

SIGNATURE PAGE

for

RESEARCH NATURAL AREA ESTABLISHMENT

Mud Lake Research Natural Area

Plumas National Forest

Plumas 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 4063.41 5 e (3) in arriving at this recommendation.

Prepared by Todd Keeler-Wolf Date Feb. 21, 1989
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Recommended by Mike Williams Date 3/22/89
Mike Williams, District Ranger, Greenville Ranger District

Recommended by Mary J. Coulombe Date 3/24/89
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Recommended by David M. Jay Date 4-11-89
for - Paul F. Barker, Regional Forester, Region Five

Recommended by Ronald E. Stewart Date 4/18/89
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TITLE PAGE
ESTABLISHMENT RECORD FOR
MUD LAKE RESEARCH NATURAL AREA
WITHIN PLUMAS NATIONAL FOREST
PLUMAS COUNTY, CALIFORNIA

A. INTRODUCTION

The Mud Lake Research Natural Area (MLRNA) lies within the Greenville Ranger District, Plumas National Forest. The stand of Baker cypress (*Cupressus bakeri*)¹ at Mud Lake was first brought to the attention of the Region Five RNA committee in early 1984 following the designation by the Plumas N.F. of a Baker Cypress Special Interest Area in March 1984. An ecological survey of the area was completed in 1985 (Keeler-Wolf 1985). The ecological survey recommended that a second stand of Baker cypress at Wheeler Peak, approximately five miles (8 km) south of Mud Lake also be included within the RNA. The Region Five R.N.A. committee approved the recommendation for both sites.

1) Land Management Planning

The final Land and Resource Management Plan and Environmental Impact Statement for the Plumas N.F. (1988) recommends the establishment of the MLRNA in the preferred management alternative (Appendix 3). The area lies within the Antelope Management Area (Management Area 29).

B. OBJECTIVES

The MLRNA was selected to preserve the two isolated stands of Baker Cypress in Plumas County. This species is considered a special target element by Region Five (Appendix 2).

C. JUSTIFICATION STATEMENT FOR ESTABLISHMENT OF AREA

The two stands of Baker cypress included within the MLRNA are unique for their high elevation, cool montane climate, and for their distance inland from the coast. No other species of cypress in California is known to occur above 6000 ft. (1829 m) and further than 150 miles (241 km) from the Pacific Ocean. These two stands on northerly-facing slopes at or above 6500 ft. (1981 m) approximately 175 miles (282 km) from the ocean are probably subjected to lower temperatures and more snowfall than any other population of cypress in California or the world (Peattie 1953). There is an

¹ In this establishment record all trees are named following Little, E.L. Jr. 1979. Checklist of United States trees (native and naturalized). Agriculture Handbook No. 541. U.S.D.A. Washington D.C.

estimated average of 50-75 inches (127-191 cm) of snow on April 1 (Department of Water Resources 1988), with drifts to at least 6 ft. (1.8 m) deep common in mid-winter.

The cool montane climate and the isolated location of the stands has undoubtedly influenced their genetic composition (Wagener and Quick 1963, Dr. Connie Millar, research geneticist at the U.S.F.S. P.S.W. Forest and Range Experiment Station pers. comm. May 1988). The dark green foliage of these two stands indicates a reduced number of dorsal glands (resin pits) compared to other populations of *Cupressus bakeri*.

The six interior species of cypress in California (*Cupressus bakeri*, *C. macnabiana*, *C. nevadensis*, *C. sargentii*, *C. forbesii*, and *C. stephensonii*) all are strongly aromatic and have small dorsal glands (resin pits) on the scales (Wolf 1948). This suggests that the resin pits and presumably accompanying terpenoid differences confer an advantage in relatively hot, dry habitats away from the more mesic maritime climate generally experienced by all other cypress species in California. The reduction of the resin pits in the Plumas populations further suggests that these structures may be less important because of the locally cool and relatively moist climate.

