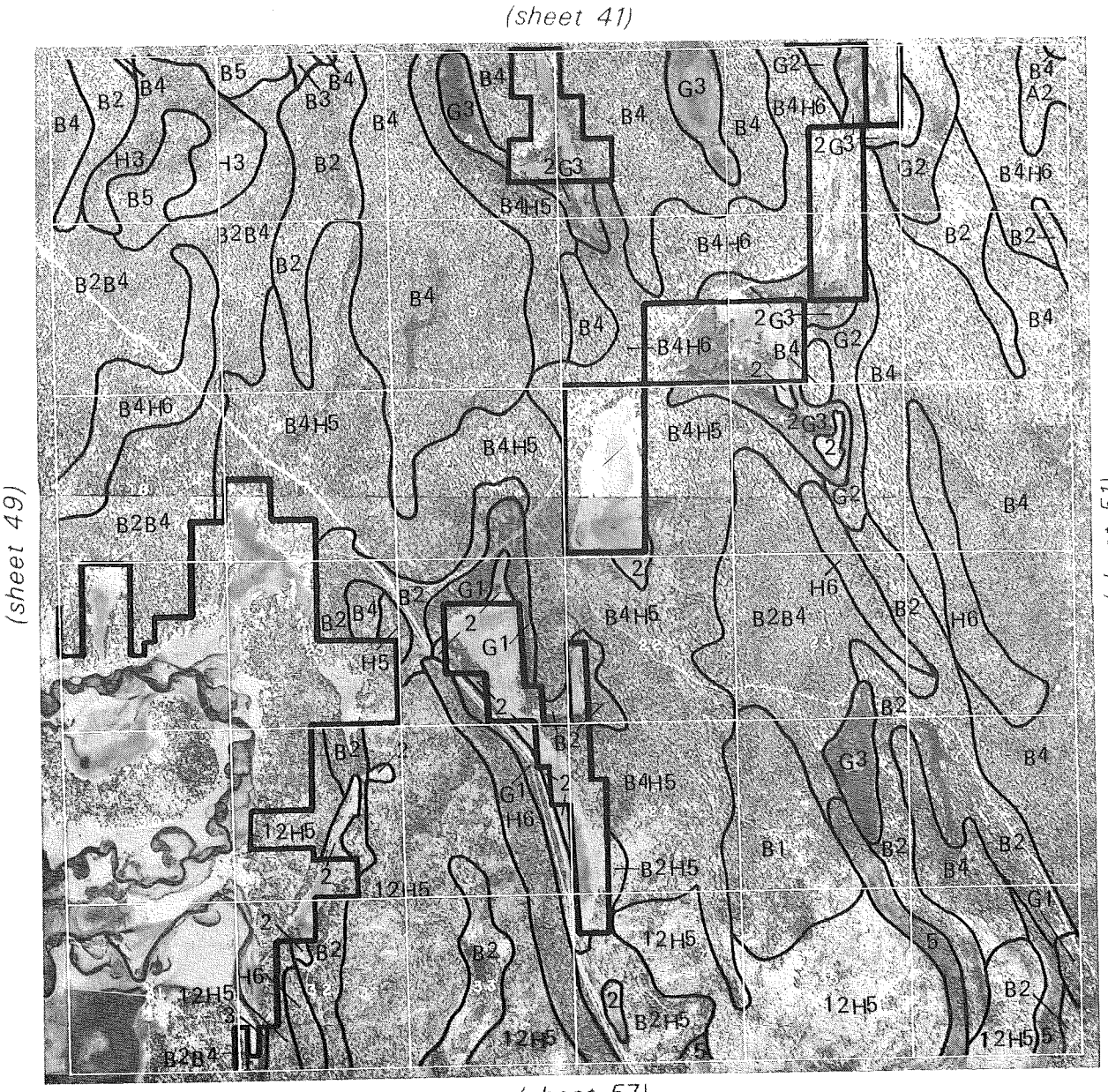
1 inch = 1 mile

Legend

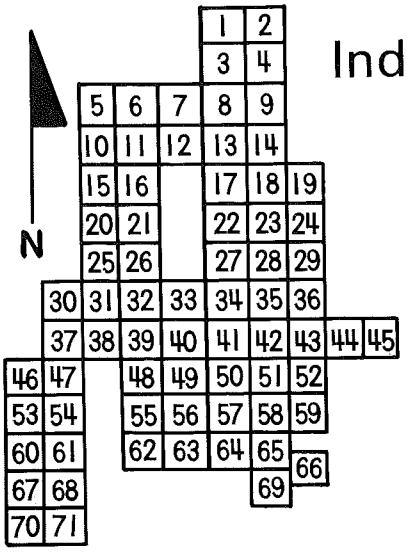
⊙ Soil Group Modal Location

T.34S.,R.9E.

Sheet No. 50



Index Map



Scale

1 inch = 1 mile

Legend

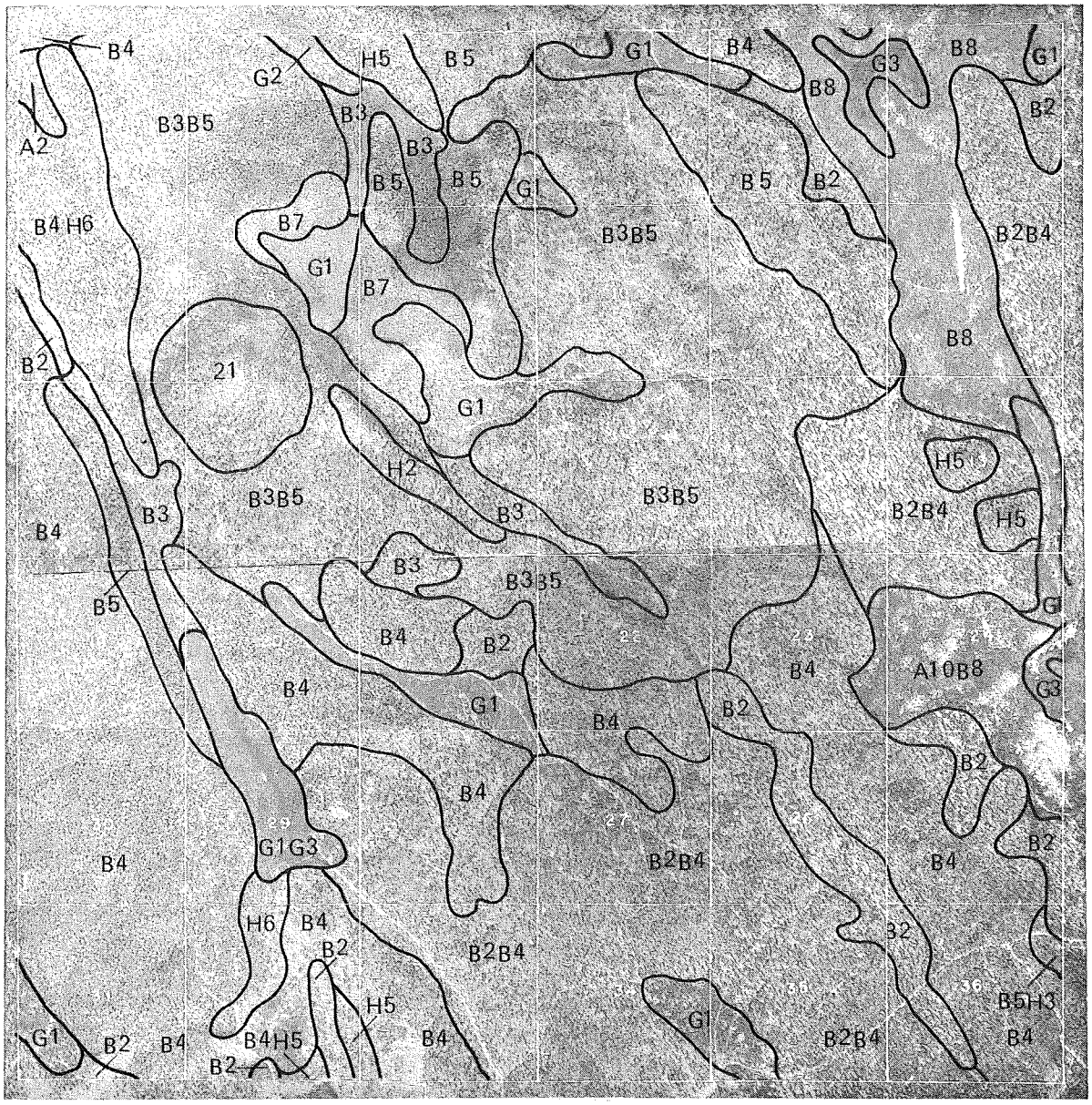
⊙ Soil Group Modal Location

T.34S.,R.10E.

Sheet No. 51

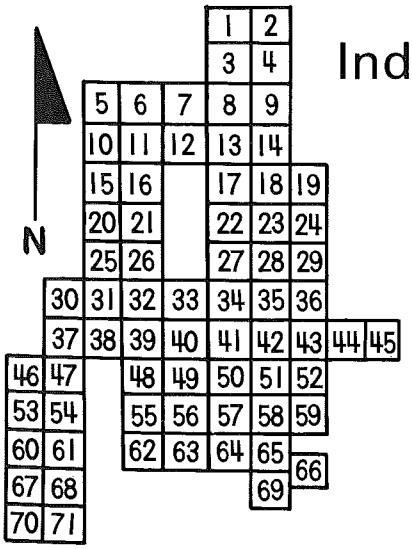
(sheet 42)

(sheet 50)



(sheet 52)

(sheet 58)



