SIGNATURE PAGE

for

RESEARCH NATURAL AREA ESTABLISHMENT RECORD

McAfee Research Natural Area

Inyo National Forest

Mono County, California

The undersigned certify that all applicable land management planning and environmental analysis requirements have been met and that boundaries are clearly identified in accordance with FSM 4063.21, Mapping and Recordation and FSM 4063.415.e(3) in arriving at this recommendation.

Prepared by _____ Date 9/29/03
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Concurrence of _____ Date 10/8/03
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Established by _____ Date 11/6/03
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Pacific Southwest Region

Establishment Record

for

McAfee Research Natural Area

within

Inyo National Forest

Mono County, California

McAfee Research Natural Area

MAPS

## A. INTRODUCTION

The Forest Service Research Natural Areas (RNAs) are part of the national RNA system, which is a network of public lands being protected permanently for the purposes of maintaining biological diversity, providing ecological baseline information, education, and research. Areas representing both widespread and unique ecosystems are selected for RNAs and only non-manipulative research and observation are allowed in the RNAs.

Selection of RNAs in California Forest Service land (Pacific Southwest Region [Region 5]) is based on the identification of "target elements" and unique ecosystems. Target elements are plant communities described in varies ecological studies and reference works, such as Kuchler (1966), Holland (1986), Society of American Foresters (SAF) (Eyre 1980), and Keeler-Wolf's (1990a)evaluation of target elements. Unique ecosystems include unusual plant assemblages, geologically unusual environments, or aquatic areas. Selections are intended to accurately reflect the natural diversity of vegetation types on Forest Service land in California and lead to the long term study of each.

Most RNAs contain far greater diversity of vegetation types than the designated target elements and representation of these types within the RNA is of equal importance. For an overview of Forest Service RNAs in California, refer to Todd Keeler-Wolf (1990b), "Ecological Surveys of Forest Service Research Natural Area in California" (USDA Forest Service General Technical Report PSW-125).

The McAfee Research Natural Area (MRNA) is located one mile (1.6 km) north of the Ancient Bristlecone Pine Forest on the White Mountain Plateau near White Mountain Peak, east of Bishop. Alpine fell-fields (Holland type 91140, Kuchler type 45 [Alpine Meadows and Barren]) including scree slopes, alpine grassland slopes and sedge meadows are represented in the RNA.

This area was first established as White Mountain Scientific Area in 1971. In 1976 it had received consideration for RNA designation after a preliminary ecological survey (Taylor 1976) was completed. It was formally recommended as a candidate RNA by the Inyo National Forest Land and Resource Management Plan (1985, LRMP) to represent the alpine fell-field in the Basin Ranges physiographic province (Keeler-Wolf 1990b), or the Intermountain Semi-Desert and Desert province, the ecological unit defined by the USDA Forest Service (Miles and Goudey 1997). An ecological survey was conducted over an area much larger than the final RNA boundaries (Travers 1993).

The name and boundaries of MRNA have been changed over time while different areas were being considered. The final recommendation was determined as a result of the Environmental Assessment process. As a result, approximately ten percent of the RNA was not covered by the Ecological Survey. Millar, Cheng and DesBaillets visited the area and mapped the vegetation of the unsurveyed portion in July, 2000 (Millar, et al. 2000).

The MRNA as described in this Establishment Record lies entirely on lands managed by the Inyo National Forest, the sole administrator of this RNA. Lands adjoining the MRNA are all Forest

Service lands. Lands to the east are proposed Wilderness Area and to the west are managed for Semi-Primitive Recreation Area.

Two White Mountain Research Station (WMRS) laboratories are located nearby the RNA. The Summit Laboratory is located atop White Mountain Peak 2.2 miles (3.6 km) northwest and the Barcroft Laboratory is 0.4 mile (o.6 km) southwest of MRNA. Both laboratories have been operating since late 1940s. Barcroft Laboratory is a developed research site which includes roads, buildings, and active research (including manipulative research). Thousands of scientists in the biological, natural, and physical sciences have used the WMRS research facilities (USDA Forest Service, Inyo National Forest 1975, Hall 1991). The White Mountain Research Station is administrated by the University of California under a Forest Service special-use permit.

(1) Land Management Planning

The establishment of McAfee RNA is recommended and evaluated in the Inyo National Forest Land and Resource Management Plan (LRMP) and accompanying Environmental Impact Statement (USDA Forest Service 1988a and 1988b, Appendix A, B). The land allocation for McAfee RNA was decided by the Record of Decision for the LRMP by the Regional Forester in 1988. The establishment of MRNA will be completed by the signing of this Establishment Record with concurrence of the Station Director, and finally by signing the Record of Decision for the Environmental Analysis.

The McAfee RNA is within Management Area #13 - White Mountains and Management Prescription #5 - Research Natural Area, which emphasizes maintenance of natural ecological processes for research, study, and observation (Appendix A).

B. OBJECTIVE

The MRNA is established to represent alpine fell-field communities (Holland type 91140, Kuchler type 45) of the Southern Basin Ranges physiographic province (Intermountain Semi-Desert and Desert ecological province). Fell-field is a subset of the ecosystems found at high elevations (7500 feet [2286 m]) and is defined as alpine areas characterized by perennial herbs, dwarf shrubs and cushion plants of low stature (Holland 1986).

Preservation of the plant communities in MRNA serves the objective to protect rare species. *Potentilla morefieldii* B.Ertter (Hickman 1993) and *Draba monoensis*[1] Rollins & R.A. Price (Hickman 1993) are two species considered by the California Native Plant Society (CNPS) as listed 1B species (plants rare, threatened, or endangered in California and elsewhere) (Skinner and Pavlik 1994, Tibor 2001). The MRNA also contains habitat for *Poa abbreviata* ssp. *marshii* [see Phytologia 71(5):390-413 (1991)], a CNPS List 2 species (plants that are rare, threatened, or endangered in California, but more common elsewhere).

[1] All plant names follow Munz (1968), except where noted, and for all tree names which are in accordance with the Jepson Manual (Hickman 1993).

Establishment of MRNA will also serve the objective of maintaining biodiversity. The MRNA contains several intermittent streams and numerous seeps and springs, which support unique plant communities for this area.

## C. JUSTIFICATION STATEMENT

According to Holland (1986), there are four types of fell-field communities in California based on location: Klamath-Cascade fell-field (Holland type 91110), Sierra Nevada fell-field (Holland type 91120), Southern California fell-field (Holland type 91130) and White Mountain fell-field (Holland type 91140). The White Mountain fell-field ecosystem, where the MRNA is located, is the driest of these.

There is another established RNA located within the White Mountain fell-field ecosystem, the White Mountain RNA. Some of the plant communities in the MRNA are also represented in the White Mountain RNA, which is located approximately 4 miles (6 km) south of MRNA. However, the White Mountain RNA was established to represent the bristlecone pine (*Pinus longaeva*) forest of the Southern Basin Ranges physiographic province.

Plant communities within the boundary of the MRNA represent a diverse and unusual array of high elevation plant species. There are nine distinct plant communities between the peak of White Mountain and the dolomite barrens to the south. Thus, in a relatively small area, is the opportunity to preserve a rich diversity of unique plant communities.

Many of the plant species found in the MRNA are not found in other localities below 10,000 ft (3048 m) in California.

The hydrological system in the RNA has important watershed values and supports unique plant communities. MRNA contains the entire watershed of the headwaters of North Fork McAfee Creek and part of the South Fork McAfee Creek. Both the North and South Fork of McAfee Creek originate in the RNA. In addition, there are numerous seeps and springs. Many plants occur in these wet areas only. Establishment of the RNA is valuable for maintaining the interrelationships of terrestrial and aquatic systems, and facilitates research, monitoring and protection.

McAfee RNA is part of the largest continuous alpine steppe in California and the Great Basin, and is the most accessible large alpine area in California. It is unique due to the long history of research activities in the area. With the adjacent scientific facilities of WMRS and the concentration of scientific interest, the MRNA can be used as a control area for research done in the surrounding region and is valuable as a scientific research site for local (such as high-altitude environment and physiological processes related to reduced oxygen and increased ultraviolet levels) and global ecosystem studies (such as plant genetics, speciation, global warming, etc.)

Another unique aspect of this region is the rainfall level. Rainfall in the MRNA area is, on average, lower than in many other high elevation alpine ecosystems due to the rain-shadow effect of the Sierra Nevada.

D. PRINCIPAL DISTINGUISHING FEATURES

Topography of the RNA is a rolling plateau with fairly gentle relief. The plateau is flanked to the north and east by steep canyons, formed by nivation (erosion of rock or soil caused by the alternate thawing and freezing of meltwater beneath and at the margins of snowbanks) and glaciation, actively cutting into the plateau.

Within the RNA, there are two major sub-plateaus lying in a west-east direction, separated by the North Fork McAfee Creek. The South Fork McAfee Creek, which supports the McAfee Meadow, runs on the southern portion of the RNA. Both creeks drain to the east.

To the west of the sub-plateaus is a ridge line which extends from the base of White Mountain Peak southward. White Mountain Peak (14,246 ft [4342 m]), the highest point in the region, is steep-sloped with active talus and lies northwest of the RNA.

In general, the whole area appears rocky with shallow and poorly developed soil. Climate is severe, being cold and dry with strong winds during all seasons.

E. LOCATION (reference maps 1 and 2)

(1) National Forest involved

The MRNA is located entirely in the Inyo National Forest.

(2) Latitude/Longitude

The approximate mean latitude and longitude at the center of the MRNA are 37°35'N, 118°15'W.

(3) Boundary description

The MRNA lies within T4S R34E, Mt. Diablo Base and Meridian (MDBM) and includes portions of sections 4, 8, 9, 10, 15, 16, 17, 20, 21, and 22 (USGS Mount Barcroft and Juniper Mtn. 7.5 Minute quad.)

The boundaries are described as follows (Map 1):

1. Beginning at the peak (elevation 13,189 ft [4020 m]) in NW1/4 NW1/4 Sect. 9 (Point A) and running south-southwestwardly approximately 0.88 mile (1.42 km) to the peak of 12,970 feet (3953 m) elevation in SE1/4 SE1/4 Sect. 8 (Point B),

2. thence south approximately 1.43 miles (2.30 km) to the northeast corner of Barcroft Observatory Site in E1/2 NE1/4 Sect. 20 (Point C),

3. thence southeastwardly approximately 0.79 mile (1.27 km) to the peak of 12,205 feet (3720 m) elevation in NW1/4 SE1/4 Sect. 21 (Point D),

4. thence eastwardly approximately 1.29 miles (2.08 km) to the peak of 11,783 feet (3591 m) elevation in NE1/4 SE1/4 Sect. 22 (Point E),

5. thence northwardly approximately 0.80 mile (1.29 km) to the peak of 11,745 feet (3580 m) elevation in NE1/4 SE1/4 Sect. 15 (Point F),

6. thence north-northwestwardly approximately 1.06 miles (1.71 km) to the knoll at the east end of the plateau, approximately 11,880 feet (3621 m) elevation, in NW1/4 SE1/4 Sect. 10 (Point G),

7. thence westwardly approximately 1.32 miles (2.13 km), then northwardly approximately 0.66 miles (1.06 km), following the break-off line between- the plateau and the steep canyon and ascending to a switchback at 13,091 feet (3990 m) elevtion in SE1/4 SW1/4 Sect. 4 (Point H),

8. thence southwestwardly approximately 0.3 mile (0.48 km) to the peak of 13,189 ft (4020 m) elevation in NW1/4 NW1/4 Sect. 9 (Point A), the point of beginning.

(4) Acreage

The total acreage of McAfee RNA is 2030 acres (822 ha).

(5) Elevations

Elevations range from 13,189 ft (4,020 m) at the northern tip of the RNA to 10,600 ft (3,231 m) at the intersection of South Fork McAfee Creek and the RNA's eastern boundary.

(6) Access

The MRNA can be reached by two-wheel drive vehicles via the White Mountain Road from the south. White Mountain Road branches off from highway 168 near Cedar Flat, approximately 12 miles (19 km) northeast of Big Pine. It runs northward, passes the Ancient Bristle Cone Pine Forest, and reaches the RNA. The road runs along the western boundary of the RNA and ends at the peak of White Mountain, passing WMRS's Barcroft facility. The distance from Cedar Flat to the southwest boundary of MRNA is approximately 27 miles (43 km) (Map 2).

There are no foot trails within the boundaries of the RNA. However, access in the RNA is easy, due to gentle aspects and lack of upright vegetation.

F. AREA BY COVER TYPES

| SAF TYPES (Eyre 1980) | percent | acres | hectares |
|---|---|---|---|
| Unclassified | 99 | 2009 | 814 |
| Aspen (217) | 1 | 21 | 8 |
| TOTALS | 100 | 2030 | 822 |
| KUCHLER TYPES (Kuchler 1966) | | | |
| Alpine meadows and barren (K45) | 99 | 2009 | 814 |
| Unclassified | 1 | 21 | 8 |
| TOTALS | 100 | 2030 | 822 |
| Holland (Holland 1986): | | | |
| White Mountain Fell-field (91140) | 51 | 1043 | 422 |
| Subalpine Sagebrush Scrub (35220) | 22 | 449 | 182 |
| Wet Subalpine or Alpine Meadow (45210) & Alpine Snowbank Margin (91300) | 6 | 118 | 48 |
| Alpine Talus and Scree Slope (91200) | 20 | 399 | 162 |
| Aspen Forest (81B00) | 1 | 21 | 8 |
| TOTALS | 100 | 2030 | 822 |

## G. PHYSICAL AND CLIMATIC CONDITIONS

The nearest reliable weather Station operated by the National Weather Service is Bishop, at 4,180 ft (1250 m), in Owens Valley to the west of MRNA. However, due to the significant elevational difference, the climatological data in Bishop are only broadly applicable to the MRNA.

The White Mountain Research Station collected climatic data on the east slope of Mt. Barcroft, at 12,470 ft (3800 m), since 1956. However, data collecting in winter months stopped in 1980 (Hall 1991).

The climate is characterized by cold, dry weather. The average maximum and minimum temperatures are 36 $^{o}$F (2 $^{o}$C) and -26 $^{o}$F (-32 $^{o}$C) respectively. Precipitation falls mostly (over 80%) in the winter months as snow. Occasionally thunderstorms in the summer bring minor rainfall. The average annual precipitation is 18 inches (46 cm). Table 1 lists the 30-year average monthly temperature and precipitation data from 1956 to 1985 (winter months data are from 1956 to 1980), collected by the White Mountain Research Station (Hall 1991).

The average annual (1 Oct. - 30 Sept.) snowfall is 164 inches (417 cm), maximum annual snowfall was 238 inches (606 cm) in 1969, and the maximum monthly snowfall was 86 inches (219 cm, Dec. 1966).

Winds are persistent and strong at the MRNA. Maximum velocity recorded is around 100 miles per hour (m.p.h.) (161 km per hour). The strongest winds usually come in winter. Monthly average maximum speeds are about 30 m.p.h. (48 km per hour) during the winter and near 20 m.p.h. (32 km per hour) in the summer.

Because of the high elevations, solar radiation, especially ultraviolet, is intense in the area.

Table 1: Temperature and precipitation of McAfee RNA (from: Hall 1991)

| | Temperature: | | | | | | Precipitation: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (°F) | | | (°C) | | | (inches) | | | (mm) | | |
| | Ave. | Max. | Min. | Ave. | Max. | Min. | Ave. | Max. | Min. | Ave. | Max. | Min. |
| Jan. | 15.5 | 47 | -23 | -9.2 | 8.3 | -30.6 | 2.20 | 6.01 | .T | 560 | 1529 | .T |
| Feb. | 14.8 | 52 | -21 | -9.6 | 11.1 | -29.4 | 1.66 | 4.94 | 0.21 | 422 | 1257 | 53 |
| Mar. | 15.4 | 46 | -35 | -9.2 | 7.8 | -37.2 | 2.11 | 6.35 | .T | 537 | 1616 | .T |
| Apr. | 18.7 | 50 | -30 | -7.4 | 10.0 | -34.4 | 1.86 | 6.65 | 0.00 | 473 | 1692 | 0 |
| May | 28.4 | 59 | -15 | -2.0 | 15.0 | -26.1 | 1.71 | 6.75 | .T | 435 | 1718 | .T |
| June | 38.6 | 64 | 2 | 3.7 | 17.8 | -16.6 | 0.85 | 4.39 | 0.00 | 216 | 1117 | 0 |
| July | 46.7 | 72 | 12 | 8.2 | 22.2 | -11.1 | 1.13 | 4.05 | 0.00 | 288 | 1031 | 0 |
| Aug. | 45.8 | 73 | 13 | 7.7 | 22.8 | -10.6 | 1.21 | 4.30 | 0.00 | 308 | 1094 | 0 |
| Sep. | 38.6 | 60 | - 8 | 3.7 | 15.6 | -22.2 | 0.91 | 3.18 | 0.00 | 232 | 809 | 0 |
| Oct. | 30.6 | 62 | -20 | -7.8 | 16.7 | -28.9 | 1.05 | 3.33 | 0.00 | 267 | 847 | 0 |
| Nov. | 22.8 | 50 | -28 | -5.1 | 10.0 | -33.3 | 1.21 | 3.17 | 0.00 | 309 | 807 | 0 |
| Dec. | 17.6 | 48 | -30 | -8.0 | 8.9 | -34.4 | 2.04 | 8.55 | .T | 519 | 2176 | .T |
| Annual | 28.9 | 73 | -35 | -1.7 | 22.8 | -37.2 | 17.94 | 8.55 | 0.00 | 4565 | 2176 | 0 |

note: .T = Trace

## H. DESCRIPTION OF VALUES

### (1) Flora

Due to the severe climate conditions of the area, the number of plant species found in the MRNA compared to other RNAs is not large. However, for such a high elevation location, the diversity is high, and includes many unique species not found in other localities. Fifty one species were identified in Travers' (1993) report (Appendix C). Additional 16 species were tentatively identified by Millar, Cheng and DesBaillets (2000) (Appendix D). For the entire White Mountains above 11,500 ft (3505 m) Lloyd and Mitchell (1973) reported 197 taxa.