To date no detailed taxonomic studies of the Plumas County cypress stands have been made. However, Connie Millar, is making an in-depth genetic study of all of the California cypress species and has included these populations in her studies. Wagener and Quick (1963) suggested that the two Plumas populations most closely resemble *C. bakeri* ssp. *matthewsii* (*fide* Wolf 1948). However, this is somewhat puzzling. Subspecies *matthewsii* was described from distant populations in the Siskiyou Mountains and on Goosenest Mountain (near Mt. Shasta) both in Siskiyou County. Two Shasta County populations of ssp. *bakeri* occur between the Mud Lake and the Goosenest Mountain populations, these stands are much closer to the Mud Lake stands, the closest being ca. 76 miles (122 km) northwest of Mud Lake (Griffin and Critchfield 1976).

In addition to Baker cypress, the Mud Lake unit of the MLRNA contains several other plant taxa that are disjunct from their known distributions (see flora section). Thus, the MLRNA may be useful to the study of several

outlier populations.

The southern Wheeler Peak unit of the MLRNA contains the world's largest specimen of Baker Cypress. This individual is 56 inches (142 cm) diameter breast height (dbh) and 71 feet (21.6 m) tall. This specimen occurs in one of several small ridgetop groves, isolated from surrounding mixed conifer forest. In addition to the champion tree several other specimens at the Wheeler Peak stand are over three feet (1 m) dbh (Photos 1 and 2).

The ecological differences between the Mud Lake and the Wheeler Peak stands are significant enough to warrant both to be included within the MLRNA. Mud Lake is the more extensive of the two stands (over 130 acres or 53 ha). It comprises trees up to 100 years old that grew following a fire before the turn of the 20th century. Presently the Mud Lake stands are largely senescent as a result of crowding by shade-tolerant white and red fir (*Abies concolor* and *A. magnifica*, respectively), and lack of recent fire. Competition for light in this dense forest has produced some of the tallest Baker cypress known. Some are slightly over 90 ft. (27 m) tall (photo 3). However, the largest dbh specimens at Mud Lake are only 30 inches (76 cm). The riparian, meadow and lacustrine environments at Mud Lake are also not present at Wheeler Peak and sample a broad range of habitats for the species. The bordering groves of lodgepole pine along the Mud Lake meadows also contain some Baker cypress under what are probably the most mesic conditions for the species. At the base of the eastern ridge of Eisenhower Peak Baker cypress grows at 6940 ft. (2115 m) elevation surrounded by successional mountain chaparral and young white fir - red fir forest. This is the absolute highest elevation known for any *Cupressus* in North America, if not the world.

The Wheeler Peak population, though smaller than the one at Mud Lake (ca. 30 acres or 12 ha), contains distinctly different types of stands. The ridgetop groves not only contain the largest, but probably the oldest specimens of Baker cypress (an estimated 300+ years). These stands are dense and monospecific, with numerous small, even-aged trees interspersed with occasional large, old specimens. They grow on shallow, dry ridgetop volcanic soil, which they appear to tolerate better than any other local tree species. These dense groves are surrounded by largely uncolonized ground and are thus well-protected from fire in the surrounding mixed conifer forest. They may have served as seed sources for younger cypresses that

occupy the northerly-facing slopes below these stands. The lower slope cypresses occur in a mixed conifer forest that is more mature than the Mud Lake forest. This forest has had light selective logging and has a more open canopy than the Mud Lake stands. The cypress trees are scattered throughout the forest in similar densities to those at Mud Lake, but are in less immediate danger of being shaded out by competing species.

D. PRINCIPAL DISTINGUISHING FEATURES

The main feature distinguishing both the Mud Lake and the Wheeler Peak units of the MLRNA is the isolated populations of Baker cypress. They occupy the north- to northeast-facing slopes of ridges vegetated with mixed conifer, white fir, and red fir forest, with a variable mixture of mostly successional montane chaparral. The Wheeler Peak unit is generally more successional advanced than the Mud Lake unit, which was largely engulfed by a crown fire just before the turn of the 20th century. The Baker cypress stands are both monospecific and mixed within the mixed conifer forest at Wheeler Peak, while they are almost entirely intermixed with other conifers at Mud Lake. Baker cypress is considered a plant of limited distribution by the California Native Plant Society (Smith and Berg 1988). The ridgetop flora at Mud Lake and Wheeler Peak contain typical elements of the western Great Basin flora, underscoring the past climatic and geological relationships of this extreme northeastern portion of the Sierran physiographic province to the northern Great Basin. Both units of the MLRNA are underlain by volcanic rock. The Mud Lake unit contains a small shallow lake and associated meadow and riparian plant associations. This lake was glacially carved from the northeast-facing slope of Eisenheimer Peak.