Index Map

Scale

1 inch = 1 mile

Legend

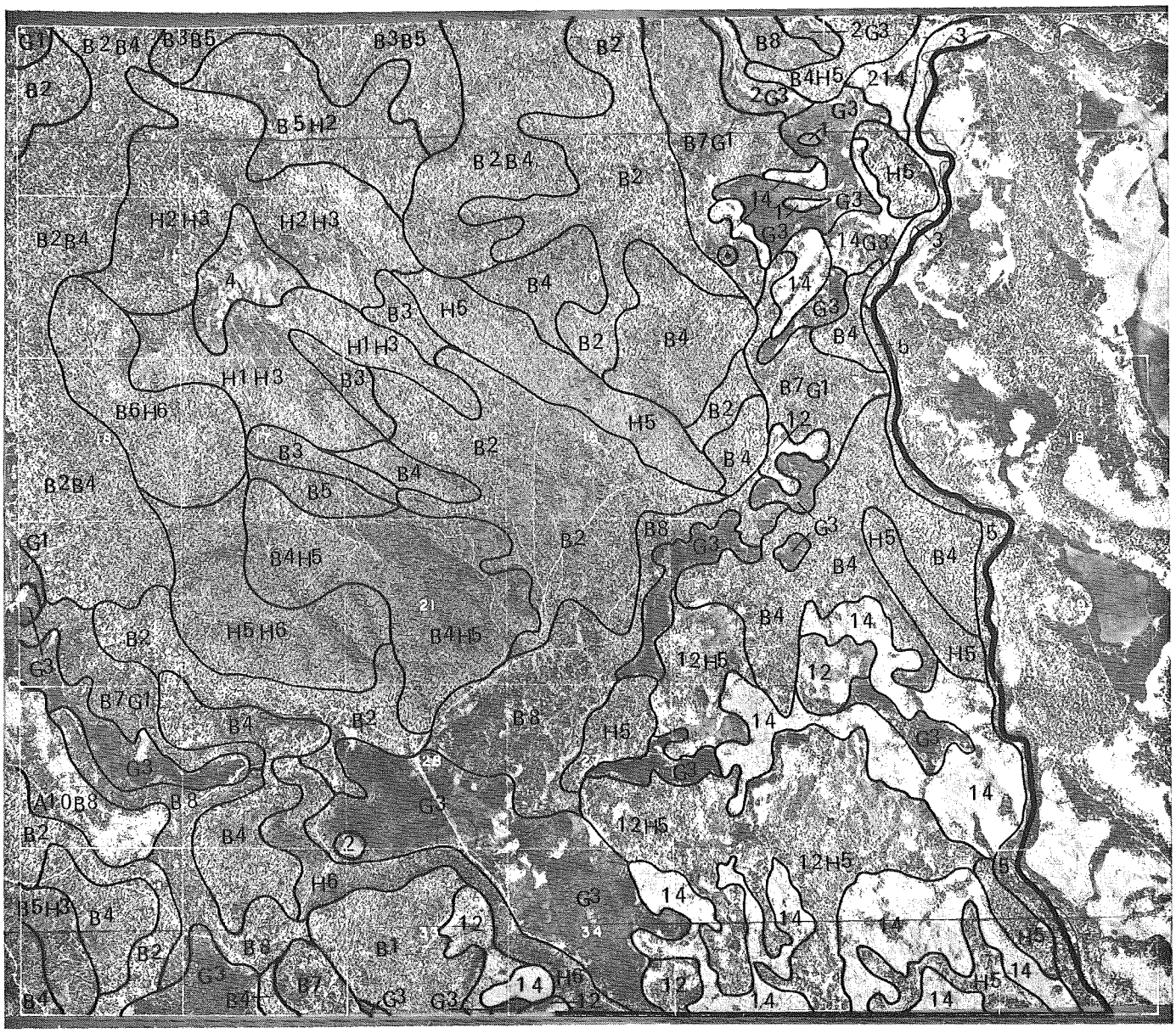
⊙ Soil Group Modal Location

T.34S.,R.11E.

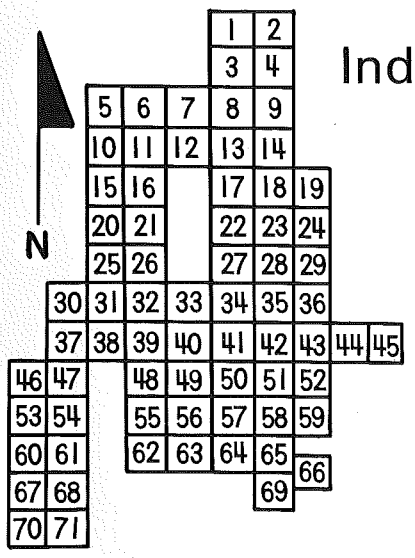
Sheet No. 52

(sheet 43)

(sheet 51)



(sheet 59)



Index Map

Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

T.35S.,R.5E.

Sheet No. 53

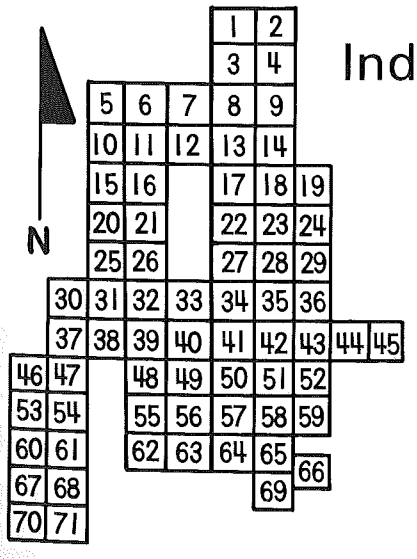
(sheet 46)



Rogue River National Forest

(sheet 54)

(sheet 60)



Index Map

Scale

1 inch = 1 mile

Legend

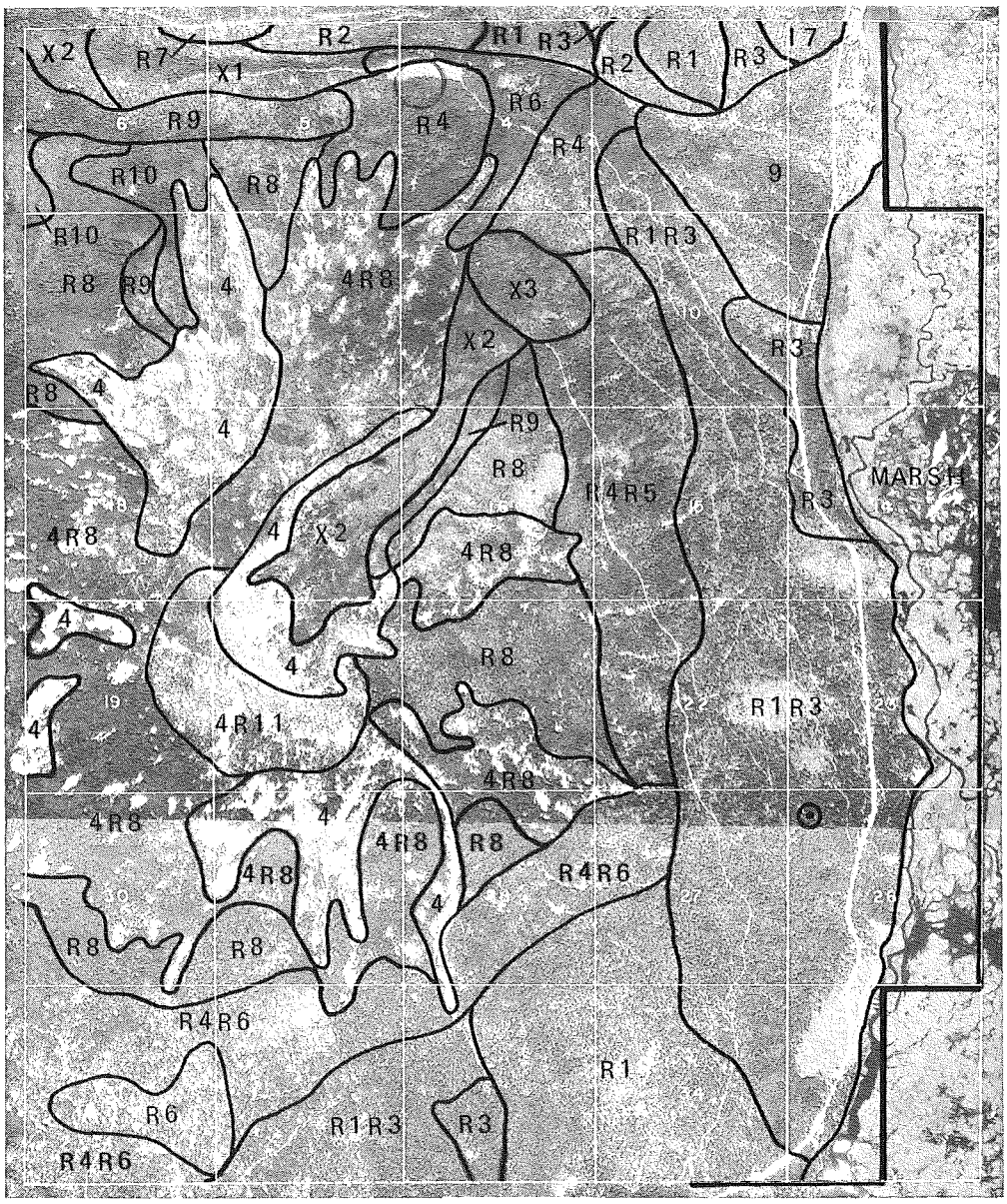
⊙ Soil Group Modal Location

T.35S.,R.6E.

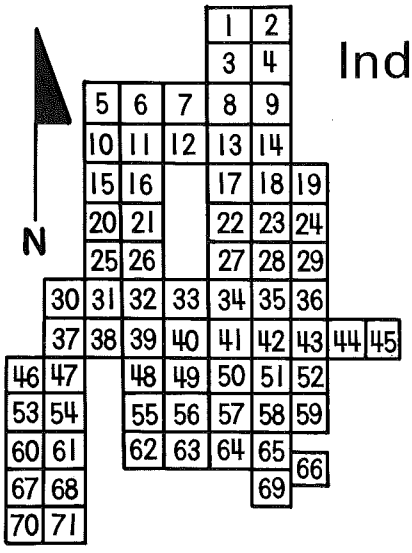
Sheet No. 54

(sheet 47)

(sheet 53)



(sheet 61)