Growth in fell-fields generally occurs in July and August depending on snow cover. It is also affected by the geology and soil conditions, which determine the local availability of water for plants.

Taylor (1976) defined five plant communities within the RNA. Travers (1993) re-classified the vegetation into eight plant communities. Barely within the RNA border, at the lowest elevation, along the North and South Forks of McAfee Creek, are small groves of aspen (*Populus tremuloides*). Several individuals of limber pine (*Pinus flexilis*) and bristlecone pine (*Pinus longaeva*) scatter in the area upstream of the aspen forest (Millar, et al. 2000).

The following descriptions of plant communities are mainly based on Travers (1993) and Keeler-Wolf (1990). For a complete list of species found in each plant community and a summary of vegetation survey data, refer to Appendix E. On the basis of dominant plant species, which generally follow physiographic patterns of soil distribution and water availability, vegetation in the RNA falls into five broad categories: alpine grassland steppe (four plant communities), shrubland (two plant communities), sedge meadow (one plant community), scree slopes (one plant community), and aspen forest (one plant community). The largest expanse of shrubland is in the southern lower elevation portions of the RNA. The rest of the RNA is mostly grassland. Acreage of each plant community is listed in Table 2.

Table 2: Areas of the plant communities in McAfee RNA

| Plant Community | Acre | Hectare | Percentage |
|---|---|---|---|
| 1. *Koeleria cristata*[2] | 597 | 242 | 29 |
| 2. *Ivesia lycopodioides* | 235 | 95 | 12 |
| 3. *Carex sp. - Eriogonum ovalifolium* | 142 | 57 | 7 |
| 4. *Trifolium monoense* | 69 | 28 | 3 |
| 5. *Artemisia arbuscula* | 119 | 48 | 6 |
| 6. *Chrysothamnus parryi* | 330 | 134 | 16 |
| 7. *Carex - Deschampsia* | 118 | 48 | 6 |
| 8. *Ribes viscosissimum* | 399 | 162 | 20 |
| 9. *Populus tremuloides* | 21 | 8 | 1 |
| x *Pinus longaeva / P. flexilis* | <0.1 | <0.1 | <0.1 |
| Total | 2030 | 822 | 100 |

Alpine Grassland Steppe:

This is the largest group of communities in the MRNA. There are four grassland communities: *Koeleria cristata*, *Ivesia lycopodioides*, *Carex* sp. - *Eriogonum ovalifolium*, and *Trifolium monoense*. These four communities are loosely separated on the basis of soil moisture or elevation. *Carex incurviformis* is common in all four communities. The *Trifolium monoense* plant community dominates the driest areas. *Koeleria cristata* and *Ivesia lycopodioides* communities are distributed in areas of increasing wetness. The *Carex*

[2]listed as *Koeleria macrantha* in the Jepson Manual (Hickman 1993).

sp. - *Eriogonum* community is restricted to high elevation sites at the base of White Mountain Peak.

(1) *Koeleria cristata*
(Holland: 91140 - White Mountain Fell-field)

This is the largest grassland plant community and is found at the gently-sloped, lower elevation plateau. The central portion of the RNA is dominated by this type of grassland.

The *Koeleria cristata* community is characterized by a lack of shrubs and dominance of monocot species. Many species in this community are the same as in the dolomite regions (*Phlox-Ivesia* community) south of the RNA. However, species diversity in this grassland is much lower than in the dolomite area.

The dominant species, *Koeleria cristata*, is also very common in the other two shrubland communities, *Chrysothamnus* and *Artemisia*. However, the relative cover of the species in the shrubland communities is lower than in the *Koeleria cristata* grassland community.

This community is characterized by intermediate soil moisture level. In regions of similar soil type, aspect, and slope but increased wetness, *Ivesia lycopodioides* dominates. In drier regions, *Trifolium monoense* is the dominant species.

(2) *Ivesia lycopodioides*
(Holland: 91140 - White Mountain Fell-field)

The *Ivesia lycopodioides* community is distributed in small patches, scattered throughout the area according to location of mesic regions. This plant community prevails in sloped, mesic regions below snowmelts. Generally these wet areas are north- or east- facing slopes where snow patches persist. This community also dominates in natural seeps, giving way to *Carex* - *Deschampsia* community (described in section 7) in areas with standing surface water.

This is the second-most species-rich community. In total, 12 species are identified in this community. *Ivesia lycopodioides* and *Antennaria rosea* are the dominant species.

(3) *Carex* sp. - *Eriogonum ovalifolium*
(Holland: 91140 - White Mountain Fell-field)

The highest elevation plateau of the MRNA is characterized by an almost pure community of *Carex incurviformis* interspersed with *Eriogonum ovalifolium*. This community is characterized by low species diversity and an absence of most dicot species observed in other plant communities. *Koeleria* is absent in this community.

This community is distributed on the plateau southwest of White Mountain Peak, where conditions are especially exposed and windswept. There are no mesic microsites on this plateau. As the plateau slopes southward and eastward into a large bowl, the more typical communities of *Koeleria* and *Ivesia* increase in frequency.

(4) *Trifolium monoense*
(Holland: 91140 - White Mountain Fell-field)

This community is distributed in two separated locations, on the southeast-facing slope along the ridge line on the western part of the RNA, and at the easternmost end of the plateau in the central portion of the RNA. These areas are flat and relatively dry, protected by ridges to the west.

The species composition of this community is similar to the *Artemisia* communities below 12,000 ft (3657 m), but without the shrubs. *Trifolium monoense* and *Carex incurviformis* are the two most common species. Associated species are mixtures of the grasses *Elymus elymoides* and *Stipa occidentalis* (*Achnatherum occidentalis* in Jepson Manual [Hickman 1993]). *Koeleria cristata* is present but in much lower frequency than in other grasslands.

Shrubland

There are two plant communities dominated by low shrubs: *Artemisia arbuscula* and *Chrysothamnus parryi*. The *Artemisia* community covers more area than the *Chrysothamnus* community, which is largely restricted to north-facing ridge tops.

(5) *Artemisia arbuscula*
(Holland: 35220 - Subalpine Sagebrush Scrub)

This community is distributed in the southern portions of the RNA, at relatively low elevations (below 12,000 ft [3567 m]). Within the *Artemisia arbuscula* region, patches of *Carex-Deschampsia* community (described in section 7) can be found in level mesic areas.

*Artemisia arbuscula* is not the species with the highest relative cover in this community. The three most common species found here are *Trifolium monoense*, *Linanthus nuttallii*, and *Koeleria cristata*. However, in no other community does *Artemisia* reach the frequency with which it occurs in this community.

(6) *Chrysothamnus parryi*
(Holland: 35220 - Subalpine Sagebrush Scrub)

The northern plateau is completely covered by *Chrysothamnus parryi* shrubs. This community can also be found at rocky transition zones between steep scree slopes and the relatively level grasslands.

*Chrysothamnus parryi*, *Carex incurviformis*, and *Koeleria cristata* are the three most common species found in this community. As a result of this community generally occurring at the edge of scree slopes, many of the species found here are shared with the scree slope community (described in section 8), including *Ribes viscosissimum*.

Sedge Meadow

(7) Carex - Deschampsia
(Holland: 45210 - Wet Subalpine or Alpine Meadow, 91300 - Alpine Snowbank Margin)

This community has highest percentage plant cover and the lowest species diversity (9 species). It is also the wettest of all the communities in the RNA.

In almost all cases this community is found in association with pooling or flowing surface water from seeps. *Carex* sp. forms a dense sod, and *Deschampsia* sp. indicates standing water during the growing season. This community is found in wet areas predominantly in the southern lower elevation part of the RNA, interspersed with drier, elevated areas of plant communities dominated by *Artemisia*, *Koeleria*, and *Ivesia* (described in sections 5, 1, and 2). The largest area, McAfee Meadow, is along the South Fork McAfee Creek.

*Deschampsia caespitosa*, *Carex incurviformis*, and *Carex heteroneura* are the three most dominant species. In areas where surface water is flowing in streams, *Carex* and *Deschampsia* will also be associated with high densities of *Mimulus primuloides* and *Pedicularis attolens*. *Carex* and *Deschampsia* are regularly both present in the same locality, but often one species is more common than the other.

Scree Slopes

(8) *Ribes viscosissimum*
(Holland: 91200 - Alpine Talus and Scree Slope)

The granitic pluton is characterized by outcrops of scree, generally at the tops of steep ridges. These areas are almost completely devoid of vegetation, except *Ribes viscosissimum*. Scree slopes are composed of unstable collections of either shale or granitic rocks.

Aspen Forest

(9) *Populus tremuloides*
(Holland: 81B00 - Aspen Forest)

Occurs at two locations in the RNA, the lowest elevation along the South and North Fork McAfee Creek on the eastern border of the RNA; quaking aspen forms dense stand on the slopes. It was thought the stand along the South Fork McAfee Creek is a genetic dwarf form (Hall 1991), but tests on other aspen groves in the region suggested that the cause was "environmental" rather than "genetic" (Millar, personal communication 2000).

(2) Fauna

Six species of mammals, two insects and four birds were observed by Travers (1993) (Appendix F). Among them, golden eagle (*Aquila chrysaetos*[3]) is listed as a California Fully Protected Species and California Species of Special Concern (Laudenslayer et al. 1991) .

(3) Geology

Geological formations underlying the MRNA are in two groups: 1) Quaternary alluvium and volcanic rocks region, and 2) Jurassic pluton region.

Most of the MRNA is of the plutonic region (Barcroft Pluton), which extends from the base of White Mountain peak northwest of the RNA to the dolomite ridges southeast of the RNA. This formation is characterized by felsic plutonic rocks, which were formed by crystallization at great depths and later exposed. The plutonic region is covered with outcrops of granite-like rocks (aplite), where the plant communities are *Ribes*, alpine steppe grassland, shrubland and moist meadows.

A small area along the lower elevation slopes of North Fork McAfee Creek is of the alluvium and volcanic rocks region. It is characterized by sand, silt, clay and glacial deposits. *Ribes viscosissimum* is the dominant species in the general area.

Figure 1 shows the geologic map of the MRNA area.

[3]Nomenclature of animal species follows Hall (1991).

page for geologic map

# Geologic Map of McAfee RNA

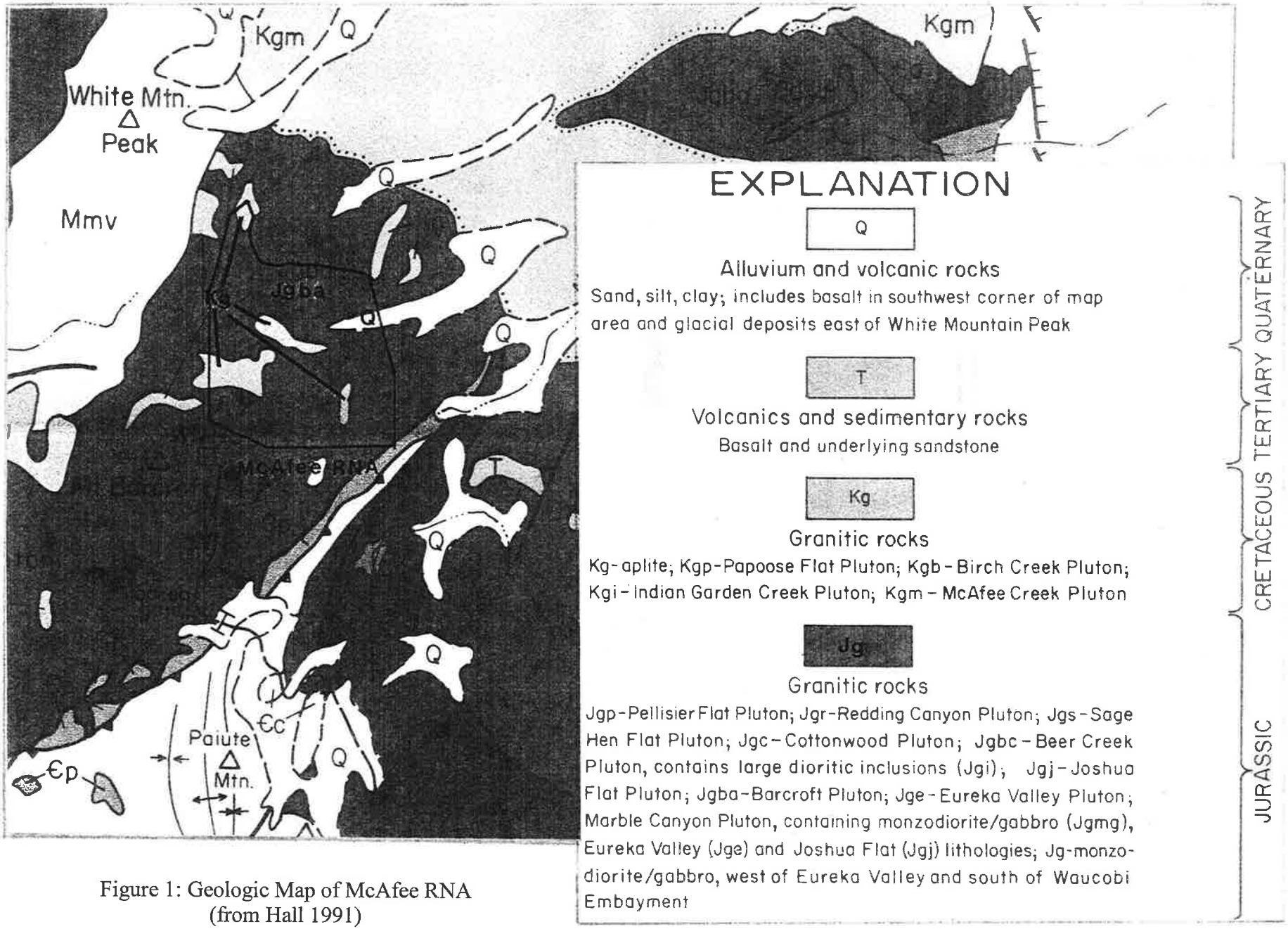


Figure 1: Geologic Map of McAfee RNA
(from Hall 1991)

(4) Soils

Most of the soils in MRNA are of one mapping unit in the third order survey, Pergelic Cryoborolls – Soakpak family association, 5 to 70 percent slopes (USDA Forest Service 1994) (Figure 2). Pergelic Cryoborolls is loamy-skeletal, mixed xeric haplocryolls and the Soakpak family is loamy-skeletal, mixed xeric eutrocryepts (or xeric dystrocryepts) (Bryant, personal communication). They are well-drained, very stony or cobbly loam soils. Pergelic Cryoborolls soils are on mountainsides, with slopes ranging from 30 to 80 percent. Soakpak soils are on remnant alluvial fans, in alluvial-colluvial flats and on mountainsides. Slopes range from 5 to 60 percent. These soils remain dry throughout the growing season of the plants. No permafrost was mentioned in the soil survey, but it is suspected that the wet meadow area may have permafrost orgelic material (Bryant, personal communication).