E. LOCATION (reference maps 1, 2 and 3)

1) National Forests Involved

The MLRNA is located on the Plumas National Forest. No other Forest System Lands are involved.

2) Latitude and Longitude

The center of the Mud Lake unit of the RNA is at Latitude 40° 10' 45" North and a Longitude 120° 42' 30" West. The center of the Wheeler Peak unit is at Latitude of 40° 06' North and Longitude of 122° 42' 30" West.

3) Boundary Description

The Mud Lake unit of the RNA falls within portions of Sections 23 and 26 T 27N R 11E Mt. Diablo Base and Meridian. The Wheeler Peak unit lies entirely within Section 23 T26N, R 11E. Mt. Diablo Base and Meridian (MDBM).

The boundaries of the MLRNA are delineated using a combination of topographic and political systems. Following are descriptions of the boundaries of both units:

The southwestern corner of the Mud Lake unit is atop the Eisenhower Peak ridge approximately 0.33 miles (0.53 km) east of the triangulation point atop Eisenhower Peak (7500 ft. or 2286 m). This point lies in the NW 1/4 of Section 26 T27N, R11E MDBM and has an approximate elevation of 7320 ft. (2231 m), distinguishing it as the highest point in the MLRNA. From this point the boundary follows the ridge top in an easterly direction over point 7168 (reference USGS Kettle Rock 7.5 minute quadrangle map) to a point on the ridge approximately 0.2 miles (0.3 km) southeast of point 7168. This point is atop a small rocky prominence that is separated from point 7168 by a small saddle. From this point in the NE 1/4 of Section 26 T 27N, R11E MDBM the boundary follows a bearing due east for 0.33 miles (0.53 km) to a point on the mid-slope between the ridge top and Hungry Creek at an elevation of approximately 6450 ft. (1966 m). This point, representing the southeast corner of the unit, lies approximately 0.15 miles (0.24 km) west of the section line separating sections 25 and 26 T27N, R11E MDBM. From this point the boundary turns due north paralleling the section lines dividing Sections. 25 and 26, and 23 and 24 to a point 0.75 miles (1.2 km) north of the southeast corner. This point, marking the northeast corner lies at an approximate elevation of 6160 ft. (1878 m) and represents the lowest elevation in the Mud Lake unit. It lies in the

southeast 1/4 of sect. 23 T27N, R11E MDBM. From the northeast corner the boundary turns due west for approximately 0.6 miles (0.97 km), crossing the outlet stream from Mud Lake, until the top of a minor ridge is reached. This point in the southwest 1/4 of Sect. 23 T27N, R11E MDBM is at an elevation of approximately 6520 ft. (1987 m). From this point, which represents the northwestern corner of the unit, the boundary turns due south and ascends the slope to approximately the 6640 ft. (2024 m) contour, which lies ca. 50 ft. (15 m) north of the edge of the roadbed of road 27N34, the access road to Mud Lake. This point is approximately 0.2 miles (0.3 km) south of the northwest corner. From here the boundary turns southeast paralleling the road bed 50 ft. (15 m) away from it to the log landing area at the road's end, approximately 0.15 miles (0.24 km) from the last point. From this point in the SW 1/4 of Section 23 T 27N, R11E MDBM the boundary crosses the meadow to the south for approximately 100 yards (91 m) until it ascends the small rise which marks the small lateral moraine northeast of Mud Lake and the stream course. Here the boundary follows the top of the small lateral moraine up-slope to the southwest, ascending the northern slope of Eisenhower Peak in the northwest 1/4 of Section 26 T27N, R11E MDBM. The boundary follows the lateral moraine until it junctures with a more prominent ridgeline, which ascends in a southerly direction to meet the main Eisenhower Peak ridge top at the point of beginning.