Index Map

Scale

1 inch = 1 mile

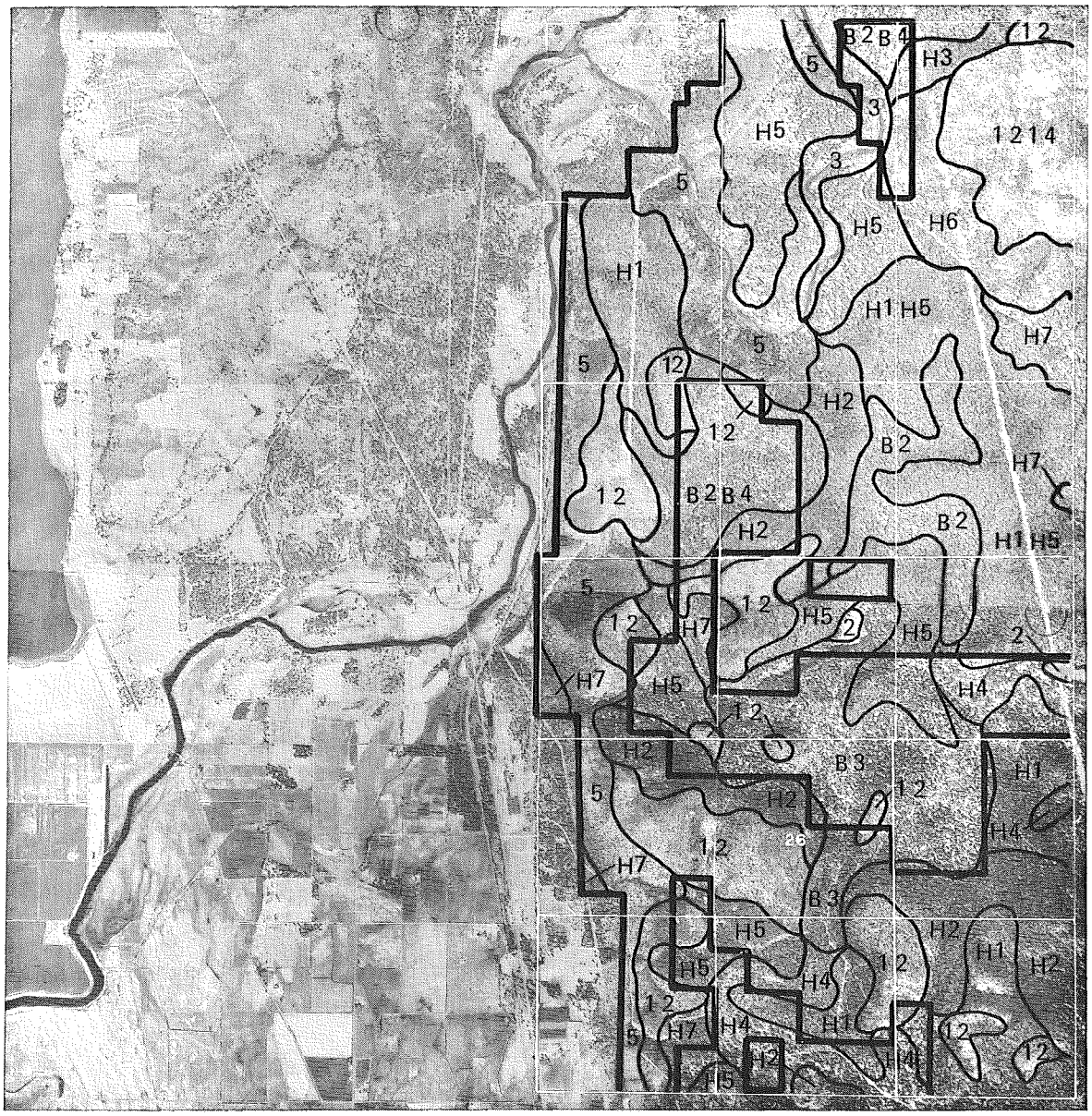
Legend

⊙ Soil Group Modal Location

T.35S.,R.7E.

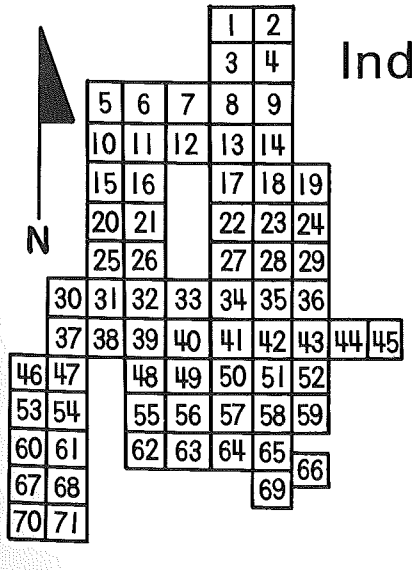
Sheet No. 55

(sheet 48)



(sheet 56)

(sheet 62)



Index Map

Scale

1 inch = 1 mile

Legend

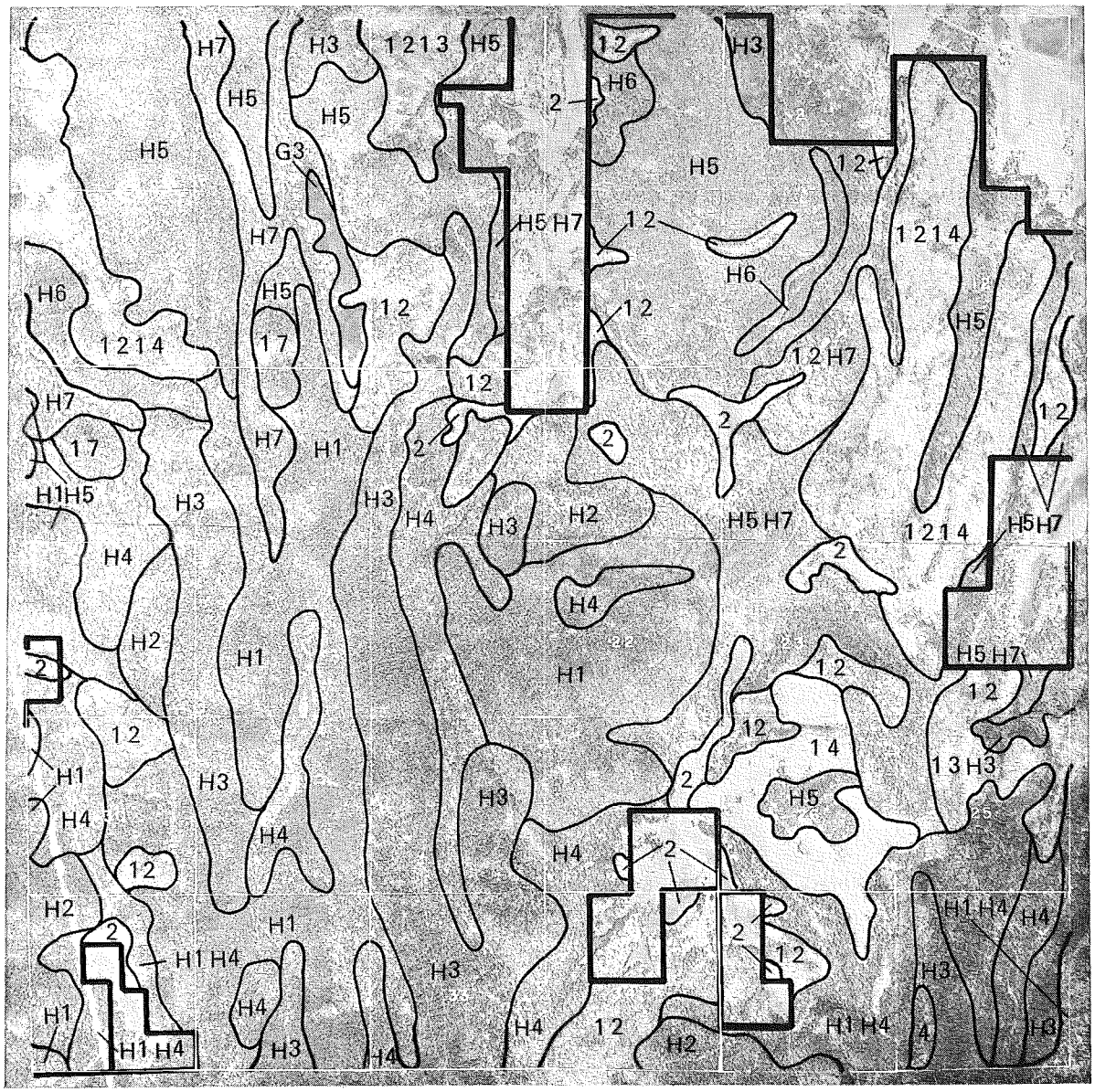
⊙ Soil Group Modal Location

T.35S.,R.8E.

Sheet No.56

(sheet 49)

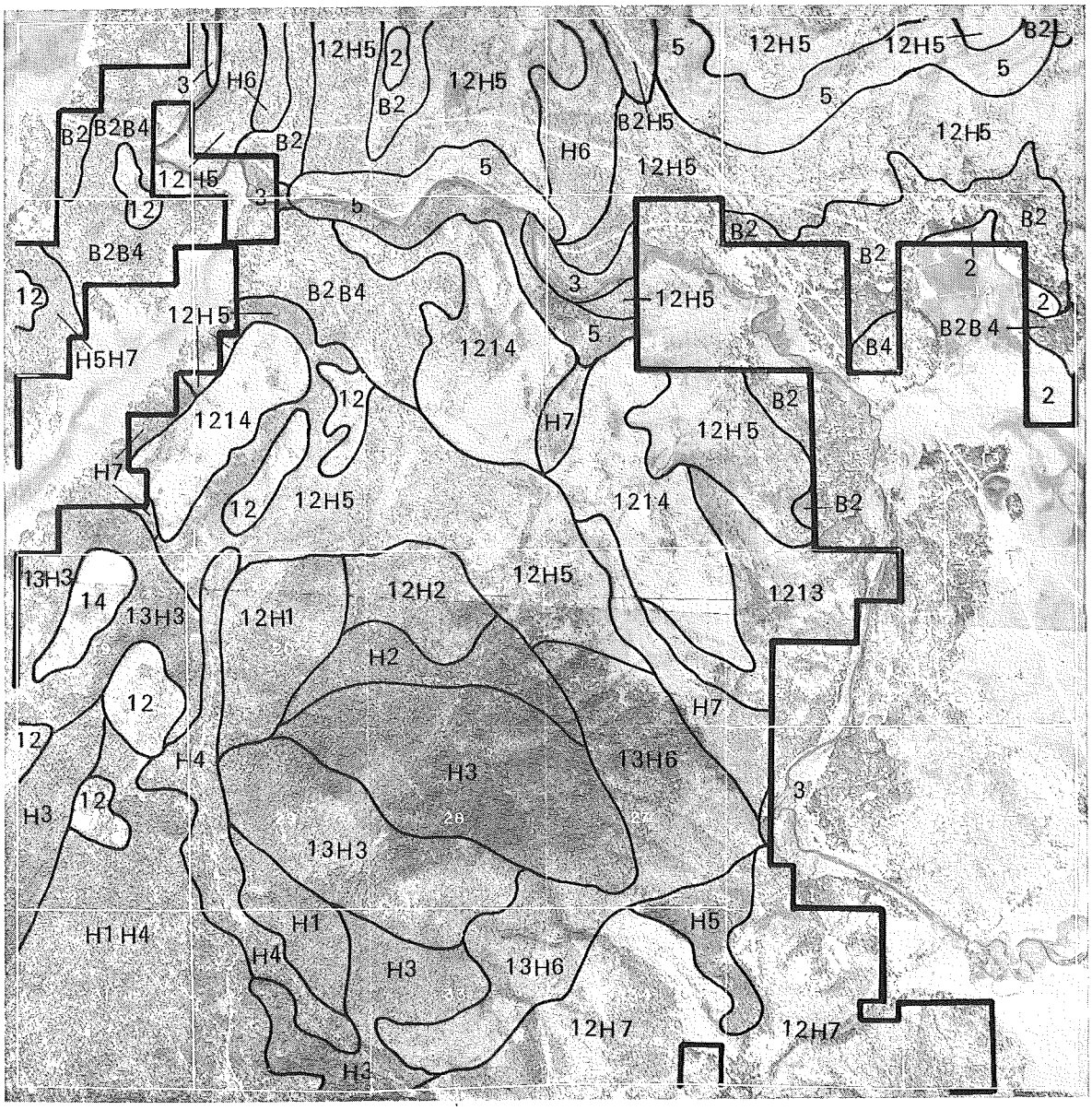
(sheet 55)


H7 H3 1213 H5
H5 H5
H5 G3
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T.35S.,R.9E.