A small portion of the MRNA is of Rock outcrop, granitic - Packham family - Rubbleland association, 30 to 80 percent slopes, within which 25% is soils of Slinger family (loamy-skeletal, mixed [calcareous], frigid xeric torriorthents [Bryant, personal communication]), 30 to 60 percent slopes. This soil type is distributed along the lower reach of North Fork McAfee Creek on the eastern part of the RNA. Packham family (loamy - skeletal, mixed, frigid xeric haplocambids [Bryant, personal communication]) soil is well drained, with an extremely cobbly sandy loam top soil.

Followings are brief descriptions of the soil types in the RNA. Detailed descriptions can be found in Appendix G.

1. Pergelic Cryoborolls - Soakpak family association, 5 to 70 percent slopes (map unit 150)

   This soil type consists of approximately 55% Pergelic Cryoborolls and 25% Soakpak family. The rest 20% are small areas of the Soakpak family, 30 to 50 percent slopes, Pergelic Cryoborolls, 5 to 30 percent slopes, and rock outcrop.

   Pergelic Cryoborolls has a one inch (2.5 cm) thick surface layer of root mat, and a very shallow top soil (2 inches [5 cm]) layer, which is very stony loam. Its subsoil (at the depth from 2 to 14 inches [5 to 36 cm] in the soil profile) is very stony loam also. The available water capacity is low (2.0 to 3.5 inches [5.1 to 8.9 cm]).

   Soakpak family soil is very gravelly sandy loam. It has a relatively thick surface layer (9 inches [22.9 cm]) and subsoil layer (at the depth from 9 to 27 inches [22.9 to 68.7 cm] in the soil profile).

2. Rock outcrop, granitic - Packham family - Rubbleland association, 30 to 80 percent slopes (map unit 158)

   This soil type consists of 30% granitic rock outcrop, 25% Packham family, 20% granitic rubbleland, and 25% of 30 to 60 percent slopes Slinger family.

Packham family has a shallow surface layer (3 inches [7.6 cm]), which is extremely cobbly sandy loam and has a moderate very thick platy structure. The subsoil is at the depth from 3 to 15 inches (7.6-38.2 cm), very and extremely gravelly sandy clay loam.

Slinger family soil is very similar to the Soakpak family, but warmer. It is distributed on upper mountainsides and ridges.

page for soil map

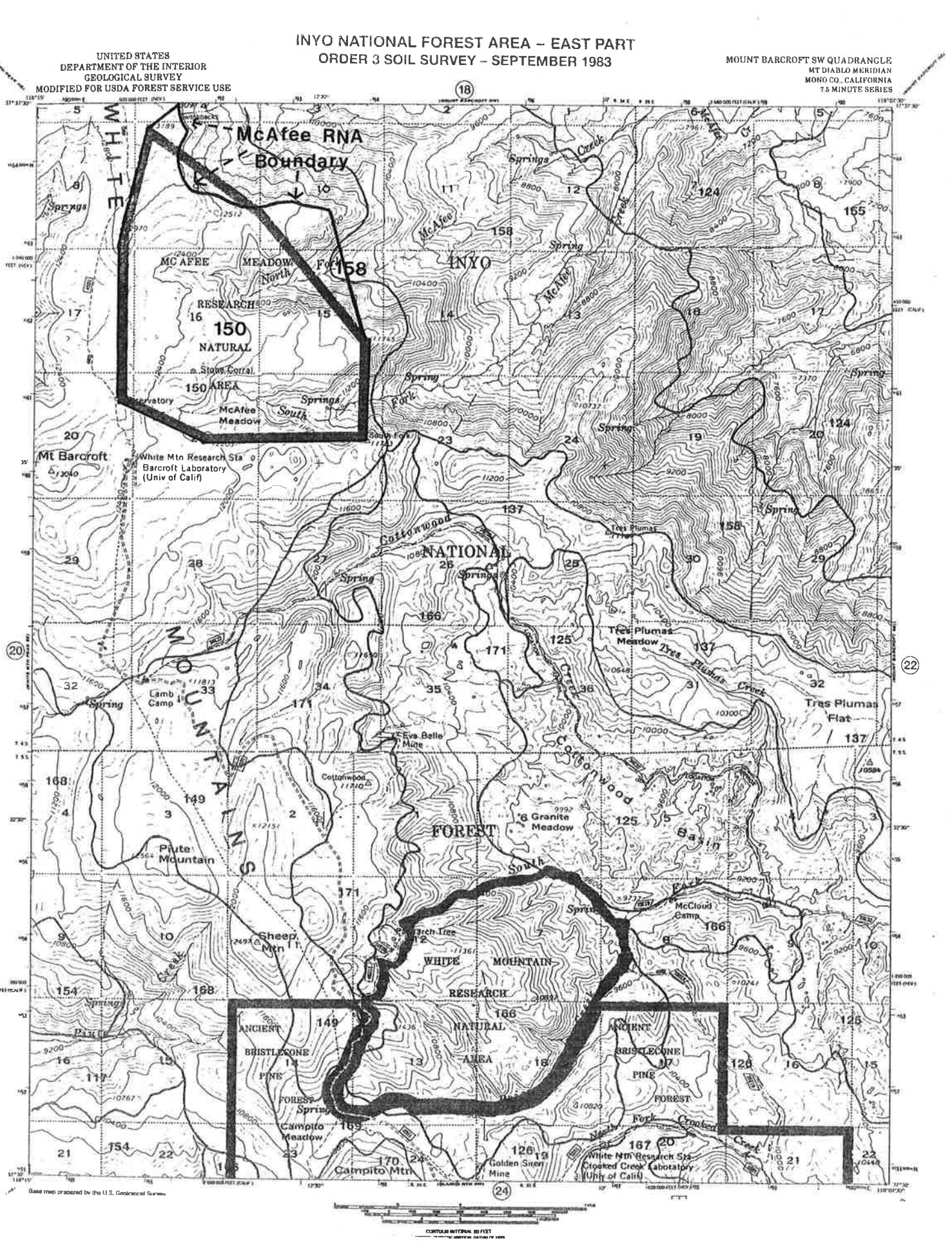


Figure 2: Soil Map of McAfee RNA
(from USDA F.S. PSW 1994)

(5) Land

All land within the boundaries of the MRNA is under the management of the Inyo National Forest. There are no private inholdings.

(6) Cultural

Prior to the arrival of Europeans in the 1830s, the White Mountains had been inhabited by the Paiute tribes for as long as 10,000 years. There are three Native American archaeological sites on the plateau. Artifacts of Native Americans, such as obsidian arrow heads or flakes from the points, are often found in the RNA. Travers (1993) observed most of the obsidian on the open central regions of the plateaus.

Livestock was introduced into the Owens Valley in 1861 and grazing has prevailed in the area since then. Little is known about the early ranching of the area, except that at one time more than 40,000 sheep overgrazed the high meadows and plateaus of what is now the Inyo National Forest land. In 1907 grazing regulations were established, and hostilities occurred between angry ranchers and the U.S. Forest Service. In 1909 the Army was called in to quell the range war. The U.S. Forest Service did not achieve full control of grazing use in White Mountains until 1931 (Hall 1991).

A stone corral and hut built by Basque sheepherders in the late nineteenth or early twentieth centuries exist within the RNA.

The area that includes the McAfee RNA was part of the Tres Plumas Allotment. The Tres Plumas Allotment permitted sheep grazing (about 1600 annually from June 1 to September 30) from about 1920 to 1955, then cattle grazing (100-300 from July 1 to September 15 annually) from 1956 to 1994. However, due to the high elevation and access difficulties, the McAfee RNA area was probably never grazed much by cattle, compared to grazing use in other areas (Hubbs, personal communication).

In 1948 the U.S. Navy sought a location to test infrared sensors in the region and, through the assistance of the University of California, installed a facility at Crooked Creek (10,000 ft [2,090 m] elevation). In 1950 the White Mountain Research Station, with four separate laboratory sites, was established and operated by the University of California. Two laboratories are located nearby the RNA. In 1978 the U.S. Navy transferred the title of all facilities and equipment to the University of California. The general area has great scientific and research value.

(7) Alpine Research

The summit plateau of the White Mountains contains the largest continuous area of alpine steppe vegetation in California and the Great Basin. It is also the most accessible large alpine area in California. The area is well studied and has been used as a high altitude research center since the 1940s. Barcroft Research Station is the 11th highest high-altitude station in the world and the

4th highest in North America. The Summit Laboratory, located 2.2 miles (3.6 km) to the north of the RNA atop White Mountain Peak, is the 4th highest high-altitude research facility in the world and highest in North America. Many important physiological experiments have been conducted at the two laboratories.

## I. IMPACTS AND POSSIBLE CONFLICTS

### (1) Mineral Resources

There is no evidence or documented history of mining-related activities within the MRNA. The nearest known mining and mineralization to the RNA occurs about 2.5 miles (4 km) to the south. It is a high mineral resource potential area of contact-metamorphosed dolomite and quartz veins, and contains the Eva Belle Mine. Another high mineral resource potential area for sericite occurs about 4.5 miles (7.2 km) to the west of the RNA.

Mining claim records show no recent or current activity within, or immediately adjacent to the RNA. The nearest active mining claims occur at the Eva Belle Mine.

The potential for mineable concentrations of mineral resources within the MRNA appears to be low to none. The outcrops of limestone at southeast corner of the RNA has been field checked and determined to be of poor mineral quality and unlikely to have potential mining interest (Millar, et al. 2000; Dunn, personal communication).

Establishment of the MRNA will have minimal impact on the mineral resource values of the area.

### (2) Grazing

The Tres Plumas Allotment that includes the McAfee RNA has been ungrazed entirely since 1994. All action alternatives in the Environmental Assessment would re-draw the allotment boundary to exclude McAfee RNA. Therefore, establishment of the MRNA will have no impact on the livestock grazing values of the area.

There is a healthy wild-horse herd in the area, wintering on Bureau of Land Management land and summering on Forest Service land. Increasing horse use of the area up through Tres Plumas Flat has been observed as the cattle use has been reduced. Increased wild horse use of the area may be anticipated (Hubbs, personal communication).

### (3) Timber

The MRNA is located at high elevations above timberline. Establishment of MRNA will have no conflict with timber resources.

(4) Watershed Values

There are two major intermittent streams, the North Fork and South Fork of McAfee Creek and numerous seeps and springs in the RNA. Establishment of MRNA will provide the necessary protection for the watershed, thereby securing the water resource and providing important habitats for wildlife and plant communities, and maintaining the biodiversity of the area.

(5) Recreation Values

The primary recreational users of the plateau are hikers and mountain bikers, who use the road along the west boundary of the RNA to ascend White Mountain peak. There is significant mountain bike traffic along the road up to White Mountain peak. Very little camping occurs in the area because of the altitude and cold. There may be some hunting on the meadows. Occasionally, hang gliders and recreational off road vehicles (ORV) have been observed. There is no fishing because of the lack of permanent stream habitat.

Hiking is allowed on RNAs, but overnight camping, ORV and hang glider uses are not. Hunting and fishing within RNAs are regulated in the same manner as other general Forest Service land.

Establishing MRNA will have minimal impact on the current recreational use of the area. However, excessive hiking could have adverse impacts on the RNA through trampling or depositing human waste.

(6) Wildlife and Plant Values

The White Mountain bighorn sheep (*Ovis canadensis*) near the area is the only wildlife species that needs special consideration. The nearest permanent population of sheep, the White Mountain herd, lives north of the area. Wandering rams may enter the boundaries of RNA while searching for ewes but would not remain there for long, because of the presence of humans in the area. On occasion, the White Mountain herd ranged slightly south of the peak, very close to the boundary of the RNA (USDA Forest Service, Inyo National Forest, McAfee Meadows RNA Establishment ID Team 1998).

The establishment of MRNA will probably not have any impact on the sheep population of the area, since the long history of human presence in the area had kept the herds from establishing permanent residency south of White Mountain peak.

Establishment of MRNA will have a positive impact on the conservation and preservation of plant and other wildlife values, since only non-manipulative research will be conducted in the RNA.

(7) Special Management Area Values

The MRNA is not within any congressionally designated area. Establishment of MRNA will have no conflict with the Special Management Area values.

(8) Transportation Plans

There is no plan to construct roads or trails in any part of the MRNA and nearby areas. Establishment of the RNA will have no conflict with the transportation plans of the area.

(9) Research

Barcroft Research Station was established by the U.S. Navy in the 1940s. Since the 1950, the station has been administered by the University of California system. A great deal of physiological research is done at the station itself and at the summit hut. Astronomical studies are also common. More recently, ecological studies of the alpine zone have become more common.

The physiological and astronomical studies most often take place indoors, using outside subjects or pre-existing equipments. Ecological studies may be most affected by the establishment of the RNA. Ecological studies involving methods such as trap-and-release or destructive population sampling may be considered manipulative depending on sampling intensity. Geological study methods involving significant soil disturbance are likely incompatible with RNA status.

This area has been administered as an RNA since it became a candidate. All ongoing research thus has already been modified to standards consistent with RNA regulations and will not be disrupted by MRNA establishment. Due to the high concentration of research activities in the area, if scientist use increased within the MRNA significantly, there is a potential for cumulative impact on the RNA, through trampling or depositing human waste, for example.

## J. MANAGEMENT PRESCRIPTION

The primary management direction for the MRNA will be to maintain and promote natural functions of the alpine fell-field and associated plant and wildlife communities. Appendix A contains management direction for RNA's on the Inyo National Forest.

1) RNA Management Strategy

During the revision of the Inyo National Forest LRMP, a detailed MRNA management strategy will be developed by the Inyo National Forest in consultation with the Pacific Southwest Research Station and WMRS to provide additional management direction to maintain the values for which the MRNA is established. At that time, a larger boundary with zoned research uses will be reconsidered as had been considered in the evaluation precess.

## K. ADMINISTRATION RECORDS AND PROTECTION

The official responsibility for administration and protection of the McAfee RNA is with the Assistant Forest Supervisor for the South Zone of Inyo National Forest. The address is: White Mtn. Ranger Station, 798 N. Main St., Bishop, CA 93514.

The research coordinator is the Director, Pacific Southwest Research Station, 800 Buchanan Street, Albany, CA 94710. The Director is responsible for approving and coordinating observational or non-manipulative applied research in the area and maintaining research data files.

## L. ARCHIVING

The Station Director shall establish and maintain a system for archiving data and reports from Research Natural Areas in a manner that will facilitate the exchange and transfer of information among Stations, Forests, and scientists.

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APPENDICES

Appendix A: Information excerpted form the Inyo National Forest Land and Resource Management Plan (USDA Forest Service 1988a)

Appendix B: Information excerpted from the Inyo National Forest Environmental Impact Statement for the Forest Land and Resource Management Plan (USDA Forest Service 1988b)

Appendix C: Vascular plant list of McAfee RNA (from Travers 1993)

Appendix D: Plants observed in bloom on July 12, 2000 and and tentatively identified by Millar, et al.

Appendix E: Results of plant community survey (from Travers 1993)

Appendix F: List of animals observed in the McAfee RNA (from Travers 1993)

Appendix G: Descriptions of soils in the McAfee RNA (USDA Forest Service 1994)

Appendix A: Information excerpted form the Inyo National Forest Land and Resource Management Plan (USDA Forest Service 1988a)

Inyo National Forest

Pacific Southwest Region USDA Forest Service

# Land and Resource Management Plan

1 9 8 8


DENNIS W. MARTIN
Forest Supervisor

PAUL F. BARKER
Regional Forester


This Forest Plan establishes the management direction and associated long-range goals and objectives for the Inyo National Forest for the next ten to fifteen years.

# CHAPTER II

Gordon Wiltsie

# Issues and Concerns

- There is a need for more restriction on OHV use. (p)
  (Forest-wide Standards and Guidelines, Prescriptions, Management Area Direction, Plan Chapter IV)

- Remove OHV routes from sensitive areas. (p)
  (Forest-wide Standards and Guidelines, Management Area Direction, Plan Chapter IV)

**Response:** The demand for recreation on the Inyo and the concerns of local residents for the recreation program are discussed in Chapter III of the EIS. Chapter II of the EIS explores a wide range of recreational development options. Chapter IV of the EIS documents the analysis of impacts on recreation by other resources and activities. The Forest Objectives in Chapter IV of the Plan display projected recreation outputs by type over the planning period. Management direction in the Plan provides for the protection of recreation values and for a broad and diverse range of developed and dispersed summer and winter recreation opportunities.

## Research Natural Areas

**Issue/Concern:** What contribution should the Inyo make to the national and regional systems of Research Natural Areas (RNAs)?

- Research Natural Areas should be identified and established. (m & p)
  (EIS Chapter III, Forest-wide Standards and Guidelines, Plan Chapter IV)

- The Inyo should confirm the fact that all botanical RNA targets assigned to the Forest have been met. (m)
  (EIS Chapter III)

**Response:** Chapter III of the EIS displays the regional Research Natural Area targets for the Inyo and shows how these targets have been met. The Forest-wide Standards and Guidelines call for the establishment of recommended Research Natural Areas.