The Wheeler Peak unit is bounded on the north and west by road 26N71, on the south by the ridge top, and on the east by a small gully (see Map 3). Starting at the low point where the gully bottom intersects the edge of the roadbed in the northeast 1/4 of Section 23 T26N, R11E MDBM the boundary follows the upper edge of the road bed in a southwesterly direction for approximately 0.6 miles (0.97 km) to a saddle in the northwest 1/4 of Section 23 T26N, R11E MDBM at approximately 6300 ft. (1920 m) elevation. This saddle marks the junction of road 26N71 and an unnumbered spur. At this point the boundary follows the low ridgeline up-slope for approximately 0.17 miles (0.27 km) to its intersection with the main summit ridge. At this point in the southwest 1/4 of Section 23 T26N, R11E MDBM the boundary follows the main ridge line up-slope to the east for approximately 0.6 miles (0.97 km). This point marks the southeastern corner of the unit and lies at an elevation of approximately 6550 ft.

(1996 m). This point lies at the head of the small ravine the bottom of which marks the eastern boundary. The boundary drops into the ravine to the north of this point, following the ravine bottom 0.38 miles (0.61 km) to the northwest until the edge of 26N71 is intersected, marking the point of beginning.

4) Acreage

The acreage for the Mud Lake unit as described above is 307 (124 ha). The acreage for the Wheeler Peak unit as described above is 73 (30 ha). Total acreage for the RNA is thus 380 (154 ha).

5) Elevations

Elevations in the Mud Lake unit range from 6160 ft. (1878 m) to 7320 ft. (2231 m). Elevations in the Wheeler Peak unit range from 6080 ft. (1853 m) to slightly over 6560 ft. (1999 m).

6) Access (reference Map 1)

Both the Wheeler Peak and the Mud Lake units of the MLRNA may be accessed from the town of Greenville by following state Highway 89 south for approximately 6 miles (10 km) to the junction of county road 207, which turns east approximately 5 miles (8 km) to Taylorsville. From Taylorsville one travels north on county road 211 for 1 mile (1.6 km), turns left onto county road 112 for 0.5 miles (1 km), and turns right on county road 214 for 2 miles (3.2 km), thence turning right on Forest Service Road 27N10. From this point it is ca. 8.5 miles (13.7 km) to the gulch at the northeastern corner of the Wheeler Peak unit using the following route: Continue on road 27N10 to Green Flat (ca. 5 miles or 8 km), turn south on road 26N71 and cross Hosselkus Creek, continue up the road for ca. 1 more mile. As of September 1987 the road was only passable by four-wheel drive beyond this point, which corresponds to the northeastern corner of the Wheeler Peak unit. Travel time from Greenville to Wheeler Peak is approximately 1.5 hours.

To access the Mud Lake unit one continues past Green Flat on road 27N10 for approximately 8 miles (12.9 km) to its junction with road 27N09 in

Wilcox Valley. At this point one follows 27N09 for approximately 1.5 miles (2.4 km) to the junction with 27N57. Following this road for approximately 1 mile (1.6 km) one turns east on the logging spur (27N34) that leads to the meadow adjacent to Mud Lake. Travel time to Mud Lake using the previous route is approximately 2 hours. Mud Lake may also be accessed following the North Arm Road north of Taylorsville along Lights Creek (county road 213) and eventually intersecting road 27N09 again in Wilcox Valley. Using this route travel time from Greenville is approximately 1.5 hours. See Map 1 for details.

Foot travel is relatively easy within the small Wheeler Peak unit. Slopes are moderate and the vegetation is typically open. However, on the Mud Lake unit the dense senescent chaparral, at the upper elevations makes access to the highest elevation cypress stands difficult. The dispersed stand at lower elevations is easily accessible through the dense, but passible, forest. The southern (ridgetop) area of the Mud Lake unit is accessible from the road end via a 30 minute walk up the western boundary ridge.