Sheet No. 57

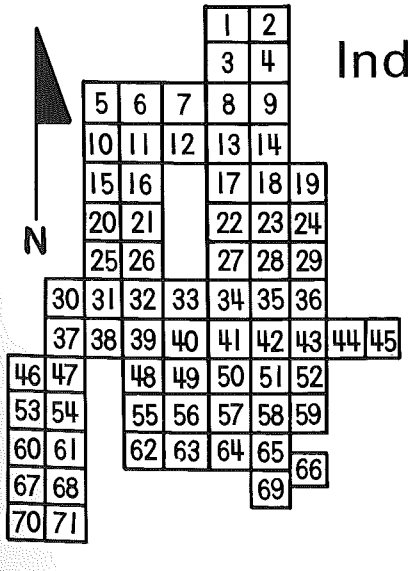
(sheet 50)



(sheet 56)

(sheet 58)

(sheet 64)



Index Map

Scale

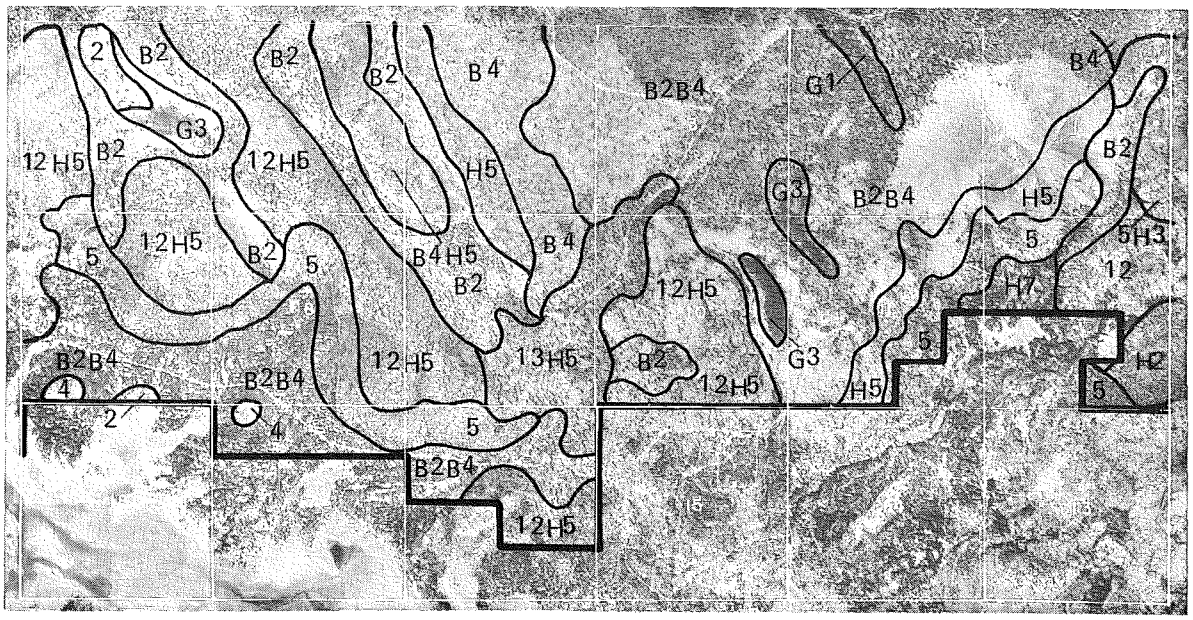
1 inch = 1 mile

Legend

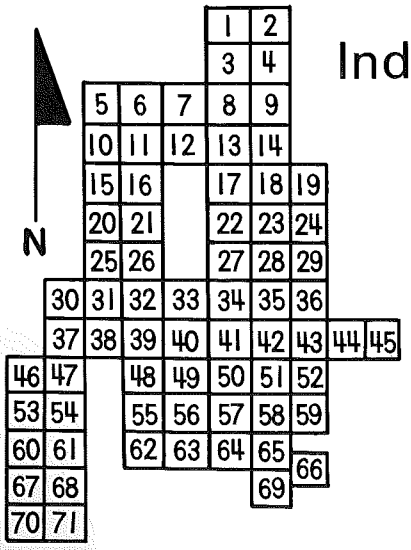
⊙ Soil Group Modal Location

T.35S.,R.10E.

Sheet No. 58



Index Map



Scale

1 inch = 1 mile

Legend

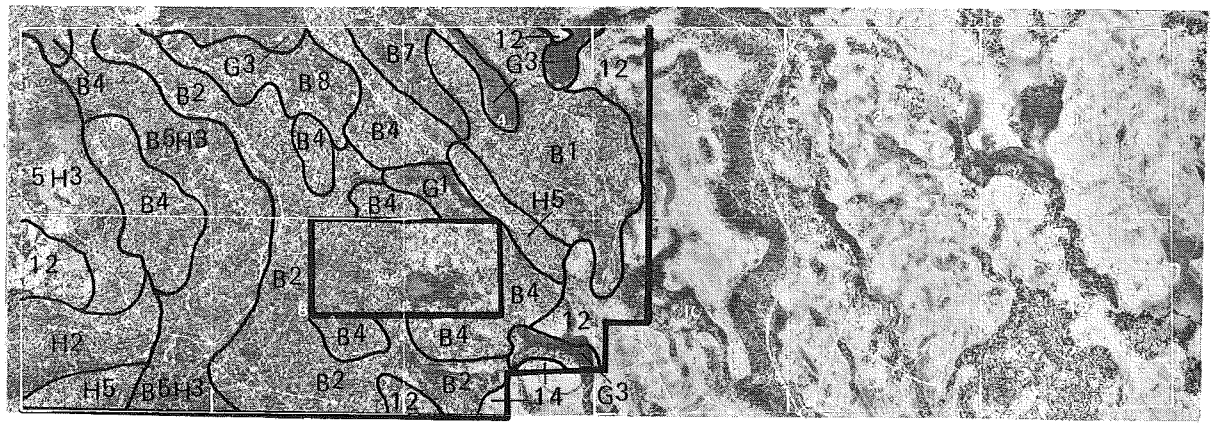
⊙ Soil Group Modal Location

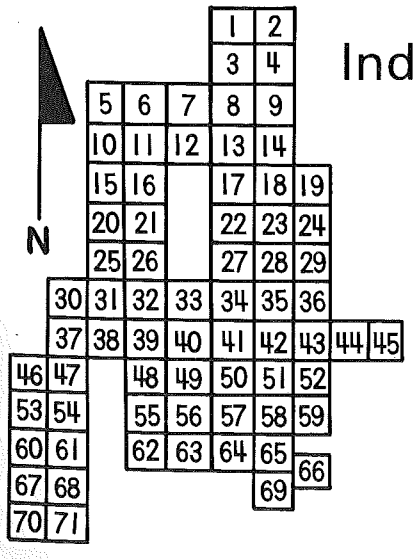
T.35S.,R.11E.

Sheet No. 59

(sheet 52)

(sheet 58)





Index Map

Scale

1 inch = 1 mile

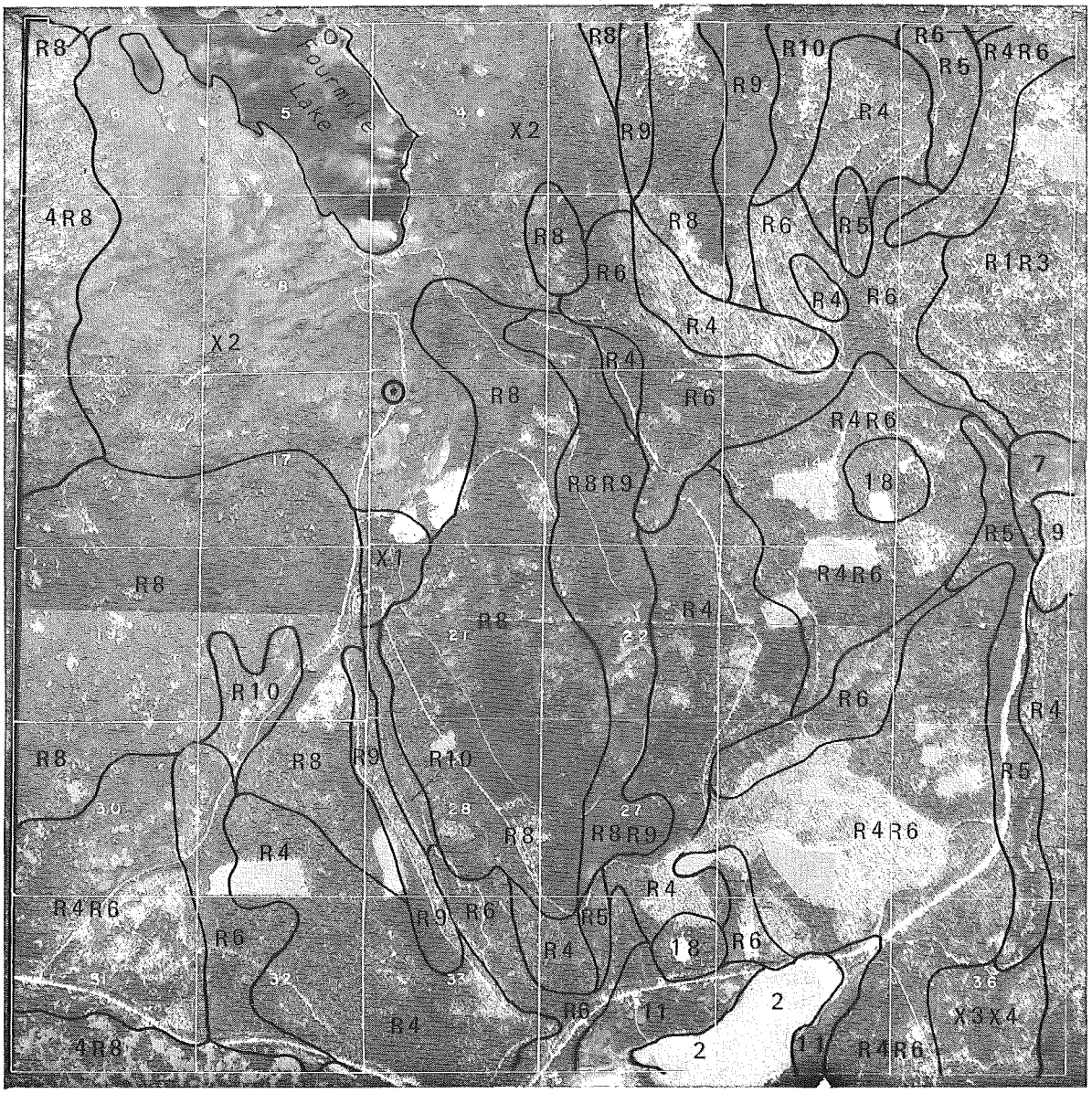
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⊙ Soil Group Modal Location