## Riparian Areas

**Issue/Concern:** What is the significance of riparian areas on the Forest, and how should riparian area-dependent resources be maintained, enhanced, and/or restored?

- Maintain and increase riparian vegetation. (p)
  (Forest-wide Standards and Guidelines, Plan Chapter IV)

- Livestock grazing, recreation, and water diversion have impacts on riparian areas. (p)
  (EIS Chapter IV, Forest-wide Standards and Guidelines, Plan Chapter IV)

- Energy developments, mineral activities, and timber harvest represent actual or potential conflicts with riparian area-dependent resources. (m)
  (EIS Chapter IV, Forest-wide Standards and Guidelines, Plan Chapter IV)

### Supply and Demand

Dispersed recreation in 1982 amounted to a total of 1,935,000 Recreation Visitor Days (RVDs). Of this total, 540,000 RVDs represented wilderness use; 340,000 represented fishing, 25,200 represented deer hunting; and 25,800 represented other wildlife-related recreation. The remaining 1,004,000 RVDs represented such activities as driving for pleasure, hiking, riding, dispersed camping, and boating.

The demand for dispersed summer and winter recreation is expected to increase in relative proportion to the demand for developed summer and winter recreation.

### Plan Management Emphasis

The Plan recognizes the relationship of developed and dispersed recreation on the Inyo. Dispersed recreation opportunities will be enhanced by expanding campground capacity, constructing day-use trails in concentrated recreation areas, and developing (or encouraging private parties to develop) facilities that support nordic skiing. In addition, certain lands will be managed with an emphasis on off-highway vehicle (OHV) recreation. OHVs are those vehicles capable of traveling off two-wheel drive roads, including four-wheel drive and all terrain vehicles (ATVs) and motorbikes. There is specific direction for snowmobile use (over-snow vehicle or OSV).

## Research Natural Areas

### Current Direction and Opportunities for Change

The Forest currently manages established Research Natural Areas (RNAs) under Forest Service Manual direction. Candidate RNAs are managed so that their natural ecosystems are protected until the establishment process is completed. The Forest has the opportunity to recommend the establishment of candidate RNAs in the Plan.

The Forest is responsible for meeting RNA targets for eight vegetation types in two physiographic provinces. Once the two candidate RNAs are established, Forest RNA targets will have been met.

The current direction regarding potential geologic and aquatic RNAs is to defer consideration until Regional direction is finalized.

### Supply and Demand

The Inyo National Forest has five established and two candidate RNAs. Existing RNAs meet established targets for Jeffrey pine (Indiana Summit), lodgepole pine (Sentinel Meadow), foxtail pine (Last Chance Meadow), bristlecone pine (White Mountain), and unique ecosystems (Harvey Monroe Hall). Candidate RNAs meet the target for pinyon pine (Whippoorwill Flat) and alpine fellfields (McAfee Meadow). The target for limber pine is met by stands in the Sentinel and Whippoorwill areas.

There is public demand for RNAs, especially from the scientific community.

### Plan Management Emphasis

The Plan recommends establishment of the Whippoorwill Flat and McAfee Meadow RNAs.

## Riparian Areas

### Current Direction and Opportunities for Change

Riparian areas are currently managed by implementing plans for watershed improvement and golden trout habitat restoration on the Kern Plateau and by applying Best Management Practices (BMPs) for water quality protection to all Forest activities.

There is an opportunity in the Plan to address the management of all riparian areas on the Forest and to coordinate riparian values with the management of other resources. Such direction is especially important because riparian areas on the Inyo are limited in extent and vulnerable to impacts from many kinds of activities. Heavy recreational use, grazing, accelerated erosion, water diversion, and the encroachment of woody vegetation on wet meadows all threaten the amount and condition of riparian areas. Both the maintenance of riparian condition and the restoration of damaged areas need to be addressed.

Although wet meadows on the Forest have been adequately inventoried, and the amount of streamside riparian vegetation on the Forest is generally known, a thorough Forest-wide inventory of the streamside riparian resource is needed. A complete and accurate picture of riparian habitat types, their extent and condition would contribute significantly to managing riparian values in concert with other potentially conflicting needs and demands.

### Supply and Demand

Riparian areas on the Inyo National Forest are in short supply and great demand.

There are approximately 37,000 acres of riparian vegetation (including wet meadows) on the Forest. That figure represents less than two percent of the total land base. The species composition of a given riparian area is determined by elevation, geomorphic characteristics, and the amount of water available. Approximately 80 percent of the Forest's riparian acreage is in wilderness.

The limited supply of dense and productive riparian vegetation and its contrast with arid surroundings make it especially important to wildlife for food and cover. Riparian vegetation is also an important component of fish habitat quality as overhanging vegetation keeps the water cool and roots hold soil in place preventing sedimentation. Cattle typically graze more heavily in riparian areas than on the surrounding dry range. Recreationists seek these areas for shade and water as a relief from the hot, dry surroundings. Finally, riparian vegetation provides scenic variety, as its lush green color contrasts with the surrounding grays and browns.

# Forest-wide Standards and Guidelines

Forest-wide Standards and Guidelines set the minimum resource conditions that will be maintained throughout the Forest. They provide specific guidelines for the management of each resource to ensure its protection or enhancement. They apply wherever the resource or activity occurs. More specific or additional direction may be given by Management Prescriptions or Management Area Direction.

This section displays the guidelines for managing all resources of the Forest.

- Give priority to public access leading to or through developed or dispersed recreation areas wherever proposed improvements obstruct such access.

- Notify recreation residents within flood or avalanche zones that their residences are in dangerous areas, and that no additions to existing structures will be permitted. Include the floodplain damage clause (BR-5-3) in permits within floodplains.

- Resolve noncompliance deficiencies before issuing a permit for an improvement to an existing facility to a new owner.

## Research Natural Areas

- Cooperate in the establishment process for recommended botanical Research Natural Areas.

- Inventory geologic Research Natural Area candidates as a part of the Regional Research Natural Area program.

## Riparian Areas

- Give emphasis to riparian-dependent resources in the management of riparian areas.

- Protect streams, streambanks, shorelines, lakes, wetlands, and the plants and animals dependent on these areas.

- Prevent significant adverse riparian area changes in water temperature, chemistry, sedimentation, and channel blockages.

- Use Allotment Management Plans as the vehicle for ensuring protection of riparian areas from unacceptable impacts from grazing. Institute positive measures such as salting, herding, water developments, fencing, rest rotation, deferred rotation, and other grazing systems as mitigation measures. If mitigation is unsuccessful in preventing unacceptable resource damage to the riparian habitat, as a last resort, livestock grazing will be reduced or eliminated in the affected areas.

- Rehabilitate and/or fence riparian areas that consistently show resource damage from any cause if conflicts cannot be resolved.

- Relocate existing roads, trails, and campsites outside riparian areas where necessary to eliminate or reduce unacceptable deterioration of riparian-dependent resources.

- Allow new developments and surface disturbance in riparian areas only after on-site evaluations have determined that riparian-dependent resources are not adversely affected, or mitigation of adverse impacts is identified and incorporated in project design and implementation specifications.

# Management Prescriptions

Management Prescriptions specify how all the Forest resources will be managed to emphasize a specific resource. Each prescription has a different resource emphasis. Several prescriptions may be implemented within one Management Area, depending on the resources and use of the area.

This section describes the purpose of each prescription, what the resource emphasis will be and where the prescription will be applied. It displays direction for management of each resource. There are eighteen prescriptions that will be implemented.

## Research Natural Areas (#5)

The purpose of this prescription is to maintain the ecological integrity of target vegetation types, for research, study, and observation.

The emphasis is placed on maintaining natural ecological processes.

Both existing and recommended Research Natural Areas (RNAs) are included. Additional site-specific direction may be found in the documents that established the RNA or subsequent management plans for established RNA. This prescription applies to the following:

**Forest Research Natural Areas**

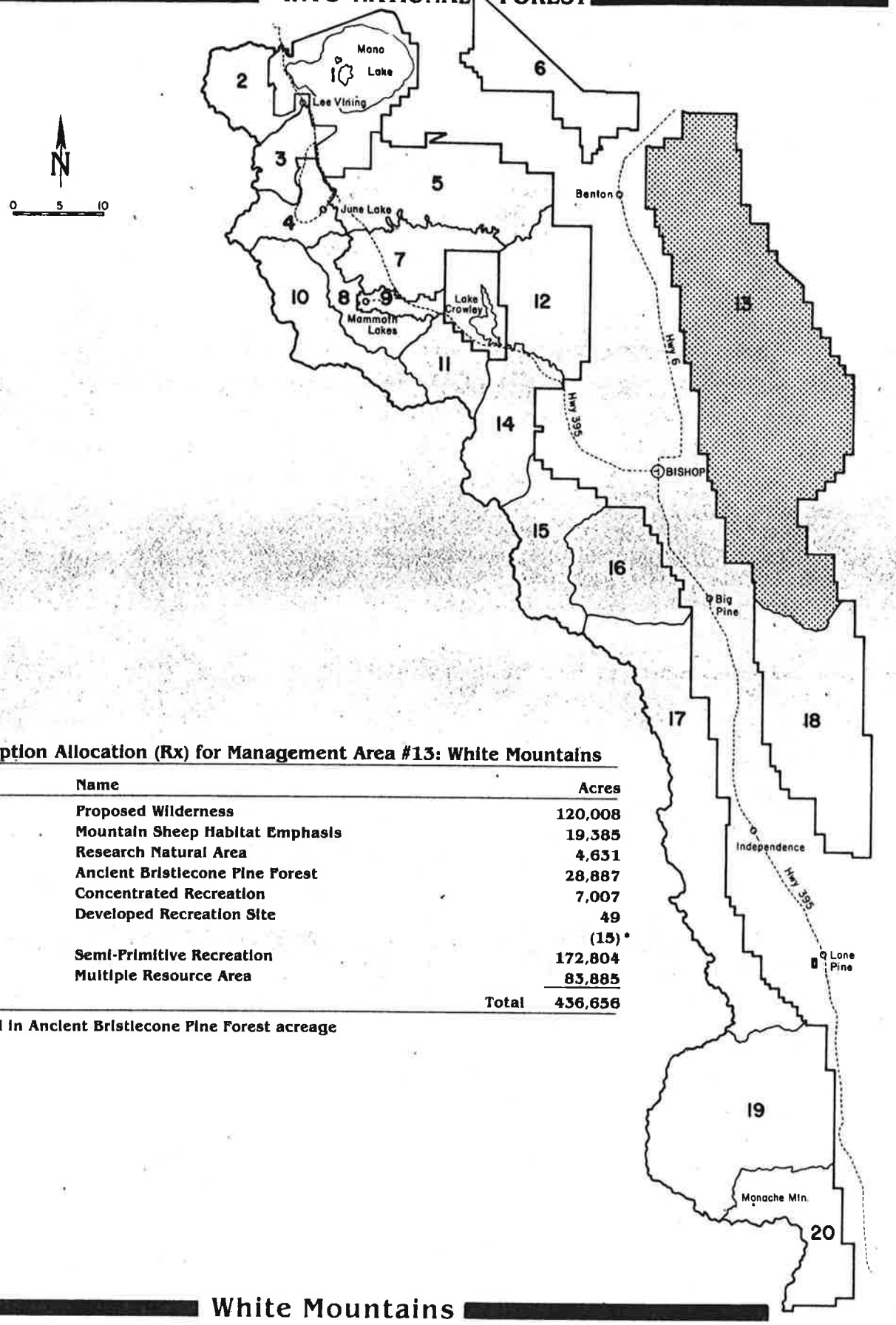
| Research Natural Area | Status | Data Base Acres | Vegetation Type | Physiographic Province |
|---|---|---|---|---|
| Indiana Summit | Est. 1932 | 1,162 | Jeffrey pine | Basin Ranges |
| Harvey Monroe Hall | Est. 1933 | 3,883 | subalpine | Sierra Nevada |
| White Mountain | Est. 1953 | 2,004 | bristlecone | Basin Ranges |
| Last Chance Mdw. | Est. 1982 | 660 | foxtail pine | Basin Ranges |
| Sentinel Meadow | Est. 1983 | 1,897 | lodgepole pine | Sierra Nevada |
| Whippoorwill Flat | Rec. 1985 | 3,328 | pinyon pine | Basin Ranges |
| McAfee | Rec. 1985 | 2,627 | alpine fellfield | Basin Ranges |

| Element | Management Direction |
|---|---|
| Cultural Resources | Protect identified cultural resources.<br><br>Coordinate ground-disturbing activities with the Pacific Southwest Research Station Director. As a general rule, excavations for cultural resources may be permitted when the natural integrity of the RNA is not endangered. |
| Energy | Allow no energy leasing, exploration or development. |
| Facilities | Do not construct new roads or trails or improve the standard of existing roads and trails unless they specifically contribute to the research objectives of the area. |

| | |
|---|---|
| | Maintain existing roads and trails to current standards. |
| **Fisheries** | Coordinate with the California Department of Fish and Game to leave all waterways unstocked. |
| **Geology** | Allow no alteration of the groundwater system. |
| **Lands** | Permit no utility or transportation rights-of-way. |
| | Permit scientific study by special use permit or cooperative agreement only. All permits or agreements are executed between the proponent and the Pacific Southwest Research Station Director with prior approval of the District Ranger and Forest Supervisor. |
| **Minerals** | Recommend and/or maintain withdrawal from mineral entry. |
| | Allow no surface occupancy for mineral leasing including geothermal. |
| | Permit no sales or extraction of common variety minerals. |
| **Pest Management** | Allow forces of nature to prevail. Manage pests only when necessary to preserve the values for which the RNA was established. |
| **Protection** | Use the fire suppression strategies of confinement, containment, or control for management of unplanned natural fires. Control all unplanned human-caused fires. |
| **Range** | Restrict livestock to those areas where grazing is essential for the maintenance of a specific vegetative type. Otherwise, permit no livestock grazing. |
| **Recreation** | Allow the dispersed recreation activities appropriate to the Primitive ROS class, but discourage or expressly prohibit any public uses that contribute to modification of the area. |
| | Prohibit overnight camping, campfires, and motorized uses including OHVs unless authorized by special use permit. OSVs are prohibited unless otherwise indicated on the Winter Motor Vehicle Use Map. |
| **Research and Study** | Make areas available for maximum scientific and academic uses that are nondestructive and nonmanipulative. |

| | |
|---|---|
| **Riparian** | Allow no modification of riparian areas. |
| **Timber** | Allow no commercial timber harvesting or gathering of fuelwood. |
| | Allow no timber stand improvement or reforestation. |
| **Vegetation** | Allow no management practices except as required to preserve or restore the vegetative condition for which the area was established. |
| **Visual** | Meet the Preservation VQO. |
| **Watershed** | Allow no modification of soil or watercourses. Restore man-induced damage to a natural condition. |
| **Wilderness** | Uphold the laws governing use and management of wilderness where an RNA is located within a designated wilderness area. |
| | Follow the more stringent RNA requirements where management differs from that of wilderness. |
| **Wildlife** | Allow legal hunting and fishing. |
| | Allow no enhancement of wildlife habitat. |

# INYO NATIONAL FOREST




## Prescription Allocation (Rx) for Management Area #13: White Mountains

| Number | Name | Acres |
|---|---|---|
| Rx 2 | Proposed Wilderness | 120,008 |
| Rx 3 | Mountain Sheep Habitat Emphasis | 19,385 |
| Rx 5 | Research Natural Area | 4,631 |
| Rx 7 | Ancient Bristlecone Pine Forest | 28,887 |
| Rx 12 | Concentrated Recreation | 7,007 |
| Rx 15 | Developed Recreation Site | 49 |
| | | (15)* |
| Rx 17 | Semi-Primitive Recreation | 172,804 |
| Rx 18 | Multiple Resource Area | 83,885 |
| | Total | 436,656 |

*Included in Ancient Bristlecone Pine Forest acreage

## White Mountains

## White Mountains (#13)

### Description

The White Mountains Management Area straddles the California-Nevada border within the Great Basin Geographic Province. Prominent features include bristlecone pine (the oldest living trees), Boundary Peak (the tallest peak in Nevada at 13,140 feet), White Mountain Peak (14,248 feet), Paiute cutthroat trout (a threatened species), and desert mountain sheep (a special interest species). The vast majority of the area is National Forest System land with only a few scattered parcels of private land inholdings.

The area is characterized by an abrupt, steep escarpment on the west; high mountain peaks, plateaus, rugged canyons, and foothills on the east. Elevations range from 4,600 feet on the Waucoba Road at the Forest boundary to 14,248 feet at the summit of White Mountain.