F. AREA BY COVER TYPES (with code numbers)

SAF TYPES (Eyre 1980)	acres	hectares	percent
Red Fir (207)	6	2.4	1.6
White Fir (211)	194	78.5	50.7
Sierra Nevada Mixed Conifer (243)	113	45.7	29.5
Whitebark pine (208 in part)	6	2.4	1.6
unclassified	64	25.9	16.7
totals	383	154.9	100.0

KUCHLER TYPES (Kuchler 1964)			
Red Fir (K-7)	6	2.4	1.6
Mixed Conifer Forest (K-5)	308	124.6	80.4
Chaparral (K-29)	24	9.7	6.3
Great Basin Sagebrush (K-32)	13	5.3	3.4
Lodgepole pine - subalpine forest (K-8)	6	2.4	1.6
unclassified	26	10.5	6.8
totals	383	154.9	100.0

HOLLAND TYPES (Holland 1986)	acres	hectares	percent
Big Sagebrush Scrub (35210)	13	5.3	3.4
Mixed Montane Chaparral (37510)	24	9.7	6.3
Wet Montane Meadow (45110)	1	0.4	0.3
Dry Montane Meadow (45110)	3	1.2	0.8
Montane Freshwater Marsh (52430)	3	1.2	0.8
Aspen Riparian Forest (61520)	1	0.4	0.3
Montane Riparian Scrub (63500)	10	4.1	2.6
Northern Interior Cypress Forest (83220)	9	3.6	2.4
Sierran Mixed Conifer Forest (84230)	113	45.7	29.5
Sierran White Fir (84240)	194	78.5	50.6
Red Fir Forest (85310)	6	2.4	1.6
Lodgepole Pine Forest (86100)	6	2.4	1.6
unclassified	0	0	0
totals	383	154.9	100.0

G. PHYSICAL AND CLIMATIC CONDITIONS

The two MLRNA units lie in the Diamond Mountains area of the extreme northern portion of the Sierra Nevada Province, east of the main Sierra-Cascade Crest. The two units occupy portions of the upper slopes of two of the prominent peaks (Eisenheimer and Wheeler) of the region. The well-known local landmarks of Kettle Rock and Taylor Lake lie between the two sites, which are separated by approximately 5 miles (8 km). Topography ranges from gradual as atop the ridges on both units and in the meadow and lakeside areas at the Mud Lake unit, to steep on the small cirque headwall above Mud Lake. The majority of both areas have slopes averaging between 25° and 35°. Both units occur within the drainage of the North Fork of the Feather River. The Mud Lake site is drained by a tributary of Hungry Creek, while the Wheeler Peak site is drained by Hosselkus Creek.

Long-term precipitation and temperatures can only be estimated for both of the units. The nearest NOAA temperature and precipitation recording station is at Canyon Dam approximately 19 miles (30.5 km) due west of Mud Lake (Latitude 40° 10' N, Longitude 121° 05' W, elevation 4555 ft. or 1388 m). Temperature records have been taken at this station for 60 years and precipitation records for 75 years. The following tables are based on

records summarized between 1941-1970.

Table 1: Monthly average temperatures for Canyon Dam.

	J	F	M	A	M	J	J	A	S	O	N	D	ann. mean
°C	-1.8	-0.1	2.9	7.1	11.1	15.0	19.1	18.2	15.1	9.6	3.3	-0.1	8.3
°F	28.8	31.8	37.3	44.8	51.9	58.2	66.4	64.7	59.2	49.2	38.0	31.8	46.9

Table 2: Monthly average precipitation for Canyon Dam.

	J	F	M	A	M	J	J	A	S	O	N	D	ANN.
mm	179	174	128	72	48	20	5	3	14	58	102	169	975
in.	7.08	6.86	5.06	2.83	1.90	0.80	0.20	0.12	0.54	2.28	4.03	6.67	38.37

The climate of the two MLRNA units at approximately 2000 vertical feet (610 m) higher and 20 miles (32 km) east of Canyon Dam is likely to be very different. According to the isohyets in Rantz (1972), the mean annual precipitation for both units is approximately 40 inches (1016 mm). This average is not substantially different from Canyon Dam. The reason for this is that the MLRNA is in a rain shadow of the main Sierra-Cascade Crest. Approximately 30 miles (48 km) to the west of MLMC at similar elevations on the Cascade crest annual precipitation is upwards of 70 inches (1778 mm). However, much more precipitation falls as snow and snow lingers on the ground for far longer in the winter.