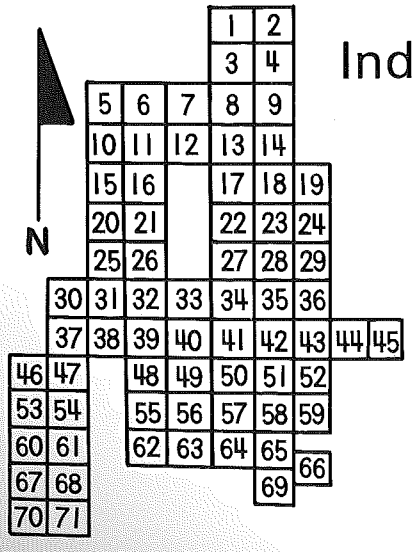
T.36S.,R.5E.

Sheet No. 60

(sheet 53)



Index Map



Scale

1 inch = 1 mile

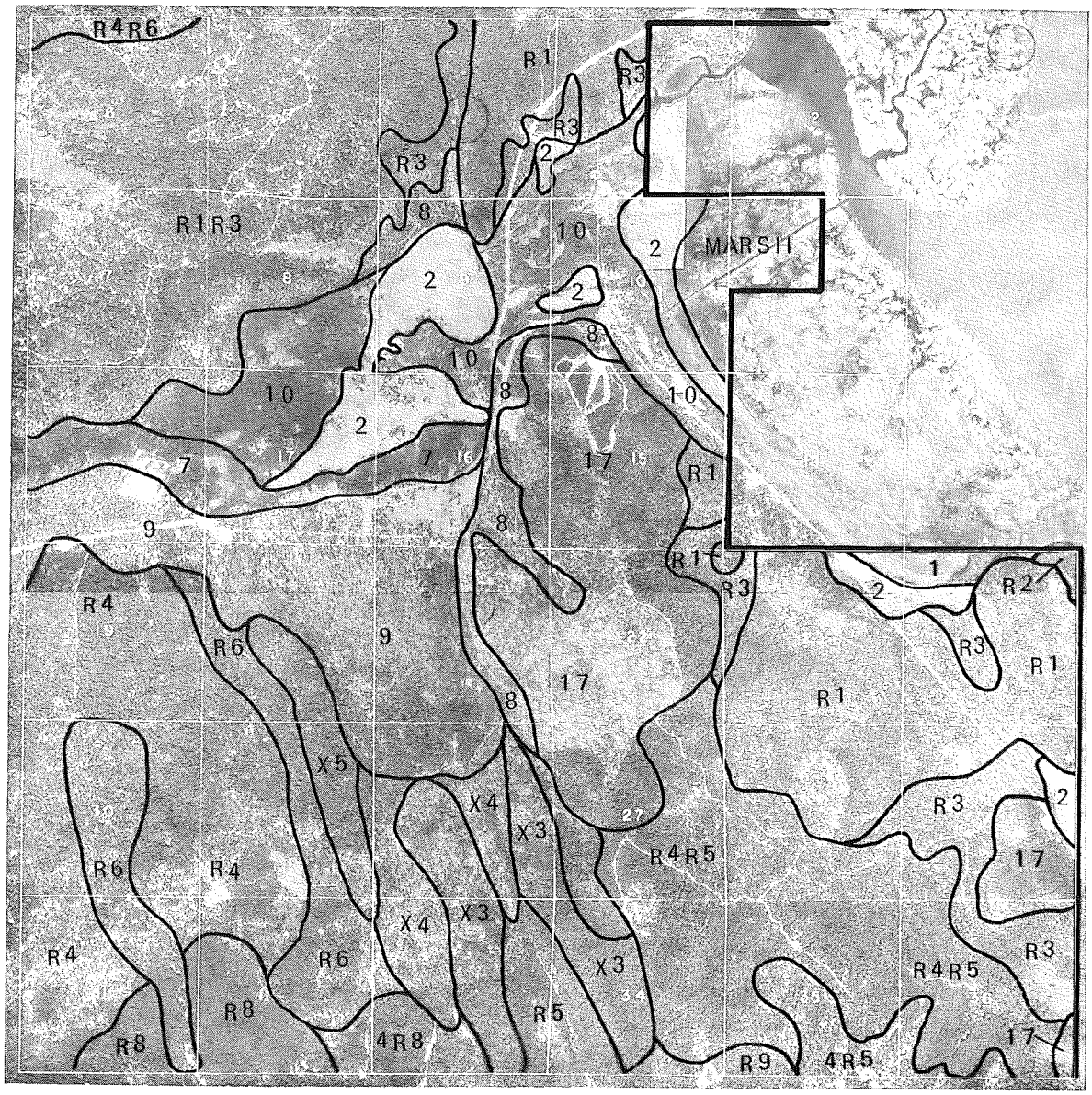
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⊙ Soil Group Modal Location

T.36S.,R.6E.

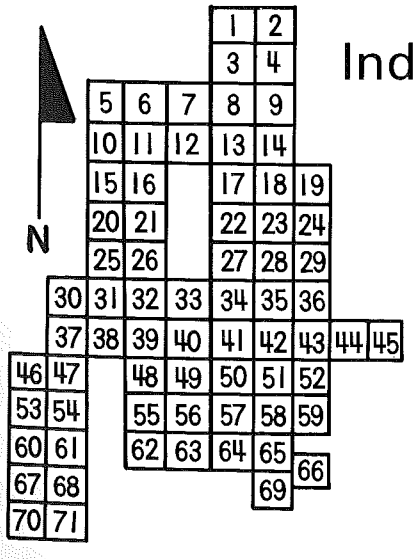
Sheet No. 61

(sheet 54)



(sheet 60)

(sheet 68)



Index Map

Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

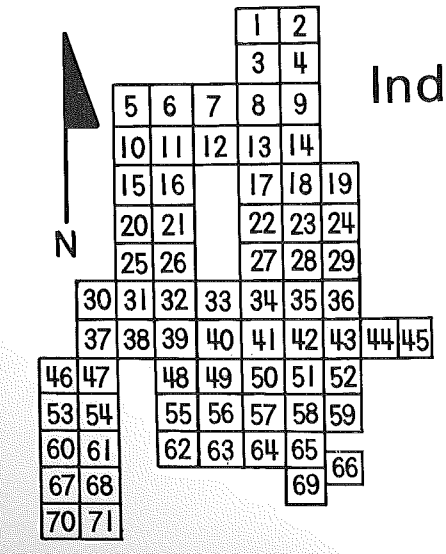
T.36S.,R.7E.

Sheet No. 62

(sheet 55)



(sheet 63)



Index Map

Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

T.36S.,R.8E.

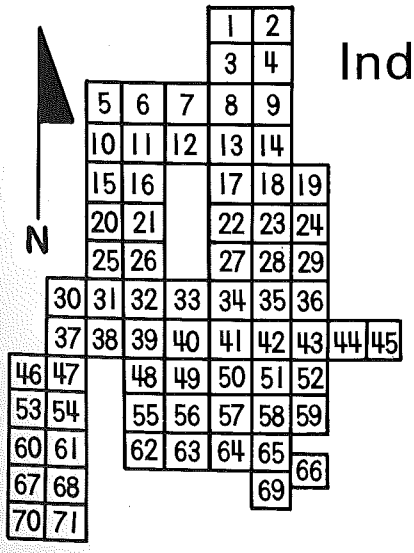
Sheet No. 63

(sheet 56)

(sheet 62)



(sheet 64)