Vegetation ranges from alpine fellfields to bristlecone and limber pine forests to pinyon-juniper woodland to sagebrush and scrub at the lower elevations.

The White Mountain wild horse herd ranges mostly in the canyons within the northeastern portion of the Management Area from Queen Canyon in the north to Indian Garden Creek in the south. Pronghorn antelope, transplanted in the vicinity of Hammil Valley in 1982, range the northwestern boundary of the Management Area.

The White Mountains are moderately mineralized with numerous unpatented claims. Recreational use focuses primarily on the Ancient Bristlecone Pine Forest, hunting, and to a limited extent trout fishing. The University of California maintains three high elevation research laboratories under permit. Livestock grazing is an important use. The Management Area contains all or part of ten grazing allotments. The area is largely unroaded and unaltered by human activities. There are occurrences of important prehistoric native American habitation sites. The scientific value of the remnant bristlecone pine wood is immeasurable.

The Management Area contains one established Research Natural Area (RNA) and one recommended for establishment. The White Mountain RNA was established in 1953 for its bristlecone pine community; the McAfee RNA is recommended for its alpine fellfield. The McAfee RNA is partially located in the White Mountain Scientific Area. This area was designated under a U-3 (Recreation) classification by the Regional Forester in 1971. This classification is no longer appropriate for the area under the regulations. Any road closures or other restrictions needed to protect the scientific values of the area are now under the jurisdiction of the Forest Supervisor.

A portion of this Management Area is being recommended for wilderness designation. It includes the White Mountains Further Planning Area, identified as having outstanding scenic attractions and recreational challenges.

## Management Area Direction

### Geology

- Emphasize the Great Basin Physiographic Province and sedimentary geology at interpretive sites and in guides that cover the area. Where appropriate, emphasize information on the White Mountain seismic gap, geology of the Bristlecone Pine Forest, history of local mining districts and the presence of important fossil groups.

### Lands

- Continue efforts to resolve conflicts between continuous broadcast and intermittent broadcast users at the Silver Peak electronic site.

- Participate with the Bureau of Land Management in the study of existing and potential powerline corridors. Include in this study the need for additional north-south utility lines paralleling the existing Oregon-Sylmar HVDC transmission line and for new east-west corridor locations.

- Declassify the White Mountain Scientific Area. Protect the scientific values of the area under the authority of the Forest Supervisor.

### Range

- Exclude portions of the Perry Aiken Flat allotment from cattle grazing to protect mountain sheep habitat.

- Issue no grazing permits for the road corridor along State Route 168 from the Forest boundary northeasterly through Westgard Canyon to the junction with the White Mountain Road (No. 4S01), and along White Mountain Road to Sierra View, in order to protect native plants and wildflowers for public viewing and enjoyment.

### Recreation

- Coordinate management of the Poleta OHV Area with the Bureau of Land Management and the Los Angeles Department of Water and Power.

- Allow OHVs to travel anywhere in the Poleta OHV Area.

- Prepare or update a recreation composite plan for areas in Prescriptions #7 and #12 that would inventory, coordinate, and program their full summer recreation development potential. Construct new facilities as funds become available.

- If the White Mountains are designated as wilderness, consider minimizing trail construction so as to continue the existing limited access within the area.

- Manage the White Mountains to emphasize Primitive and Semi-Primitive Non-Motorized ROS class activities and opportunities except in areas designated as Prescription #18, which will emphasize Semi-Primitive

Timber

- Prohibit fuelwood gathering above 8,000 feet elevation in the White Mountains.

Visual

- Update the White Mountains sensitivity level mapping from trails and OHV routes.

Wilderness

- Recommend 120,000 acres in the higher elevations of the White Mountains Further Planning Area for wilderness designation. This recommendation is a preliminary administrative recommendation that will receive further review and possible modification by the Chief of the Forest Service, the Secretary of Agriculture, and the President of the United States. Final decisions on wilderness designation are made by Congress. After designation by Congress, a wilderness management plan will be developed by the Forest.

Wildlife

- Examine the potential for habitat improvement on mountain sheep winter range using prescribed fire.

- Prepare a plan for the recovery and conservation of Nelson mountain sheep.

Appendix B: Information excerpted from the Inyo National Forest Environmental Impact Statement for the Forest Land and Resource Management Plan (USDA Forest Service 1988b)

Inyo National Forest

Pacific Southwest Region USDA Forest Service

# Environmental Impact Statement

for the

## Land and Resource Management Plan

1 9 8 8


DENNIS W. MARTIN
Forest Supervisor

PAUL F. BARKER
Regional Forester

Table 45
Supply and Demand by ROS Class

| | P | SPNM | SPM | RN | RM | R | U |
|---|---|---|---|---|---|---|---|
| **Existing Inventory** | | | | | | | |
| Area (M acres) | 870.6 | 392.6 | 189.2 | 383.6 | 35.1 | 11.6 | 2.0 |
| 1982 use (MRVDs) | 495.4 | 76.9 | 22.3 | 652.3 | 1812.6 | 1311.2 | 34.1 |
| Use coefficient (RVD/acre) | 0.6 | 0.0 | 0.1 | 1.7 | 51.6 | 113.0 | 17.1 |
| **Potential Supply** | | | | | | | |
| Capacity (PAOT) | 6540 | 8500 | 9460 | 76720 | 63070 | 92000 | N/A |
| Capacity coefficient (PAOT/acre) | 0.01 | 0.02 | 0.05 | 0.2 | 1.8 | 7.5 | N/A |
| Use (M RVDs) | 1175.3 | 439.70 | 807.90 | 2992.1 | 4043.5 | 4524.0 | N/A |
| Use coefficient (RVD/acre) | 1.35 | 1.12 | 4.27 | 7.8 | 115.2 | 390.0 | N/A |

RESEARCH NATURAL AREAS

Issues, Concerns, and Opportunities

The public has raised the issue of the need to establish Research Natural Areas (RNAs).

Management is concerned with the task of establishing recommended RNAs and with the need to determine that all Regional targets for Botanical RNAs on the Inyo have been met once these areas are established.

There is an opportunity to respond to these issues and concerns in the Plan.

Background

The Inyo is responsible for meeting botanical RNA targets for eight vegetation types in two physiographic provinces. Five RNAs have been established, and two candidate RNAs have been screened by the Region 5 RNA Committee and have been accepted as meeting Forest targets for the vegetation types represented. Ecological surveys have been completed and boundaries proposed. With the establishment of these two candidate areas, the Inyo will have met all assigned botanical targets.

The planning regulations call for the consideration of geologic and aquatic RNA candidates as part of the planning process. As the Region is in the process of developing a target system for aquatic and geologic elements, the Plan will defer the consideration of those elements and identify the need to respond to targets once they are established. It is expected that the Inyo would have considerable potential for geologic RNAs.

The demand for RNAs by the general public and the scientific community has resulted in national and Regional RNA target systems. Selected areas are established and protected under federal law.
The following are the established and candidate RNAs on the Forest, discussed in terms of their research values and potential conflicts with other activities.

Harvey Monroe Hall (3,883 acres): Established 1933

Sierra Nevada - unique ecosystems (subalpine and alpine habitats).

This is one of the few locations in the Sierra Nevada where habitats between 10,000 and 12,000 feet elevation are easily accessible by road. That fact in itself is important for research purposes. In addition, the area is representative of alpine and subalpine habitats in the southern Sierra. The Hall area has been used for scientific studies for more than fifty years. Dr. John C. Merriam wrote in 1932, "this natural area may be one of the most significant opportunities for certain aspects of scientific research in this country." R.V. Stuart, Chief of the Forest Service, established the area the following year with these words: "There was complete agreement that the future value of the area for such [scientific] purposes undoubtedly transcended any other values or uses for which it might be dedicated."

The major potential conflicts with scientific values in this area would be mineral development on adjacent lands (the RNA itself is withdrawn from mineral entry) or possible wilderness designation. The area is in Further Planning status and will be considered for wilderness during the planning process. It is expected that wilderness designation would attract more recreation use to the area. Such use could potentially conflict with scientific studies.

Indiana Summit (1,162 acres): Established 1932

Basin Ranges - Jeffrey pine forest.

This area contains a virtually pure stand of Jeffrey pine and is part of the largest contiguous pure Jeffrey pine forest in the world. Surrounding lands are managed for commercial timber production. For this reason, the RNA serves as a valuable basis of comparison between managed Jeffrey pine stands and those allowed to follow natural processes. Thirty years ago, the American Museum of Natural History in New York City conducted studies in this area. Their Hall of Forests now contains a large diorama presenting a portion of the Indiana Summit Natural Area as a typical Jeffrey pine forest.

The major potential conflict with scientific values in this area is illegal public fuelwood gathering; however, steep terrain generally discourages vehicle entry.

Last Chance Meadow (660 acres): Established 1982

Sierra Nevada - foxtail pine forest.

This area contains a representative stand of foxtail pine within a half-mile walk from a paved road. This fact is important for research purposes.

Foxtail pine is a species of special interest to the scientific community; it has an unusual disjunct distribution, being found only in the southern Sierra Nevada and in the Klamath Mountains 300 miles to the north.
There are no major potential conflicts with scientific values in this area. The RNA is within existing wilderness, but is located well away from trails and campsites. Although some hikers may enter the area, the number is likely to be low.

**Sentinel Meadow (1,897 acres):** Established 1983

Basin Ranges - lodgepole pine and limber pine.

This area contains undisturbed lodgepole pine stands typical of the arid montane habitats of the Great Basin. The area is variable in slope, aspect, and exposure, thus containing numerous variations in lodgepole pine growth form and stand formation. There is also a small pure stand of limber pine.

The major potential conflicts with scientific values in the area are illegal public entry for fuelwood cutting and OHV use. Although steep terrain generally discourages vehicle entry, there are a few vulnerable points along the boundary.

**White Mountain (2,004 acres):** Established 1953

Basin Ranges - bristlecone pine forest.

This area contains an unusual pure stand of bristlecone pine. Bristlecones usually occur as a thin fringe near timberline in certain high mountain ranges. It is most unusual to find the species growing in a pure stand as extensive as this one. The stand in this RNA is considered a remnant of the vast forests that grew in the Great Basin when precipitation was more abundant than today.

The only major potential conflict with scientific values in this area is increased recreation use. The RNA is part of a Further Planning area being studied for possible wilderness designation during the planning process. It is expected that wilderness would attract greatly increased visitation.

**McAfee Meadow (2,727 acres):** Candidate

Basin Ranges - alpine fellfield.

The gently rolling plateau on the crest of the southern White Mountains has the largest area of accessible alpine steppe in the western United States. Although alpine vegetation in the Sierra Nevada, Cascades, and Rocky Mountains is adequately represented in RNAs on federal lands, alpine steppe in the Great Basin is not yet represented.

The major potential conflicts with scientific values in this area would be grazing (10 AUMs), use of an authorized helicopter test site within the proposed boundary, and wilderness designation with associated increases in recreation. The first two uses have already been terminated in preparation for establishment of the RNA. The question of wilderness designation will be resolved by the Plan.

because of wilderness recommendations. Snowmobile use will be restricted due to wilderness recommendations, nordic and alpine ski areas, and potential impacts on wildlife.

All dispersed recreation will be managed to standard levels of operation.

Recreation Opportunity Spectrum: All ROS classes except Primitive and Rural will meet or exceed demand in the fifth decade. Primitive opportunities will be capped by quotas in wilderness, as in all other alternatives. Rural ROS class needs could be partly absorbed in the RM class where there is some excess of supply over demand. This will not be true for the alpine skier, however.

Primitive acres remain essentially the same. Other classes will have substantial increases generated by reductions in the Roaded Natural ROS class. The total shift in acres represents 8.3 percent of total Forest acres.

## RESEARCH NATURAL AREAS

### Introduction

There are no Forest activities that have direct effects on the seven Research Natural Areas (RNAs) on the Forest. Those RNAs are: Harvey Monroe Hall, Indiana Summit, Sentinel Meadow, McAfee Meadow, White Mountain, Whippoorwill Flat, and Last Chance Meadow.

Different alternatives could, however, have different indirect effects on RNAs. Since RNAs are managed with the objective of maintaining natural ecological processes, any activity that altered those processes will represent an impact.

Indirect effects will typically be generated by the Forest activities occurring on lands immediately surrounding an RNA. If activities on surrounding lands had the potential to affect natural ecological processes, and if there were a reasonable chance of those activities illegally or inadvertently occurring within the RNA, the risk of indirect effects will be present.

### Indicators

The indirect effects of alternatives on RNAs are examined in terms of the following indicators of land uses immediately surrounding RNAs:

1. Domestic livestock grazing
2. Wilderness designation
3. Public fuelwood gathering
4. Mineral activities.

Grazing animals could trample native vegetation; and due to the tendency of grazing animals to favor palatable species over unpalatable ones, natural vegetative species distribution and abundance could be altered.

Wood gathering removes dead, down logs, which are an important component of natural forest ecosystems.

Dispersed recreation could involve the trampling of vegetation, soil disturbance, and/or an increased risk of human-caused fires. The primary potential source of increased dispersed recreation will be wilderness designation superimposed on RNA designation. As most RNAs are located in Further Planning Areas, wilderness designation is an option considered in the planning process.

Mineral activities include the use of Motorized equipment, ground disturbance, and increased human use of an area, including the increased risk of fire.

**Assumptions**

Forest-wide Standards and Guidelines and the RNA Prescription will apply to these areas under each alternative. It is assumed that these sources of direction will minimize the possibility that any alternative will have a noticeable direct effect on any individual RNA or on RNAs considered as a group.

Grazing, camping, wood gathering, and mineral activities are prohibited in RNAs; daytime dispersed use is discouraged. Although there is no reasonable means of enforcing those prohibitions perfectly, it is assumed that the RNAs on the Forest are unlikely to attract such uses. Where RNAs are contained within grazing allotments, they lie on the edge of the allotment or on steep, high-elevation lands with poor forage. The few RNAs with fuelwood sources are mostly inaccessible by vehicle. All but the Hall RNA are located away from recreational destination points and travel routes. Mineral-potential ratings for most RNAs and surrounding lands are low.

**Consequences Common to All Alternatives**

In the Forest planning process, candidate RNAs have been treated as if they were already established. The number of RNAs does not, therefore, vary by alternative. For this reason, and because of the assumptions discussed above, environmental consequences will not be expected to vary by alternative for RNAs. The following figure illustrates the low level variation between alternatives in terms of overall effects on RNAs, when considered collectively.

Table 85
Indicators of Effects on Research Natural Areas

| Research Natural Area | Potentially conflicting uses of surrounding lands* | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1982 | PRF | CUR | RPA | CEE | AMN | AMB |
| Harvey Monroe Hall | M | M | M | M | W | W | M |
| Indiana Summit | F | F | F | F | F | F | F |
| Last Chance Meadow | W | W | W | W | W | W | W |
| McAfee Meadow | G | G | G | G | G,W | G,W | G |
| Sentinel Meadow | F | F | F | F | F | F | F |
| Whippoorwill Flat | F,M | F,M | F,M | F,M | F,M | F,W | F,W |
| White Mountain | - | - | - | - | W | W | - |
| Net change from base year | - | - | - | - | +3W<br>-1M | +4W<br>-2M | +1W<br>-1M |

* G=grazing; W=wilderness; F=fuelwood gathering; M=mineral activities.

**RIPARIAN AREAS**

Introduction

Forest activities that have major potential effects on riparian areas include livestock grazing, energy development, recreation, stream rewatering, and watershed management.

Consequences of these activities are assessed in terms of surface water availability, amount of riparian acreage lost or gained, and overall condition of riparian vegetation.

Indicators

1. Livestock grazing
2. Energy development (hydroelectric and geothermal)
3. Developed summer recreation use
4. Alpine ski area development
5. Stream miles rewatered
6. Watershed improvement (wet meadow restoration).

Livestock spend a disproportionate amount of time in riparian areas. The amount of grazing affects the quality of riparian areas, primarily due to the

Appendix C: Vascular plant list of McAfee RNA (from Travers 1993)

## APPENDIX C
### Plant Species List

ASTERACEAE
- *Antennaria rosea*
- *Artemisia rothrockii*
- *Artemisia arbuscula*
- *Chrysothamnus parryi*
- *Ericameria discoidea*
- *Erigeron clokeyi*
- *Erigeron compositus*
- *Solidago multiradiata*

BORAGINACEAE
- *Cryptantha sp.*

BRASSICACEAE
- *Astragalus kentrophyta*
- *Arabis lemmonii*
- *Draba californica*
- *Draba oligosperma* (Hook.) **var.** *oligosperma*

CARYOPHYLLACEAE
- *Arenaria kingii* (S. Watson) M.E. Jones **var.** *glabrescens*

CYPERACEAE
- *Carex heteroneura*
- *Carex incurviformis*
- *Carex leporinella*
- *Carex nebrascensis*
- *Eleocharis pauciflora*

FABACEAE
- *Lupinus argenteus*
- *Trifolium andersonii*

GROSSULARIACEAE
- *Ribes viscosissimum*

JUNCACEAE
- *Juncus balticus*

LINACEAE
- *Linum lewisii*

POACEAE
- *Achnatherum occidentalis*
- *Calamagrostis purpurascens*
- *Deschampsia cespitosa*
- *Elymus elymoides*
- *Festuca minutiflora*
- *Poa glauca* M. Vahl. **ssp.** *rupicola*

*Poa lettermanii*
*Poa secunda*
*Koeleria macrantha*
*Muhlenbergia richardsonis*

POLEMONIACEAE

*Leptodactylon pungens*
*Linanthus nuttallii*
*Phlox condensata*

POLYGONACEAE
*Eriogonum gracilipes*
*Eriogonum ovalifolium*
*Rumex paucifolius*

PORTULACACEAE
*Lewisia pygmaea*

PRIMULACEAE
*Androsace septentrionalis* L. ssp. *subumbellata*
*Dodecathion redolens*

ROSACEAE
*Potentilla pensylvanica*
*Ivesia shockleyi* S. Watson **var.** *shockleyi*
*Ivesia lycopodioides*

SAXIFRAGACEAE
*Heuchera duranii*

SCROPHULARIACEAE
*Castilleja nanna*
*Mimulus primuloides*
*Pedicularis attollens*
*Penstemon heterodoxus*

Appendix D: Plants observed in bloom on July 12, 2000 and tentatively identified by Millar et al.

South ridge/boundary of RNA (many were elsewhere as well):

*Arenaria kingii*
*Castilleja nana*
*Erigeron clokeyi*
*Hulsea algida**
*Leptodactylon pungens*
*Penstemon heterodoxus*
*Ranunculus eschscholtzii**
*Ribes visciddifolium*
*Trifollium andersonii*
*Artemesia arbuscula*
*Chrysothamnus viscidiflorus**
*Erigeron sp.*
*Invesia lycopoides ssp. scandularis*
*Linanthus nuttallii*
*Phlox condensata*
*Ribes sp.*
*Rumex paucifolius ssp. paucifolius*

In and near riparian zone of South Fork McAfee Creek, near eastern edge of RNA:

*Achillea lanulosa**
*Carex sp.*
*Dodecatheon redolens*
*Mimulus guttatus**
*Monardella odoratissima**
*Perideridai parishii or Angelica sp. (?)*
*Potentilla fruticosa**
*Aconitum columbianum**
*Cirsium nidulum*
*Heuchera rubescens var. pachypoda**
*Mimulus primuloides**
*Pedicularis attolens*
*Potentilla pennsylvanica var. strigosa*

North slopes of South Fork McAfee Creek and plateau to north:

*Astragalus sp.*
*Cystopteris fragilis**
*Mimulus bigelovii**
*Castilleja sp. (red)*
*Holodiscus dumosus var. glabrescens*
*Penstemon speciosus**

Barely within the RNA border at the lowest elevation of both McAfee Creeks:

*Pinus flexilis**
*Pinus longaeva**
*Populus tremuloides**

* plant not listed in the Ecological Survey (Travers 1993)

Appendix E: Results of plant community survey (from Travers 1993)

**KOELERIA MACRANTHA**

| PLANT SPECIES | NUMBER OF TRANSECTS | TOTAL INTERCEPTS | RELATIVE DENSITY | DOMINANCE |
|---|---|---|---|---|
| *Carex incurviformis* | 2 | 146 | 72.64 | 48.18 |
| *Koeleria macrantha* | 3 | 36 | 17.91 | 11.88 |
| *Phlox condensata* | 2 | 14 | 6.97 | 4.62 |
| *Trifolium andersonii* | 3 | 12 | 5.97 | 3.96 |
| *Sitanion hystrix* | 1 | 8 | 3.98 | 2.64 |
| *Eriogonum gracilipes* | 2 | 8 | 3.98 | 2.64 |
| *Erigeron clokeyi* | 3 | 6 | 2.99 | 1.98 |
| *Androsace septentrionalis* | 2 | 4 | 1.99 | 1.32 |
| *Poa secunda* | 1 | 4 | 1.99 | 1.32 |
| *Penstemon heterodoxus* | 2 | 3 | 1.49 | 0.99 |
| *Carex incurviformis* | 1 | 3 | 1.49 | 0.99 |
| *Elymus elymoides* | 2 | 2 | 1.00 | 0.66 |
| *Draba californica* | 1 | 2 | 1.00 | 0.66 |
| *Leptodactylon pungens* | 1 | 1 | 0.50 | 0.33 |
| *Potentilla pensylvanica* | 1 | 1 | 0.50 | 0.33 |

ADDITIONAL SPECIES

*Castilleja nanna*
*Draba oligosperma*
*Achnatherum occidentalis*
*Rumex paucifolius*

Table 2. Results of surveys of transects in Koeleria macrantha communities.

IVESIA

| PLANT SPECIES | NUMBER OF TRANSECTS | TOTAL INTERCEPTS | RELATIVE DENSITY | DOMINANCE |
|---|---|---|---|---|
| *Ivesia lycopoidioides* | 3 | 47 | 35.07 | 15.51 |
| *Antennaria rosea* | 3 | 38 | 28.36 | 12.54 |
| *Trifolium andersonii* | 3 | 10 | 7.46 | 3.30 |
| *Carex incurviformis* | 1 | 8 | 5.97 | 2.64 |
| *Lewisia pygmaea* | 3 | 6 | 4.48 | 1.98 |
| *Penstemon heterodoxus* | 1 | 5 | 3.73 | 1.65 |
| *Carex heteroneura* | 1 | 5 | 3.73 | 1.65 |
| *Trifolium andersonii* | 1 | 3 | 2.24 | 0.99 |
| *Draba oligosperma* | 1 | 2 | 1.49 | 0.66 |
| *Eriogonum gracilipes* | 1 | 2 | 1.49 | 0.66 |
| *Eriogonum ovalifolium* | 1 | 2 | 1.49 | 0.66 |
| *Poa secunda* | 1 | 2 | 1.49 | 0.66 |
| *Phlox condensata* | 1 | 2 | 1.49 | 0.66 |
| *Arenaria kingii* | 1 | 1 | 0.75 | 0.33 |
| *Arabis lemmonii* | 1 | 1 | 0.75 | 0.33 |

| ADDITIONAL SPECIES |
|---|
| *Androsace septentrionalis* |
| *Carex leporinella* |
| *Castilleja nanna* |
| *Erigeron clokeyi* |
| *Eriogonum ovalifolium* |
| *Koeleria macrantha* |
| *Rumex paucifolius* |

Table 3. Results of surveys of transects in Ivesia lycopoidioides communities.

**TRIFOLIUM ANDERSONII**

| PLANT SPECIES | NUMBER OF TRANSECTS | TOTAL INTERCEPTS | RELATIVE DENSITY | DOMINANCE |
|---|---|---|---|---|
| *Carex incurviformis* | 3 | 117 | 57.64 | 38.61 |
| *Trifolium andersonii* | 3 | 37 | 18.23 | 12.21 |
| *Achnatherum occidentalis* | 2 | 11 | 5.42 | 3.63 |
| *Elymus elymoides* | 3 | 9 | 4.43 | 2.97 |
| *Koeleria macrantha* | 1 | 3 | 1.48 | 0.99 |
| *Erigeron clokeyi* | 2 | 3 | 1.48 | 0.99 |
| *Phlox condensata* | 1 | 1 | 0.49 | 0.33 |
| *Potentilla pensylvanica* | 1 | 1 | 0.49 | 0.33 |

ADDITIONAL SPECIES

*Androsace septentrionalis*
*Chrysothamnus parryi*
*Draba oligosperma*
*Eriogonum gracilipes*

Table 4. Results of surveys of transects in Trifolium andersonii communities.

**ARTEMISIA ARBUSCULA**

| PLANT SPECIES | NUMBER OF TRANSECTS | TOTAL INTERCEPTS | RELATIVE DENSITY | DOMINANCE |
|---|---|---|---|---|
| *Trifolium andersonii* | 1 | 10 | 23.26 | 9.90 |
| *Linanthus nuttallii* | 1 | 9 | 20.93 | 8.91 |
| *Koeleria macrantha* | 1 | 6 | 13.95 | 5.94 |
| *Artemisia arbuscula* | 1 | 5 | 11.63 | 4.95 |
| *Carex incurviformis* | 1 | 5 | 11.63 | 4.95 |
| *Arenaria kingii* | 1 | 3 | 6.98 | 2.97 |
| *Festuca minutiflora* | 1 | 2 | 4.65 | 1.98 |
| *Heuchera duranii* | 1 | 1 | 2.33 | 0.99 |
| *Penstemon heterodoxus* | 1 | 1 | 2.33 | 0.99 |
| *Ericameria discoidea* | 1 | 1 | 2.33 | 0.99 |

ADDITIONAL SPECIES

*Androsace septentrionalis*
*Chrysothamnus parryi*
*Draba californica*
*Elymus elymoides*
*Juncus balticus*
*Leptodactylon pungens*
*Rumex paucifolius*

Table 5. Results of surveys of transect in Artemisia arbuscula community.

CHRYSOTHAMNUS

| PLANT SPECIES | NUMBER OF TRANSECTS | TOTAL INTERCEPTS | RELATIVE DENSITY | DOMINANCE |
|---|---|---|---|---|
| *Chrysothamnus parryi* | 3 | 33 | 24.44 | 10.89 |
| *Trifolium andersonii* | 3 | 24 | 17.78 | 7.92 |
| *Carex incurviformis* | 3 | 20 | 14.81 | 6.60 |
| *Koeleria macrantha* | 3 | 11 | 8.15 | 3.63 |
| *Leptodactylon pungens* | 3 | 11 | 8.15 | 3.63 |
| *Eriogonum ovallifolium* | 3 | 9 | 6.67 | 2.97 |
| *Achnatherum occidentalis* | 2 | 7 | 5.19 | 2.31 |
| *Linanthus nuttallii* | 2 | 4 | 2.96 | 1.32 |
| *Penstomen heterodoxus* | 1 | 3 | 2.22 | 0.99 |
| *Phlox condensata* | 1 | 3 | 2.22 | 0.99 |
| *Ribes viscosissimum* | 1 | 3 | 2.22 | 0.99 |
| *Elymus elymoides* | 1 | 2 | 1.48 | 0.66 |
| *Draba oligosperma* | 1 | 1 | 0.74 | 0.33 |
| *Erigeron clokeyi* | 1 | 1 | 0.74 | 0.33 |
| *Potentilla pensylvanica* | 1 | 1 | 0.74 | 0.33 |
| *Eriogonum gracilipes* | 1 | 1 | 0.74 | 0.33 |
| *Poa lettermanii* | 1 | 1 | 0.74 | 0.33 |

Table 6. Results of surveys of transects in Chrysothamnus communities.

CAREX - DESCHAMPSIA

| PLANT SPECIES | NUMBER OF TRANSECTS | TOTAL INTERCEPTS | RELATIVE DENSITY | DOMINANCE |
|---|---|---|---|---|
| *Deschampsia cespitosa* | 2 | 69 | 39.43 | 34.16 |
| *Carex incurviformis* | 1 | 37 | 21.14 | 18.32 |
| *Carex heteroneura* | 1 | 24 | 13.71 | 11.88 |
| *Eleocharis pauciflora* | 1 | 16 | 9.14 | 7.92 |
| *Moss species* | 2 | 13 | 7.43 | 6.44 |
| *Mimulus primuloides* | 2 | 10 | 5.71 | 4.95 |
| *Pedicularis attpllens* | 1 | 3 | 1.71 | 1.49 |
| *Ivesia lycopoidiodes* | 1 | 1 | 0.57 | 0.50 |

ADDITIONAL SPECIES

*Carex nebrascensis*

Table 7. Results of surveys of transects in Carex - Deschampsia communities.

Appendix F: Animal species observed in the McAfee RNA (from Travers 1993)

Mammals:

*Canis latrans*, Coyote
*Odocoileus hemionus*, Mule deer
*Eutamias sp.*, Chipmunk
*Lepus townsendii*, White-tailed Hare
*Mustela frenata*, Long-tailed weasel
*Marmota flaviventris*, Yellow-bellied marmots

Insects:

*Bombus sp.*, Bumblebee
*Lycaenid*, Butterflies

Birds:

*Aquila chrysaetos*, Golden eagle
*Corvus corax*, Raven
*Eremophila alpestris*, Horned lark
*Salpinctus obsoletus*, Rock wren

Appendix G: Descriptions of soils in the McAfee RNA (USDA Forest Service 1994)

(notes were made by L. Bryant, Forest Soil Scientist, Inyo National Forest)

EXCERPTS

**United States Department of Agriculture**

Forest Service

Pacific Southwest Region

September, 1994

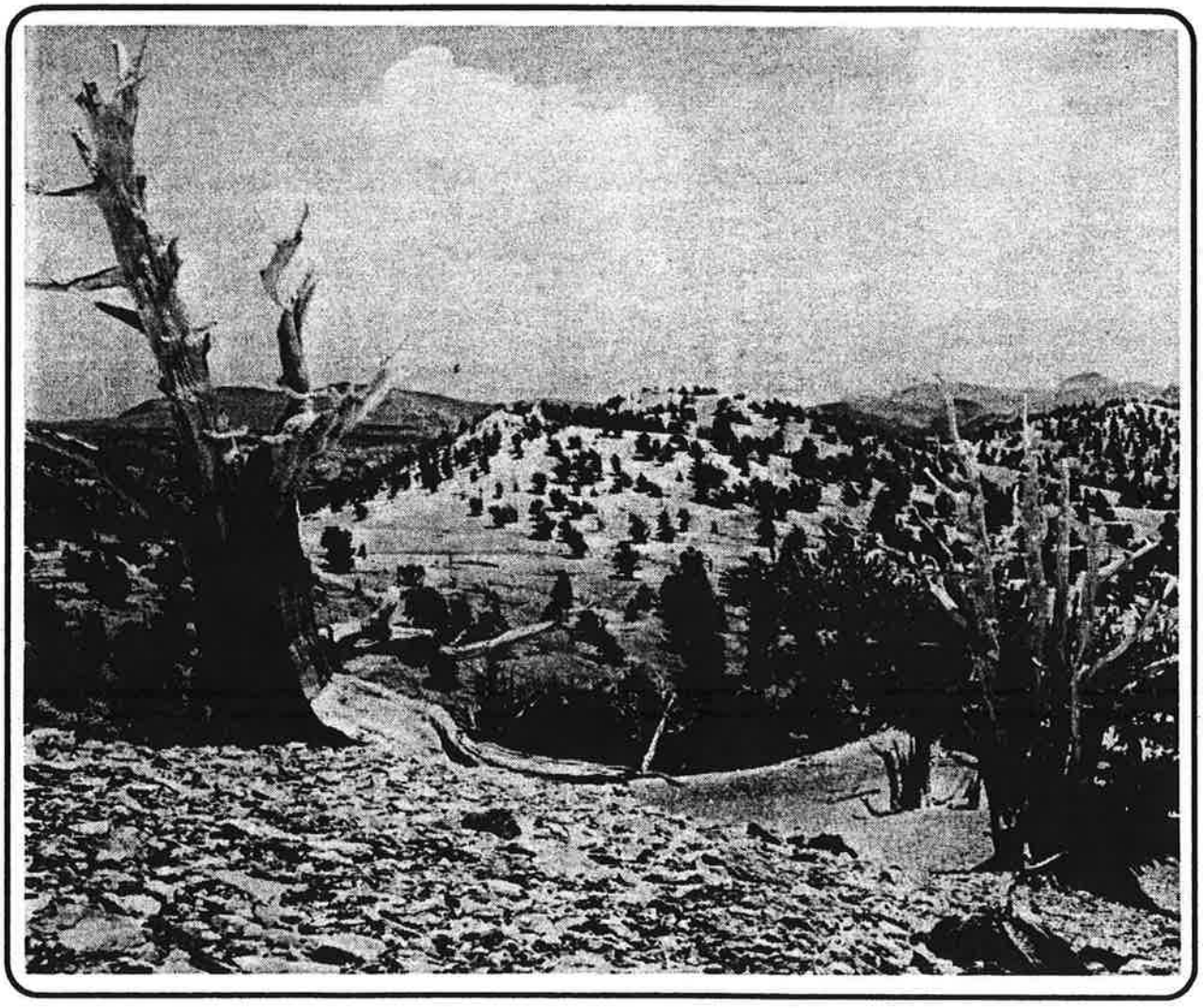
In cooperation with:

U.S.D.A. Soil Conservation Service

Regents of the University of California (Agricultural Experiment Station)

# Soil Survey

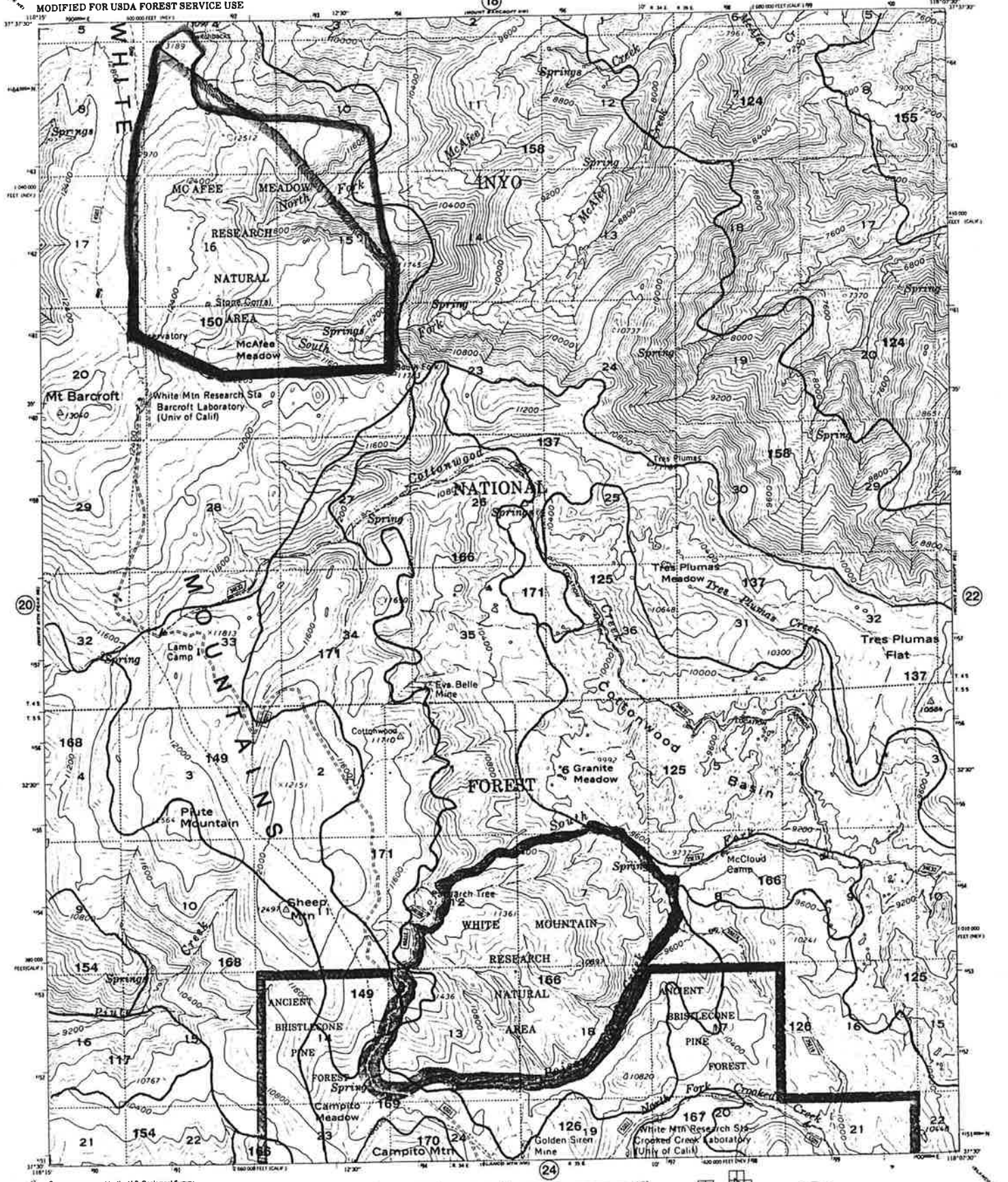
## East Part, Inyo National Forest Area California



INYO NATIONAL FOREST AREA – EAST PART
ORDER 3 SOIL SURVEY – SEPTEMBER 1983

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MOUNT BARCROFT SW QUADRANGLE
MT DIABLO MERIDIAN
MONO CO., CALIFORNIA
7.5 MINUTE SERIES




Base map prepared by the U.S. Geological Survey

Topography by photogrammetric methods from aerial photographs
Map edited 1962

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system zone 3
1000-metre Universal Transverse Mercator grid ticks zone 11

INTERIM EDITION

Photoinspected by the Geomatronics Service Center in 1984
from USFS aerial photographs and 1984 correction guides
furnished by the Pacific Southwest Region

UTM GRID AND 1984 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND

- National Forest Boundary
- Alienated Land within the Forest Boundary as of 1984
- TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction
- Landnet revised according to additional Forest Service evidence
- Primary Highway
- Secondary Highway
- Improved Light Duty
- Unimproved Dirt
- Trail
- Locked Gate
- Barrier
- Railroad
- US Highway
- State Highway
- County Road
- Forest Highway
- Forest Road
- Forest Trail
- Forest Service Trail location approx
- Forest Service Road location approx


MOUNT BARCROFT SW, CALIF
N3730-W11807 5/7.5
(431-3C)
REVISED 1984

## 150 - Pergelic Cryoborolls - Soakpak family association, 5 to 70 percent slopes

Elevation: 10,800 to 13,200 feet Annual Precipitation: 12 to 18 inches

| Soil Map Unit Components | Pergelic Cryoborolls | Soakpak family |
|---|---|---|
| Approx Proportion | 55 percent | 25 percent |
| Landscape Position | Mountainsides | Colluvial-alluvial mountain flats |
| Slope | 30 to 70 percent | 5 to 30 percent |
| Typical Vegetation | Goldenbush (Haplopappus spp.); Buckwheat (Eriogonum spp.); Pringle Bluegrass (Poa pringleii) | Carex (Carex spp.); Low Phlox (Phlox hoodii); Pringle Bluegrass (Poa pringleii) |

### Soil Profile Description

| | | |
|---|---|---|
| Surface Layer | 1 to 0 inches; Root mat | 0 to 9 inches; grayish brown & brown, extremely cobbly & very gravelly sandy loam; moderate fine & medium, & weak very fine & fine subangular blocky structure; slightly to medium acid |
| | 0 to 2 inches; dark grayish brown very stony loam; moderate medium & coarse subangular blocky structure; neutral | |
| Subsoil | 2 to 14 inches; brown & yellowish brown very stony loam; moderate fine, medium & coarse subangular blocky structure; neutral to slightly acid | 9 to 27 inches; pale brown very gravelly sandy loam; weak very fine & fine subangular blocky structure; medium acid |
| Substratum | 14 to 39 inches; pale brown very stony & extremely stony loam; moderate fine & medium subangular blocky structure; slightly to strongly acid | 27 to 42 inches; light gray very gravelly sandy loam; weak very fine & fine subangular blocky structure; medium acid |
| | 39 inches; hard fractured granodiorite bedrock | 42 inches; hard fractured granodiorite bedrock |

### Soil Properties

| | | |
|---|---|---|
| Restrictive Layer Depth | 35 to 60+ inches FB | 30 to 60+ inches FB |
| Effective Rooting Depth (inches) | 20 to 40 inches | 20 to 40 inches |
| Available Water Capacity | Low (2.0 to 3.5 inches) | Very low to moderate (1.7 to 4.2 inches) |
| Water Retention Class | 2 (1.4 to 1.8 inches) | 2 (1.3 to 1.6 inches) |
| Hydrologic Soil Group | B | B |
| Permeability (in./hr.) | 0.6 to 2.0 | 0.6 to 2.0 |
| Drainage Class | Well drained | Well drained |
| Runoff | Rapid to Very Rapid | Medium to Rapid |
| Max Erosion Hazard | High | Moderate |
| Erosion Factor (k) | | |
| Surface | 0.17 (low) | 0.17 (low) |
| Subsurface | 0.10 (low) | 0.10 (low) |
| T Value | 4 | 4 |
| Wind Erodability Group | 8 | 8 |

## 150 - Pergelic Cryoborolls - Soakpak family association (continued)

| | | |
|---|---|---|
| Soil Manageability | | |
| Group | III | III |
| Class | 3Egpx | 2epx |
| **Range Interpretations** | | |
| Productivity (lb/acre) | 75 to 100 | 75 to 100 |
| Suitability | Summer | Summer |
| Most Limiting Factors | 10% rock outcrop; high erosion hazard; steep slopes | 10% rock outcrop; high erosian hazard; steep slopes |
| **Recreation Interpretations - Limitations for** | | |
| Camp Areas | Severe: Slope | 5-8% slopes:<br>Moderate - large & small stones<br>8-15% slopes:<br>Moderate - slope; large & small stones |
| Picnic Areas | Severe: Slope | 5-8% slopes:<br>Moderate - large & small stones<br>8-15% slopes:<br>Moderate - slope; large & small stones |
| Paths & Trails | Severe: Slope; large stones | Moderate: Large & small stones |
| **Engineering Interpretations** | | |
| Unified Class | | |
| Surface | SM | SM-SC |
| Subsoil | SC | GW-GM; GM-GC |
| Substratum | SM-SC | GW-GM; GM-GC |
| AASHTO Class | | |
| Surface | A-4 | A-4 |
| Subsoil | A-2-4 | A-2-4 |
| Substratum | A-4 | A-1-a; A-1-b; A-2-4 |
| Suitability for | | |
| Sand | Unsuited | Unsuited |
| Gravel | Unsuited | Poor: Excess fines |
| Topsoil | Poor: Slope; large & small stones | Poor: Small stones |
| Roadfill | Poor: Slope; large stones; area reclaim | Fair: area reclaim |

### Included Areas & Remarks

Included in this map unit are small areas of the Soakpak family, 30 to 50 percent slopes, on transitional areas between colluvial-alluvial flats and mountainsides; Pergelic Cryoborolls, 5 to 30 percent slopes, on benches of mountainsides; and rock outcrop, on ridges and mountain tops. Included areas make up approximately 20 percent of the map unit area.

## 158 - Rock outcrop, granitic - Packham family - Rubbleland association, 30 to 80 percent slopes

Elevation: 6,000 to 12,700 feet  Annual Precipitation: 11 inches

| Soil Map Unit Components | Rock outcrop, granitic | Packham family | Rubbleland, granitic |
|---|---|---|---|
| Approx Proportion | 30 percent | 25 percent | 20 percent |
| Landscape Position | Mid to upper mountainsides | Lower mountainsides at higher elevations, and northerly and easterly-facing mountainsides at lower elevations | Mountainsides |
| Slope | — | 30 to 80 percent | — |
| Typical Vegetation | — | Singleleaf Pinyon Pine (Pinus monophylla); Big Sagebrush (Artemisia tridentata); Wheatgrass (Agropyron spp.) | — |

### Soil Profile Description

| | | | |
|---|---|---|---|
| Surface Layer | Rock outcrop consists of contiguous bare bedrock and less than 15 percent inclusions of soil material capable of supporting plants | 0 to 3 inches; pale brown extremely cobbly sandy loam; moderate very thick platy structure; neutral | Rubbleland consists of areas of detached rock fragments (colluvium) which have accumulated on steep to very steep mountainsides as talus. These areas support little or no vegetation and are subject to landslides. |
| Subsoil | — | 3 to 15 inches; yellowish brown very & extremely gravelly sandy clay loam; massive; neutral | — |
| Substratum | — | 15 to 60+ inches; light yellowish brown & very pale brown gravelly & extremely gravelly sandy loam; massive; none to violently effervescent; neutral to moderately alkaline | — |

### Soil Properties

| | | | |
|---|---|---|---|
| Restrictive Layer Depth | — | 30 to 60 inches FB | — |
| Effective Rooting Depth (inches) | — | 20 to 50 inches | — |
| Available Water Capacity | — | Very low to low (1.3 to 3.3 inches) | — |
| Water Retention Class | — | 2 to 3 (1.0 to 1.2 inches) | — |
| Hydrologic Soil Group | — | B | — |
| Permeability (in./hr.) | — | 0.2 to 0.6 | — |
| Drainage Class | — | Well drained | — |
| Runoff | — | Rapid to Very Rapid | — |
| Max Erosion Hazard | — | Moderate to High | — |
| Erosion Factor (k) | | | |
| Surface | — | 0.05 (low) | — |
| Subsurface | — | 0.05 (low) | — |
| T Value | — | 3 | — |
| Wind Erodability Group | — | 8 | — |

## 158 - Rock outcrop (continued)

| | | | |
|---|---|---|---|
| Soil Manageability Group | IV | IV | IV |
| Class | — | 4EGPX | — |

### Range Interpretations

| | | | |
|---|---|---|---|
| Productivity (lb/acre) | — | 500 to 700 | — |
| Suitability | — | Summer - Autumn | — |
| Most Limiting Factors | — | Plant competition; 30% rock outcrop; 20% rubbleland; high erosion hazard; very steep slopes | — |

### Recreation Interpretations - Limitations for

| | | | |
|---|---|---|---|
| Camp Areas | — | Severe: Slope | — |
| Picnic Areas | — | Severe: Slope | — |
| Paths & Trails | — | Severe: Slope; large stones | — |

### Engineering Interpretations

| | | | |
|---|---|---|---|
| Unified Class | | | |
| Surface | — | GM; GW-GM | — |
| Subsoil | — | GM; GW-GM | — |
| Substratum | — | GM; GW-GM | — |
| AASHTO Class | | | |
| Surface | — | A-1-a; A-1-b; A-2-4 | — |
| Subsoil | — | A-2-6 | — |
| Substratum | — | A-1-a; A-1-b; A-2-4 | — |
| Suitability for | | | |
| Sand | — | Unsuited | — |
| Gravel | — | Poor: Excess fines | — |
| Topsoil | — | Poor: Slope; small stones | — |
| Roadfill | — | Poor: Slope | — |

### Included Areas & Remarks

Included in this map unit are small areas of the Slinger family, 30 to 60 percent slopes, on southerly and westerly-facing mountainsides, at lower elevations; a soil similar to the Soakpak family, but warmer, on upper mountainsides and ridges, at higher elevations. Included areas make up approximately 25 percent of the map unit area.

Xeric Haplocryolls
~~Pergelic Cyroborolls~~
no permafrost mentioned but soil T°<0°C
wet mdw inclusions may have permafrost orgelic materials.

The Pergelic Cryoborolls consist of moderately deep to deep, well drained soils forming in colluvium from granitic rocks. These soils are on mountainsides. Slope is 30 to 80 percent. Elevation is 9,000 to 14,250 feet. The mean annual precipitation is about 18 inches and the mean annual temperature is about 28°F.

**Taxonomic Class:** Loamy-skeletal, mixed ~~Pergelic Cryoborolls~~ Xeric Haplocryolls

**Reference Pedon:** The representative profile for this soil is on a west-facing mountainside, under Goldenbrush, Buckwheat and Pringle Bluegrass, at an elevation of 13,050 feet. Slope is 38 percent. When described, (7/16/80), the soil was moist throughout. (Colors are for dry soil unless otherwise noted.)

01 – 1 to 0 inch; organic mat, made up of grass roots; abrupt smooth boundary.

A1 – 0 to 2 inches; dark grayish brown (10YR 4/2) very stony loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure, parting to fine and medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and common fine interstitial pores; 10 percent gravel, 15 percent cobbles and 10 percent stones; neutral (pH 7.0); clear smooth boundary.

B21 – 2 to 9 inches; brown (10YR 5/3) very stony loam, dark brown (10YR 3/3) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and common fine and medium roots; common very fine and fine interstitial pores; 30 percent gravel, 10 percent cobbles and 20 percent stones; neutral (pH 7.0); abrupt wavy boundary.

B22 – 9 to 14 inches; yellowish brown (10YR 5/4) very stony loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots; common very fine interstitial and few very fine tubular pores; 20 percent gravel, 10 percent cobbles and 25 percent stones; slightly acid (pH 6.5); abrupt wavy boundary.

C1 – 14 to 23 inches; pale brown (10YR 6/3) very stony loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; few very fine and fine interstitial and tubular pores; 20 percent gravel, 15 percent cobbles and 25 percent stones; slightly acid (pH 6.5); abrupt wavy boundary.

C2 – 23 to 39 inches; pale brown (10YR 6/3) extremely stony loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; common very fine interstitial, and few very fine and fine tubular pores; 10 percent gravel, 20 percent cobbles and 35 percent stones; strongly acid (pH 5.5); abrupt irregular boundary.