Index Map

Scale

1 inch = 1 mile

Legend

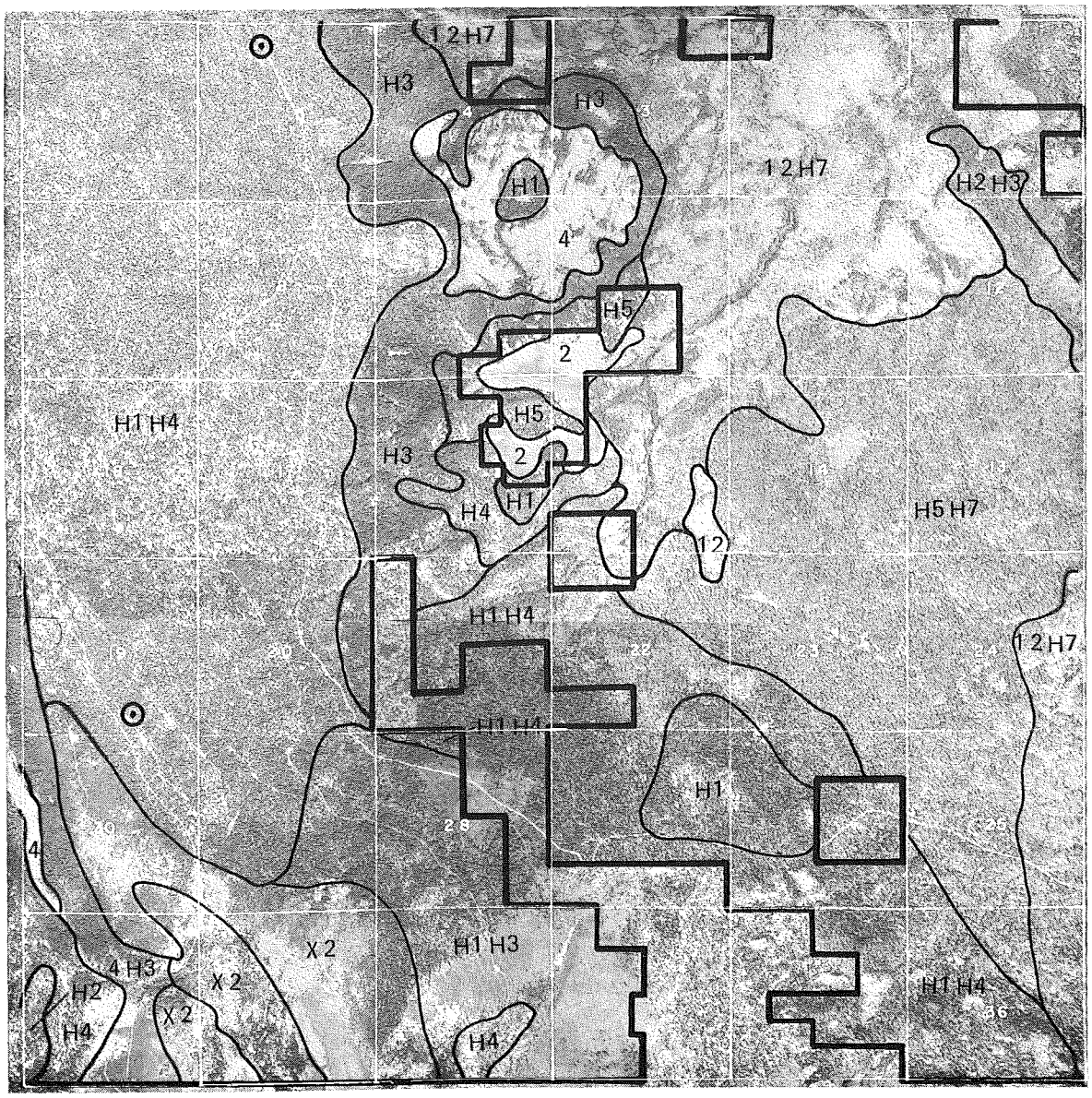
⊙ Soil Group Modal Location

T.36S.,R.9E.

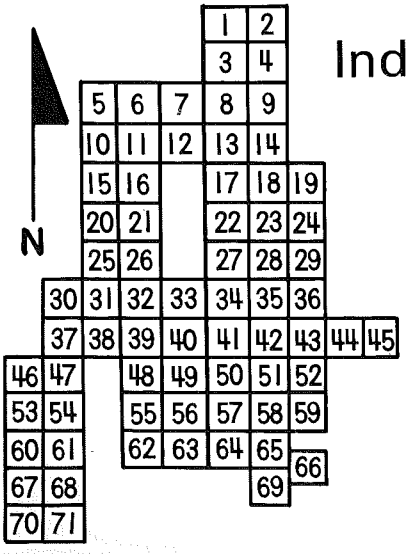
Sheet No.64

(sheet 57)

(sheet 63)



(sheet 65)



Index Map

Scale

1 inch = 1 mile

Legend

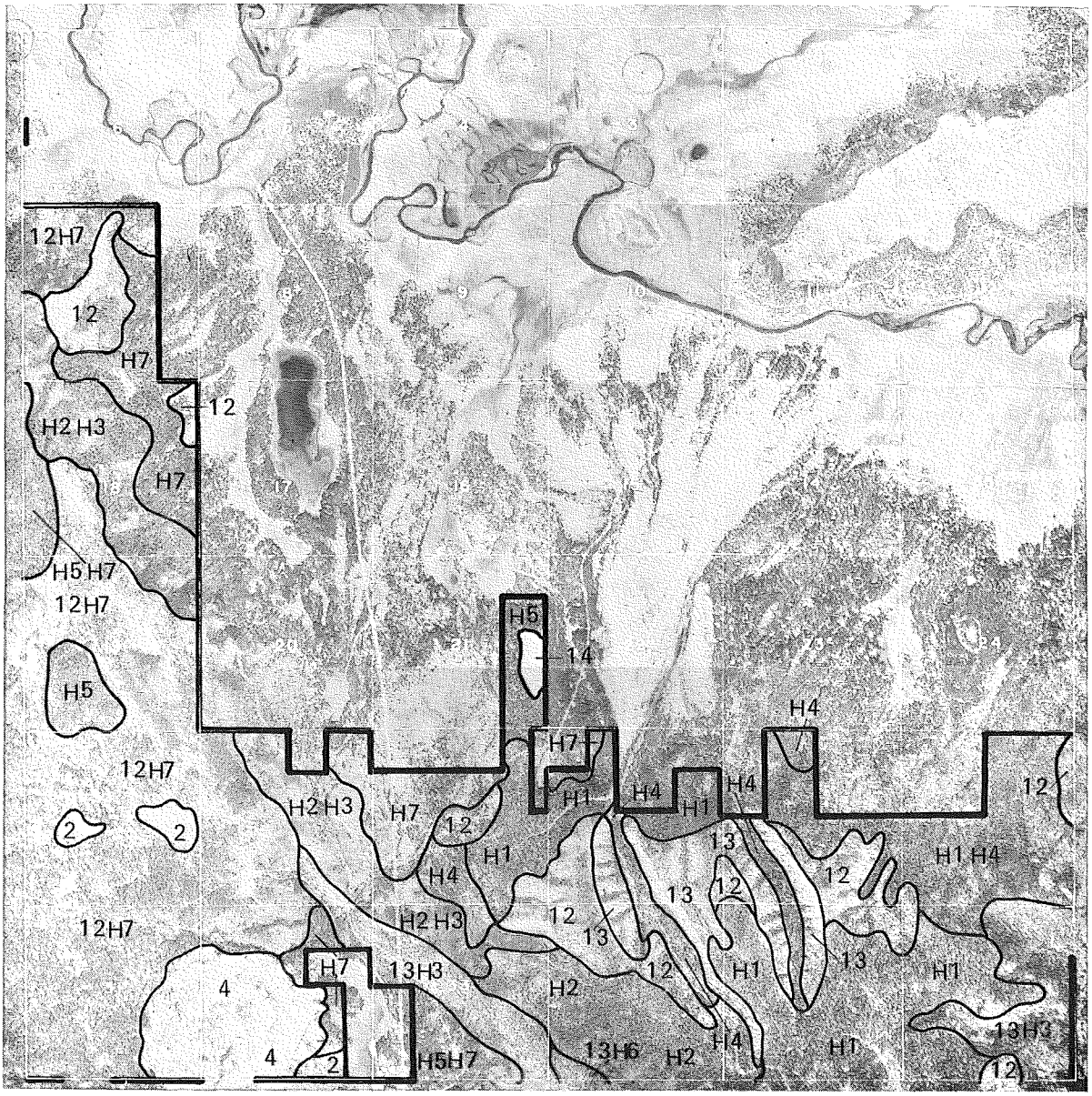
⊙ Soil Group Modal Location

T.36S.,R.10E.

Sheet No. 65

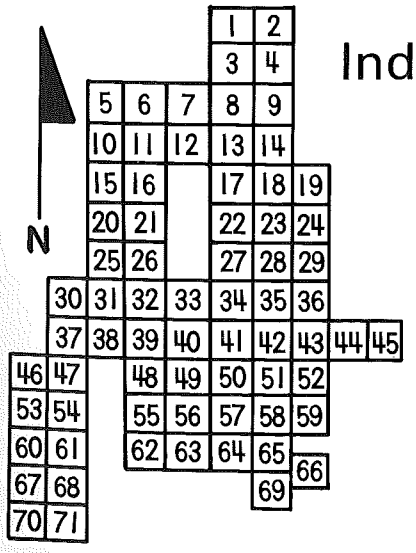
(sheet 58)

(sheet 64)



(sheet 66)

(sheet 69)



Index Map

Scale

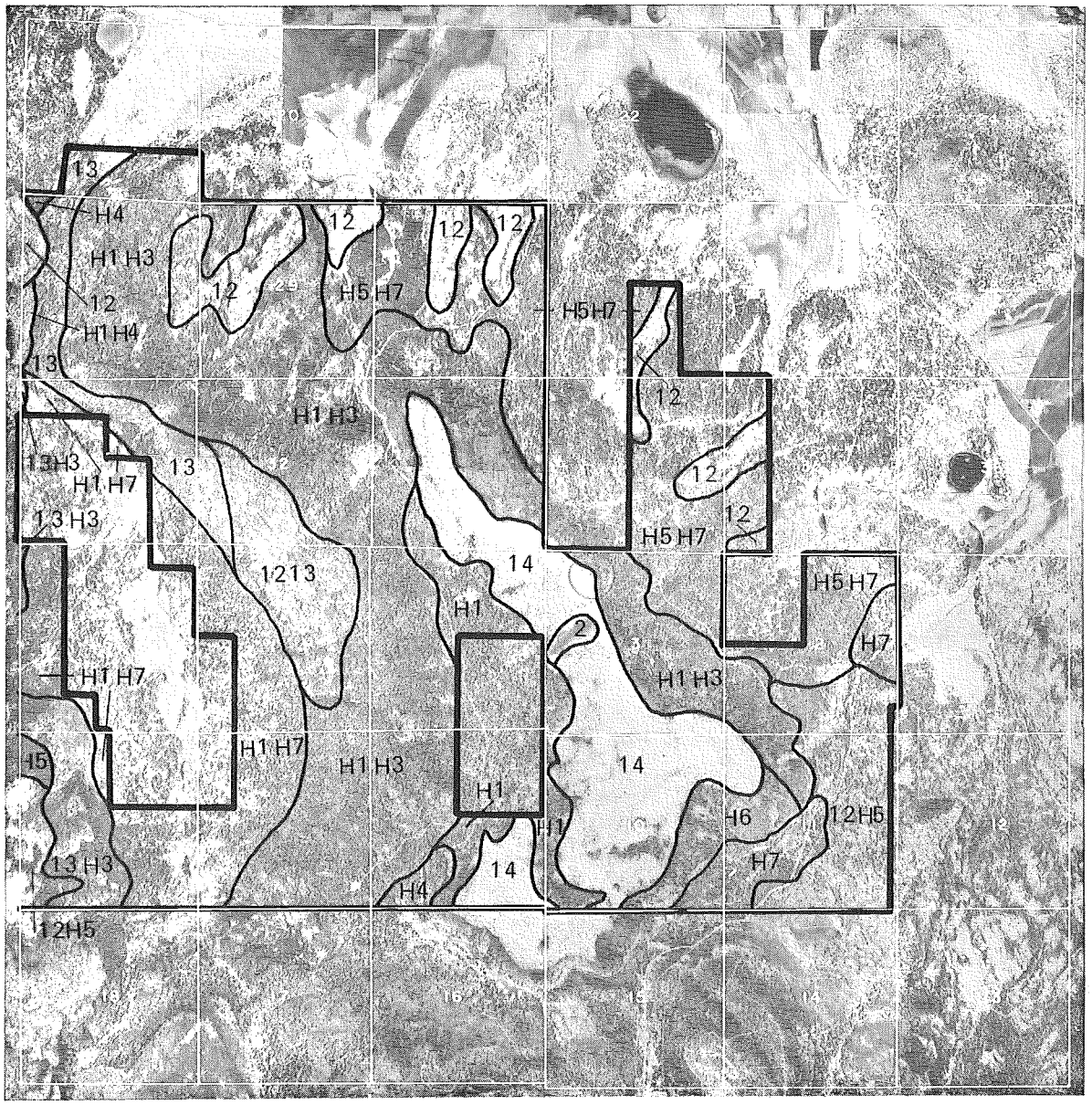
1 inch = 1 mile

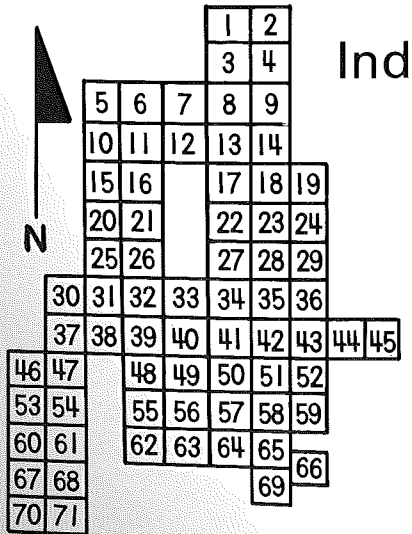
Legend

⊙ Soil Group Modal Location

T.36,37S.,R.11E.

Sheet No.66





Index Map

Scale

1 inch = 1 mile

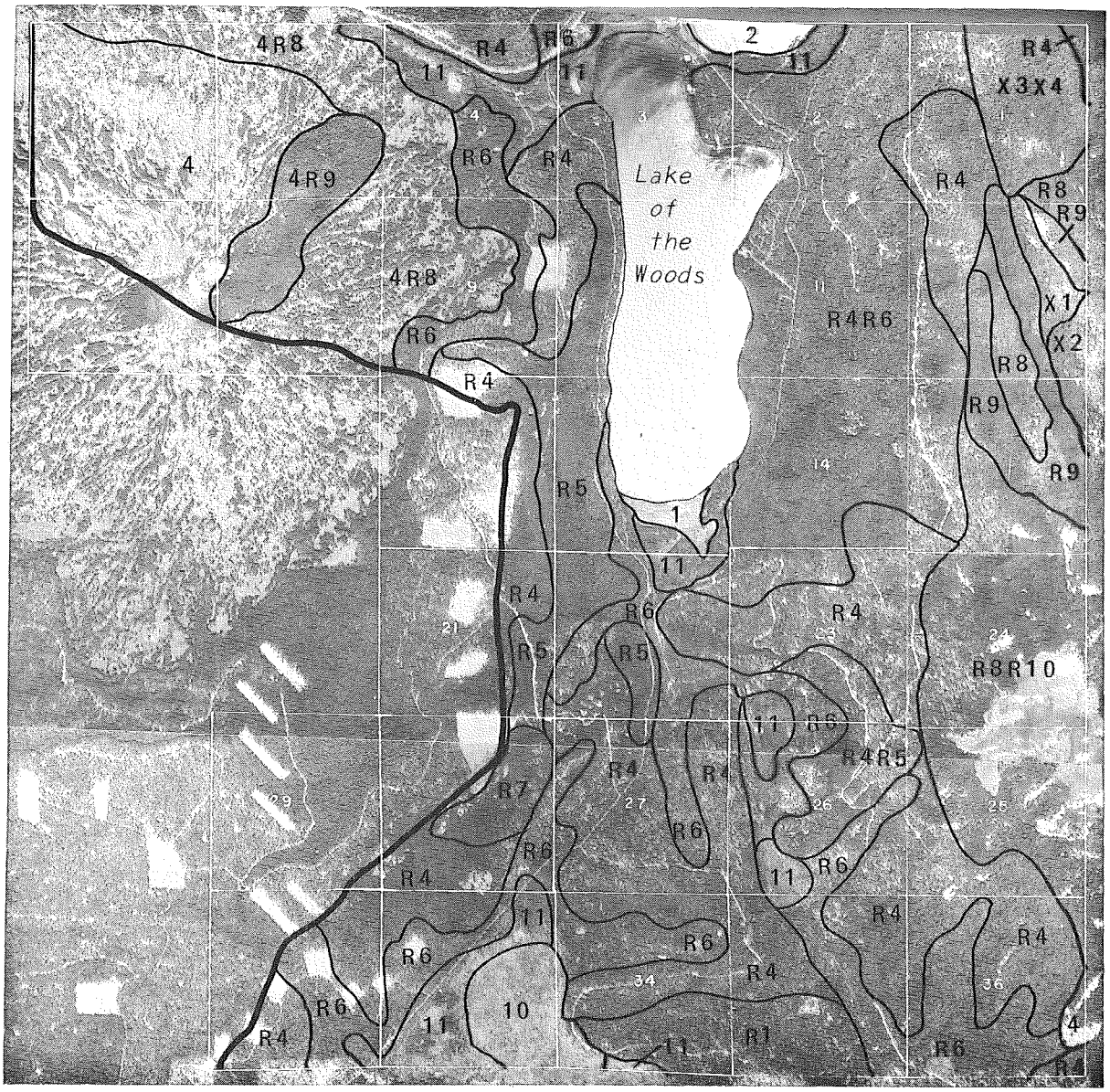
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⊙ Soil Group Modal Location

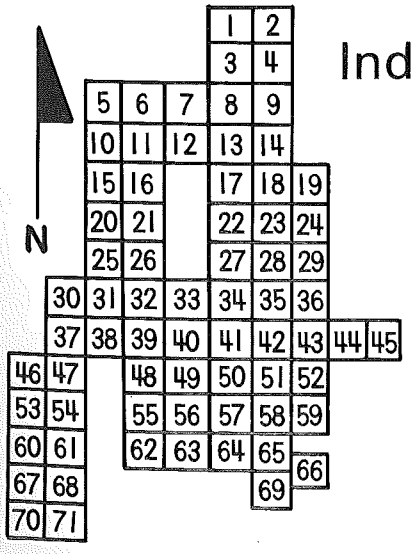
T.37S.,R.5E.

Sheet No. 67

(sheet 60)



Index Map



Scale

1 inch = 1 mile

Legend

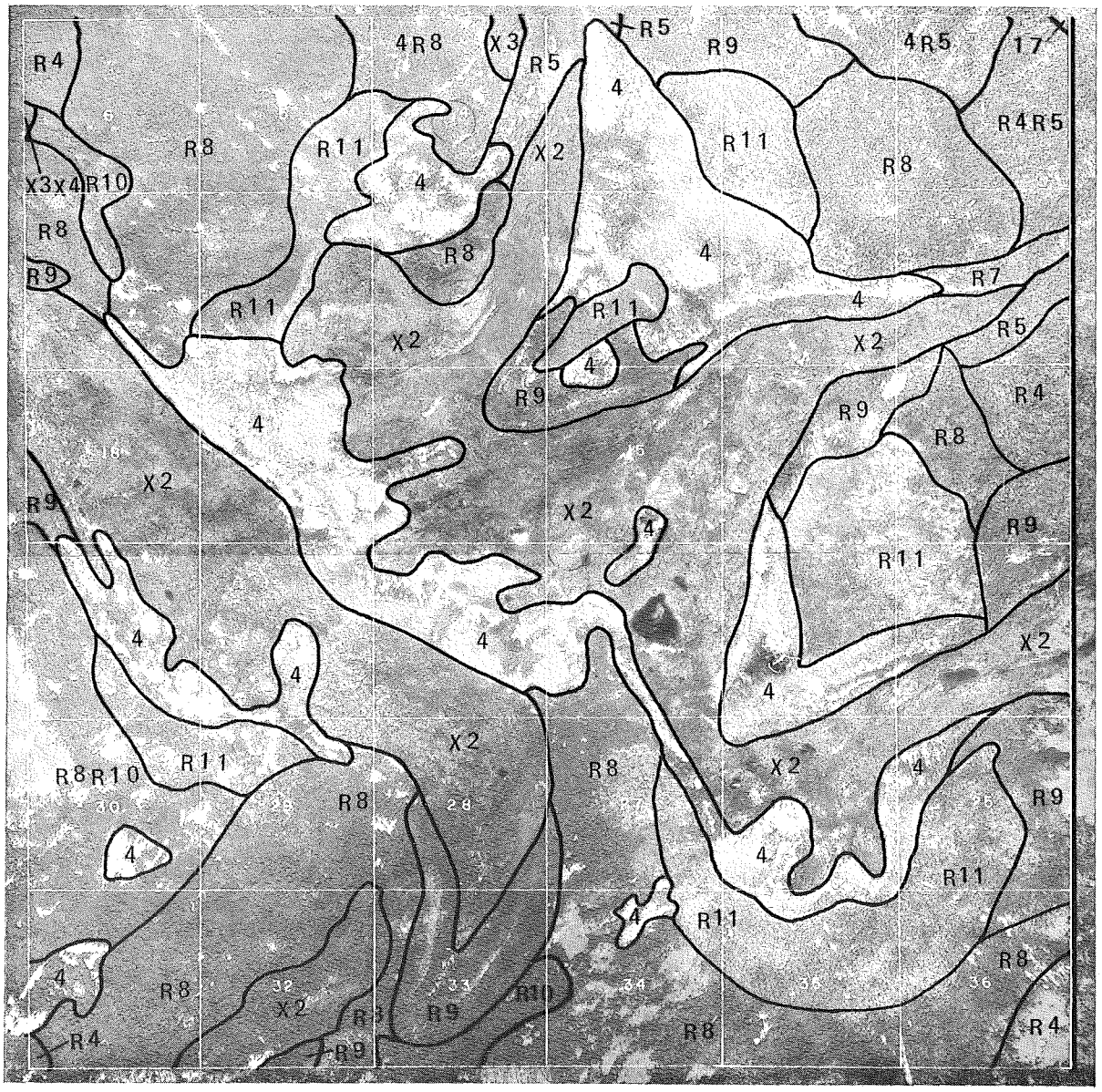
⊙ Soil Group Modal Location

T.37S.,R.6E.