R – 39 inches; hard, fractured granodiorite.

The soil surface is covered with 15 percent gravel, 20 percent cobbles and 15 percent stones.

**Type Location:** About 0.15 mile east and 320 feet north of the southeast corner of Section 8, T.4S., R.34E., MDBM, Mt. Barcroft SW Quadrangle.

**Range in Characteristics:** Depth to bedrock is 35 to greater than 60 inches. The mean annual soil temperature at 20 inches is less than 32°F. The soil moisture control section is 4 to 19 inches. It is usually dry in all parts from mid-April to late September, and moist in some or all parts the rest of the year. The textural control section is 10 to 40 inches. It is sandy loam or loam, with an average of less than 18 percent clay. Rock fragments average about 60 percent by volume.

Some pedons lack O horizons. Other pedons lack B horizons

The O horizon is up to 1 inch thick.

The A horizon has dry color of 10YR 4/2, 4/3 or 5/3, or 2.5Y 5/2; moist color is 10YR 2/2, 3/2 or 3/3, or 2.5Y 3/2. It is sandy loam or loam, with 6 to 15 percent clay. Rock fragments are 5 to 30 percent gravel, 0 to 40 percent cobbles and 0 to 10 percent stones by volume. Reaction is medium acid to mildly alkaline (pH 6.0 to 7.5).

The B horizon has dry color of 10YR 5/3 or 5/4; moist color is 10YR 3/3. It is loam, with 19 percent clay. Rock fragments are 20 to 30 percent gravel, 10 percent

cobbles and 20 to 25 percent stones by volume. Reaction is slightly acid to neutral (pH 6.5 to 7.0).

The C horizon has dry color of 10YR 5/3, 5/4, 6/3 or 6/4; moist color is 10YR 3/3, 3/4, 4/3 or 4/4. It is sandy loam or loam, with 7 to 17 percent clay. Rock fragments are 5 to 55 percent gravel, 0 to 40 percent cobbles and 0 to 35 percent stones by volume. Reaction is slightly to strongly acid (pH 5.5 to 6.5).

The Soakpak family consists of moderately deep to deep, well drained soils forming in alluvium and colluvium from mixed granitic rocks. These soils are on remnant alluvial fans, in alluvial-colluvial flats and on mountainsides. Slope is 5 to 60 percent. Elevation is 9,000 to 13,900 feet. The mean annual precipitation is about 12 inches and the mean annual temperature is about 28°F.

**Taxomonic Class:** Loamy-skeletal, mixed ~~Pergelic Cryochrepts.~~ Xeric Eutrocryepts or Xeric Dystrocryepts

**Typical Pedon:** The representative profile for this soil is on a south-facing remnant alluvial fan, under Carex, Low Phlox and Pringle Bluegrass, at an elevation of 13,200 feet. When described (7/17/80), the soil was dry throughout. (Colors are for day soil, unless otherwise noted.)

A11 – 0 to 3 inches; grayish brown (10YR 5/2) very cobbly loam, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine interstitial, and common very fine tubular pores; 20 percent gravel, 10 percent cobbles and 5 percent stones; slightly acid (pH 6.5); clear smooth boundary.

A12 – 3 to 9 inches; brown (10YR 5/3) very gravelly sandy loam, very dark gray (10YR 3/1) moist; weak very fine and fine subangular blocky structure; slightly hard, very friable, sticky and plastic; many very fine and common fine interstitial pores; 40 percent gravel; medium acid (pH 6.0); clear wavy boundary.

B21 – 9 to 13 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak very fine and fine subangular blocky structure; slightly hard, very friable, sticky and plastic; common very fine and fine, and few medium pores; common very fine, and few fine interstitial pores; 35 percent gravel; medium acid (pH 6.0); clear wavy boundary.

B22 – 13 to 27 inches; pale brown (10YR 6/3) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and few fine interstitial pores; 55 percent gravel; medium acid (pH 6.0);clear wavy boundary.

C1 – 27 to 42 inches; light gray (10YR 7/2) very gravelly sandy loam, olive brown (2.5Y 4/4) moist; weak very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; few very fine and fine interstitial pores; 55 percent gravel; medium acid (pH 6.0); abrupt irregular boundary.

R – 42 inches; hard, fractured granodiorite.

The surface is covered with 15 percent gravel, 10 percent cobbles and 5 percent stones.

**Type Location:** About 2.7 miles north of the White Mountain Research Station and about 180 feet west of the road; about 0.3 mile south of the apparent center of Section 30, T.3S., R.34E., MDBM, White Mountain Peak NE Quadrangle.

**Range in Characteristics:** Soil depth is 30 to greater than 60 inches. The mean annual soil temperature at 20 inches is less than 32°F. The soil moisture control section is 4 to 30 inches. It is usually dry in all parts from mid April to late September, and moist in some or all parts the rest of the year. The textural control section is 10 to 40 inches. It is loamy sand, sandy loam or loam, with 6 to 17 percent clay, and an average of about 11 percent. Rock fragments are 25 to 60 percent gravel, 0 to 15 percent cobbles and 0 to 30 percent stones by volume, and average 53 percent.

The A horizon has dry color of 10YR 5/2, 5/3 or 5/4; moist color is 10YR 3/1, 3/2, 3/3 or 4/3. It is loamy sand, sandy loam or loam, with 4 to 15 percent clay. Rock fragments are 15 to 70 percent gravel, 5 to 15 percent cobbles and 5 to 30 percent stones by volume. Reaction is medium acid to mildly alkaline (pH 6.0 to 7.5).

The B2 horizon has dry color of 10YR 6/3 or 7/4; moist color is 10YR 3/3, 4/3 or 5/4. It is loamy sand, sandy loam or loam, with 6 to 17 percent clay. Rock fragments are 25 to 60 percent gravel, 0 to 15 percent cobbles and 0 to 10 percent stones by volume. Reaction is medium acid to mildly alkaline (pH 6.0 to 7.5).

The C horizon has dry color of 10YR 7/2, 7/3 or 7/4, or 2.5Y 7/4; moist color is 10YR 4/3, 4/4 or 6/4, or 2.5Y 4/4. It is sandy loam with 6 to 16 percent clay. Rock fragments 35 to 55 percent gravel, 0 to 10 percent cobbles and 0 to 30 percent stones by volume. Reaction is medium acid to mildly alkaline (pH 6.0 to 7.5).

The Packham family consists of moderately deep to deep, well drained soils forming in colluvium and alluvium from mixed rocks. These soils are on mountainsides and alluvial fans. Slope is 30 to 80 percent. Elevation is 6,100 to 10,000 feet. The mean annual precipitation is about 11 inches and the mean annual temperature is about 44°F.

**Taxonomic Class:** Loamy - skeletal, mixed, frigid ~~Xerollic Camborthids~~ Haplocambids

**Typical Pedon:** The representative profile for this soil is on a northwest facing mountainside, under Singleaf Pinyon Pine, Big Sagebrush and Arizona Wheatgrass, at an elevation of 8,360 feet. Slope is 40 percent. When described (10/6/80), the soil was slightly moist from 3 to 15 inches, and dry throughout the rest of the profile. (Colors are for dry soils unless otherwise noted.)

A1 – 0 to 3 inches; pale brown (10YR 6/3) very cobbly sandy loam, brown (10YR 4/3) moist; moderate very thick platy structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine and fine interstitial pores; 30 percent gravel, 20 percent cobbles and 10 percent stones; neutral (pH 7.0); clear wavy boundary.

B21 – 3 to 7 inches; yellowish brown (10YR 5/4) very gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky and plastic; common very fine, few fine interstitial, and few very fine and fine tubular pores; 40 percent gravel; neutral (pH 7.0); clear wavy boundary.

B22 – 7 to 15 inches; yellowish brown (10YR 5/4) extremely gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky and plastic; few very fine and fine, and common medium and coarse roots; common very fine, few fine interstitial, and few very fine and fine tubular pores; 60 percent gravel and 10 percent cobbles; neutral (pH 7.0); clear wavy boundary.

C1 – 15 to 27 inches; light yellowish brown (10YR 6/4) extremely gravelly sandy loam; dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine and coarse, and common medium roots; many very fine and fine interstitial pores; 50 percent gravel and 15 percent cobbles; neutral (pH 7.0); clear wavy boundary.

C2 – 27 to 40 inches; light yellowish brown (10YR 6/4) extremely gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and coarse, and common medium roots; many very fine and fine interstitial pores; 75 percent gravel and 5 percent cobbles; neutral (pH 7.0); clear wavy boundary.

C3ca – 40 to 44 inches; light yellowish brown (10YR 6/4) very gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine, medium and coarse roots; many very fine and fine interstitial pores; strongly effervescent, disseminated lime; 50 percent gravel; moderately alkaline (pH 8.0); clear wavy boundary.

C4ca – 44 to 50 inches; very pale brown (10YR 7/3) very gravelly loamy sand, dark yellowish brown (10 YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few medium roots; many very fine and fine interstitial pores; violently effervescent, disseminated lime; many fine irregularly shaped segregated secondary carbonates occurring in seams; 50 percent gravel; moderately alkaline (pH 8.0); clear wavy boundary.

C5ca – 50 to 60 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine interstitial pores; slightly effervescent, disseminated lime; many fine irregularly shaped segregated secondary carbonates occurring in seams; 25 percent gravel and 5 percent cobbles; moderately alkaline (pH 8.0).

The soil surface is covered with 30 percent gravel, 20 percent cobbles and 10 percent stones.

**Type Location:** About 4.3 miles east on Queen Canyon Road, from its intersection with Highway 6, then about 0.4 mile south on jeep trail, from its intersection with Queen Canyon Road; about 1,270 feet east and 530 feet north of the southwest corner of Section 31, T.1N., R.33E., MDBM, Benton NE Quadrangle.

**Range in Characteristics:** Depth to the lithic contact is 30 to greater than 60 inches. The mean annual soil temperature at 20 inches is about 45°F, and the mean summer and mean winter soil temperatures differ by more than 9°F. The soil moisture control section is 4

is 30 to greater than 60 inches. The mean annual soil temperature at 20 inches is about 45°F, and the mean summer and mean winter soil temperatures differ by more than 9°F. The soil moisture control section is 4 to 30 inches. It is usually dry in all parts from early April to mid October. The 10 to 40 inch textural control section is sandy loam, fine sandy loam, loam, sandy clay loam or clay loam, with 6 to 33 percent clay, and an average of about 16 percent. Rock fragments range from 20 to 80 percent by volume, and average about 50 percent. Depth to secondary carbonate accumulations ranges from 3 to 40 inches, but typically is at depths greater than 8 inches.

Some pedons are calcareous throughout.

The A horizon has dry color of 10YR 5/3, 5/4 or 6/3; moist color is 10YR 3/3 or 4/3. It is loam or sandy loam, with 6 to 20 percent clay. Rock fragments are 5 to 30 percent gravel, 0 to 20 percent cobbles and 0 to 10 percent stones by volume. Effervescence is none to violent. Reaction is slightly acid to moderately alkaline (pH 6.5 to 8.0).

The B horizon has dry color of 10YR 5/4, 6/3, 6/4, 7/3, or 2.5Y 6/2; moist color is 10YR 4/3, 4/4 or 5/4, or 2.5Y 5/2. It is sandy loam, loam, sandy clay loam or clay loam, with 12 to 33 percent clay. Rock fragments are 15 to 60 percent gravel, 0 to 20 percent cobbles and 0 to 5 percent stones by volume. Effervescence is none to violent. Reaction is slightly acid to moderately alkaline (pH 6.5 to 8.0).

The C horizon has dry color of 10YR 6/4, 7/3 or 7/4, or 2.5Y 6/2; moist color is 10YR 4/3, 4/4 or 5/3, or 2.5Y 3/2. It is loamy sand, sandy loam, fine sandy loam, loam or sandy clay loam, with 4 to 26 percent clay. Rock fragments are 10 to 75 percent gravel, 0 to 25 percent cobbles and 0 to 25 percent stones by volume. Effervescence is none to violent. Reaction is neutral to moderately alkaline (pH 7.0 to 8.4).

## Slinger Family

The Slinger family consists of moderately deep to deep, well drained soils forming in colluvium from granitic and sedimentary rocks. These soils are on mountainsides. Slope is 30 to 60 percent. Elevation is 6,100 to 9,500 feet. The mean annual precipitation is about 11 inches and the mean annual temperature is about 44°F.

**Taxonomic Class:** Loamy-skeletal, mixed (calcareous), frigid Xeric Torriorthents. Okay

**Typical Pedon:** The representative profile for this soil is on a southwest-facing mountainside, under Singleleaf Pinyon Pine and Big Sagebrush, at an elevation of 7,480 feet. Slope is 60 percent. When described (10/8/80), the soil was dry throughout. (Colors are for dry soil, unless otherwise noted.)

01 – 1 to 0 inch; organic mat, made up of pine needles, twigs and cones; clear wavy boundary.

A11 – 0 to 2 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak fine granular structure; loose, loose, nonsticky and nonplastic; few very fine and fine roots; many very fine and fine interstitial pores; slightly effervescent, disseminated lime; 30 percent gravel and 10 percent cobbles; mildly alkaline (pH 7.8); clear wavy boundary.

A12 – 2 to 5 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; weak fine granular structure; loose, loose, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; slightly effervescent, disseminated lime; 30 percent gravel and 5 percent cobbles; mildly alkaline (pH 7.8); clear wavy boundary.

A13 – 5 to 14 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and common fine and medium roots; many very fine and fine interstitial pores; strongly effervescent, disseminated lime; 40 percent gravel and 5 percent cobbles; mildly alkaline (pH 7.8); clear wavy boundary.

C1ca – 14 to 18 inches; light gray (10YR 7/2) very gravelly sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and common medium and coarse roots; many very fine and fine interstitial pores; violently effervescent, disseminated lime; 55 percent gravel; moderately alkaline (pH 8.0); clear wavy boundary.

C2ca – 18 to 24 inches; very pale brown (10YR 7/3) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine, medium and coarse roots; many very fine and fine interstitial pores; violently effervescent, disseminated lime; 60 percent gravel; moderately alkaline (pH 8.2); clear wavy boundary.

C3ca – 24 to 38 inches; very pale brown (10YR 7/3) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; many very fine and fine interstitial pores; violently effervescent, disseminated lime; 50 percent gravel and 5 percent cobbles; moderately alkaline (pH 8.2); clear wavy boundary.

C4ca – 38 to 60 inches; very pale brown (10YR 7/3) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few medium and common coarse roots; many very fine and fine interstitial pores; violently effervescent, disseminated lime; 45 percent gravel and 15 percent cobbles; moderately alkaline (pH 8.2).

The surface is covered with 30 percent gravel and 10 percent cobbles.

**Type Location:** About 1.95 miles southeast on Queen Canyon Road, from its intersection with Highway 395, then 0.5 mile southwest on jeep trail, then 0.65 mile southeast on southeast fork of trail and 0.3 mile upslope, in a southeasterly direction; about 0.15 mile east and 0.45 mile north of the southeast corner of Section 35., T.1N., R.32E., MDBM, Benton NE Quadrangle.

**Range in Characteristics:** Soil depth is 35 to greater than 60 inches. The mean annual soil temperature at 20 inches is about 45°F., and the mean summer and mean winter soil temperatures differ by more than 9°F. The soil moisture control section is 8 to 37 inches. It is usually dry in all parts from early June to mid August, and moist in some or all parts the rest of the year. The textural control section is 10 to 40 inches. It is sandy loam or loam, with 6 to 19 percent clay, and an average

of less than 18 percent. Rock fragments are 30 to 70 percent by volume and average about 59 percent.

Some pedons do not have an O horizon.

The O horizon is 1/2 to 1 inch thick.

The A horizon has dry color of 10YR 6/3 or 6/4; moist color is 10YR 3/3, 4/3 or 4/4. It is sandy loam or loam, with 8 to 19 percent clay. Rock fragments are 25 to 40 percent gravel, 5 to 20 percent cobbles and 0 to 10 percent stones by volume. Effervescence is slight to strong. Reaction is mildly to moderately alkaline (pH 7.8 to 8.0).

The C horizon has dry color of 10YR 7/1, 7/2 or 7/3, or 5Y 8/1; moist color is 10YR 4/3, 4/4 or 5/3, or 2.5Y 4/3 or 5/2, or 5Y 6/2. It is sandy loam or loam, with 6 to 19 percent clay. Rock fragments are 30 to 65 percent gravel, 0 to 5 percent cobbles and 0 to 5 percent stones by volume. Effervesence is strong to violent. Reaction is moderately alkaline (pH 8.0 to 8.2).