Sheet No. 68

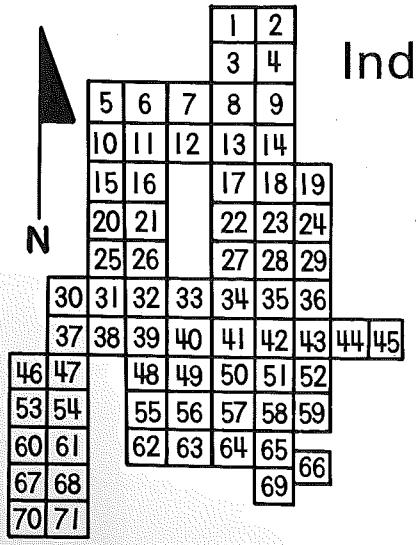
(sheet 61)

(sheet 67)



(sheet 71)

Index Map



Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location

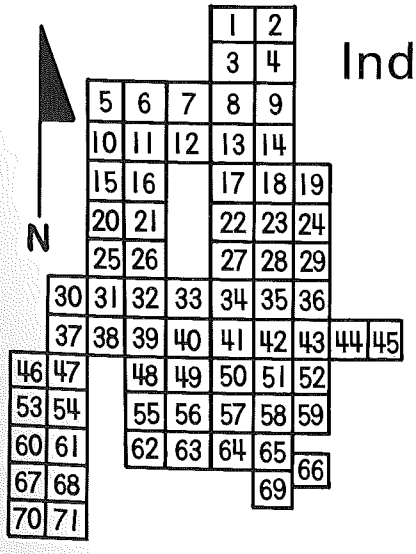
T.37S.,R.11-1/2E.

Sheet No. 69

(sheet 65)



(sheet 66)



Index Map

Scale

1 inch = 1 mile

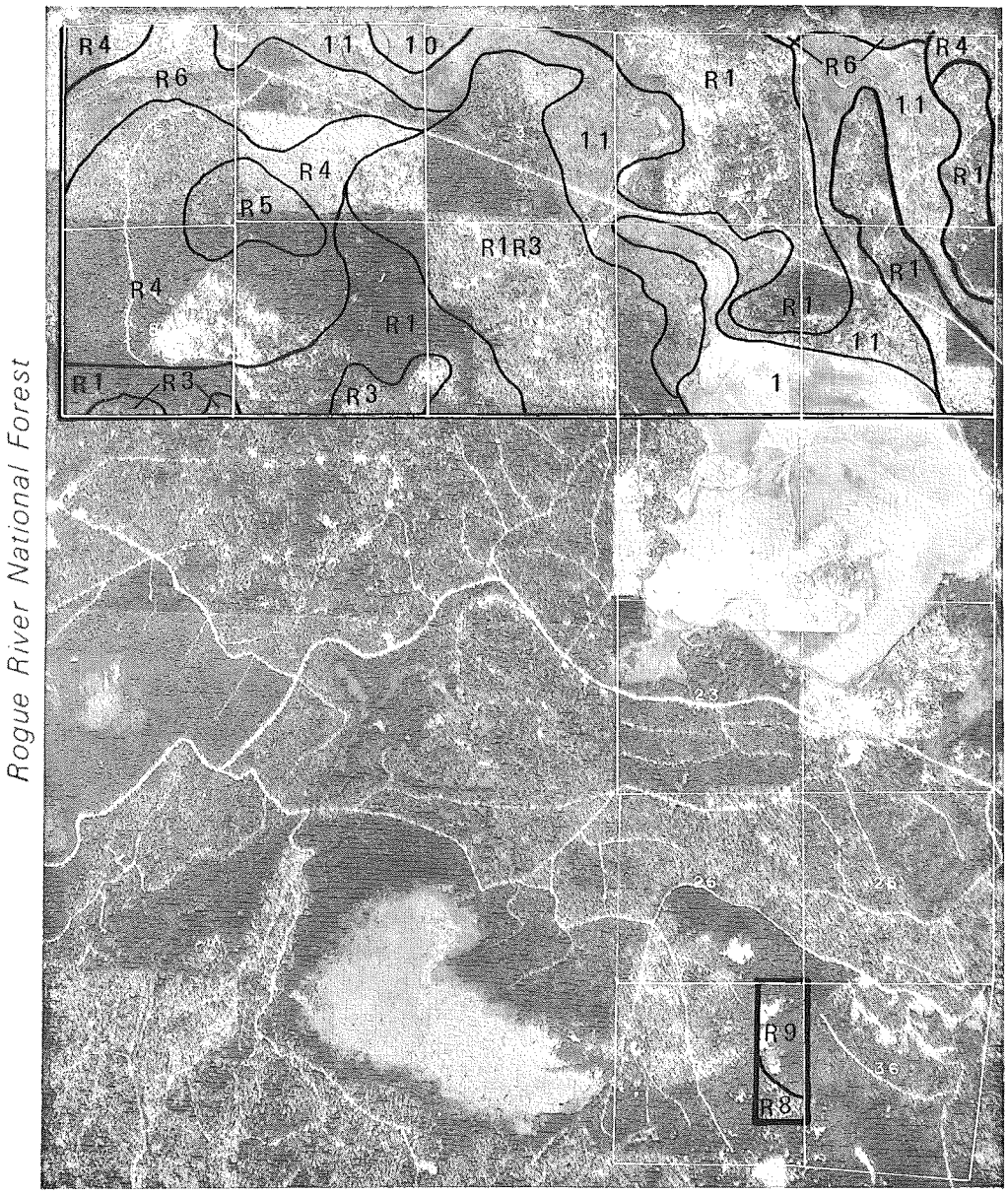
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⊙ Soil Group Modal Location

T.38S.,R.5E.

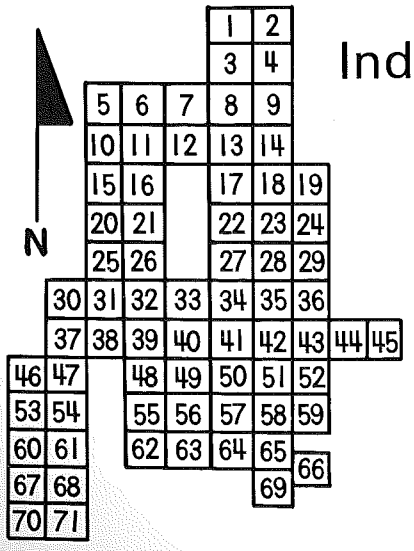
Sheet No. 70

(sheet 67)



Rogue River National Forest

(sheet 71)



Index Map

Scale

1 inch = 1 mile

Legend

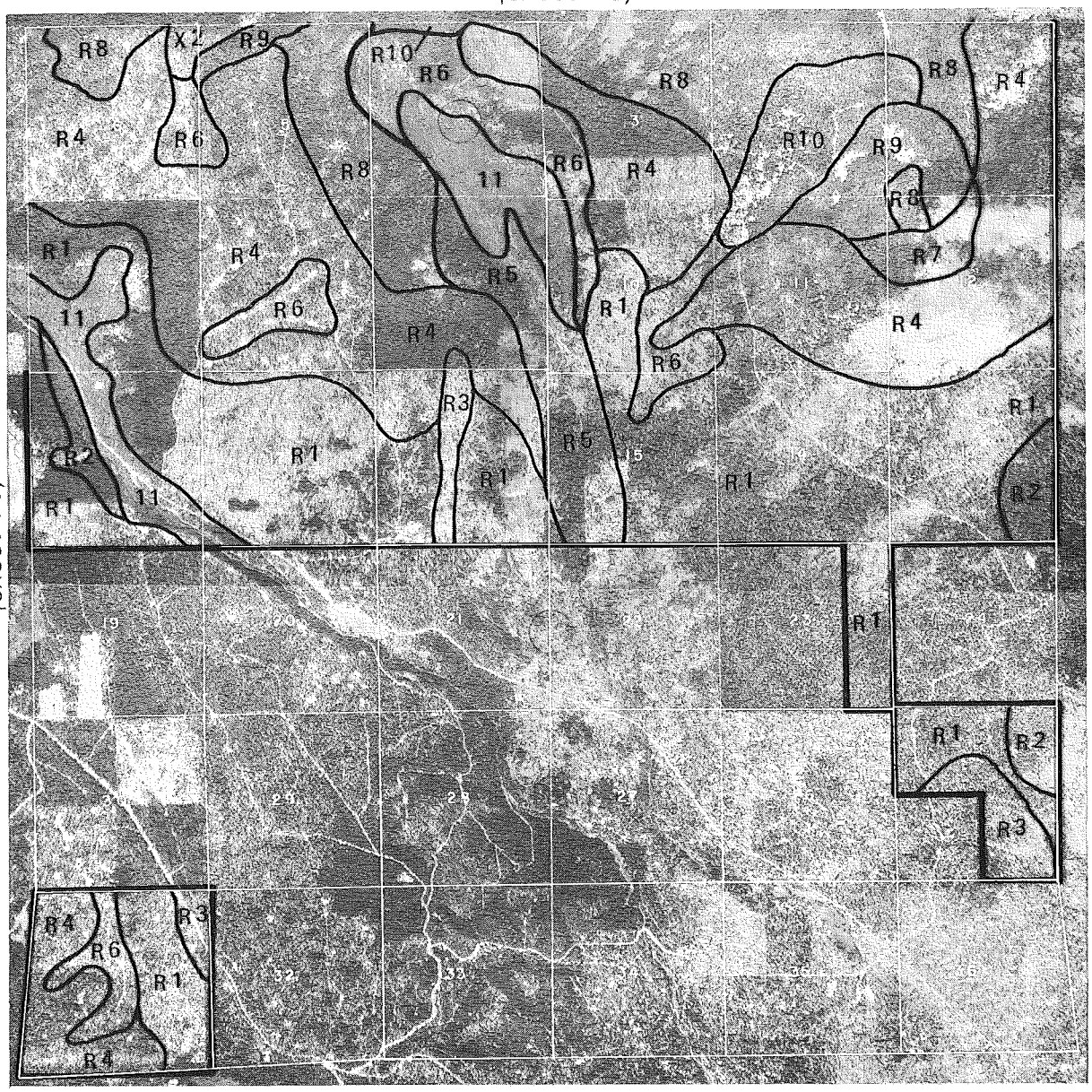
⊙ Soil Group Modal Location

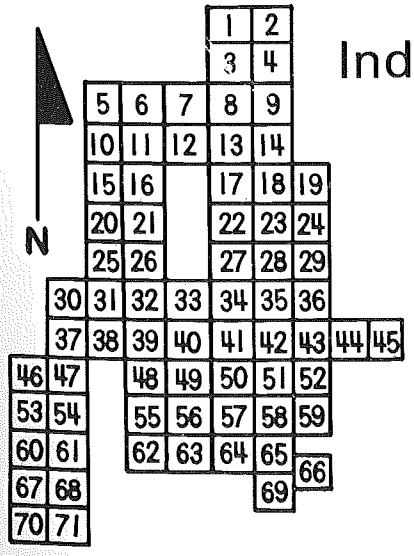
T.38S.,R.6E.

Sheet No. 71

(sheet 68)

(sheet 70)





Index Map

Scale

1 inch = 1 mile

Legend

⊙ Soil Group Modal Location



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Winema National Forest