A snow course has been operating at Kettle Rock at 7300 ft. (2225 m) elevation approximately half way between the Wheeler Peak and Mud Lake units (Latitude 40° 08' N, Longitude 120° 43' W) since 1965. Since 1979 there has been an automatic snow sensor operating in conjunction with the traditional snow course. Average April 1 water equivalent for the snow course is 24.2 inches (61 cm) and for the snow sensor the average April 1 water equivalent is 25.5 inches (65 cm) (Department of Water Resources 1988). *Letharia* lichen growth starts approximately 6 ft. (1.8 m) above ground on tree trunks at ca. 6800 ft. (2073 m) at Mud Lake. This is a fair indicator of average winter snow depth. According to Kahr1 (1979) the

average April 1 snow depth in the vicinity of the RNA units is approximately 50-75 inches (127.0-190.5 cm).

According to Major (1977), temperatures at 40° 15' N Latitude are 4° C colder than the average annual temperatures at the same elevations in Yosemite in the central Sierra. Thus, the winter temperatures are definitely colder than most other mountainous parts of California. Mean January temperatures are probably in the range of 25-27°F (-3 to -4°C) with annual minima probably below 5° F (-15°C). Average July temperatures are probably in the range of 59-61°F (15-16°C).

H. DESCRIPTION OF VALUES

1) Flora

The flora of the MLRNA is relatively rich for an area under 400 acres (162 ha) and contains at least 187 taxa of vascular plants (Appendix 1). None of these is considered rare or threatened by the State. However, *Cupressus bakeri* ssp. *bakeri* is considered a plant of limited distribution (California Native Plant Society list 4) by Smith and Berg (1988) and is listed as a special interest species by the Forest (Appendix 3). Several other species are also disjunct in their distribution (Munz 1968). The most significant taxa in this category are transmontane Great Basin species that have not been recorded on the western side of the Sierra-Cascade divide. These include: *Bromus richardsonii* (Richardson's Bromegrass), *Penstemon speciosus* (Showy penstemon), *Thelypodium flexuosum* (Perennial Thelypodium), *Poa nevadensis* (Nevada bluegrass), and *Stipa williamsii* (William's needlegrass). Along with other species typical of the Great Basin already known from the area (e.g. *Penstemon gracilentus* and *Allium platycaule*) these species suggest a previous close relationship between the Great Basin-Modoc Plateau and this part of the northeastern Sierra Nevada Province. The xeric ridgetop flora dominated by such species as *Artemisia tridentata* (big sagebrush), *Purshia tridentata* (bitterbrush), and *Chrysothamnus nausiosus* ssp. *albicaulis* (white-stemmed rabbitbush) is reminiscent of openings in Jeffrey pine (*Pinus jeffreyi*) forest in the western Great Basin.

The following is a brief account of the major vegetation types occurring in the MLRNA. The vegetation maps (Maps 4 and 5) are organized using the system of Holland (1986) with Kuchler (1964) and SAF (Eyre 1980) equivalents indicated on the map's legend. The following accounts are listed in the order they appear in Holland (1986). All scientific names are in accordance with Munz (1968)

a. Big Sagebrush Scrub (35210): This type covers the exposed ridge tops at both the Mud Lake and Wheeler Peak units. The broad ridge tops are underlain with shallow soil and may be peppered with small boulders of lava (photo 4). At Wheeler Peak big sagebrush, and bitterbrush are dominant in a rather sparse cover along with *Ceanothus prostratus*, *Penstemon deustus*, squirreltail (*Sitanion hystrix*), snowberry (*Symphoricarpos vacciniifolia*), *Poa epilis*, mule's ears (*Wyethia mollis*), scarlet gilia (*Ipomopsis aggregata*) and a few stunted Jeffrey pine. At Mud Lake the soil is slightly better developed and consequently the cover of shrubs is somewhat higher. In addition to the two dominants above, white-stemmed rabbitbrush (*Chrysothamnus nausiosus* ssp. *albicaulis*), and *Haplopappus bloomeri* are co-dominants along with several other smaller shrubs and herbs including: the wild buckwheats *Eriogonum umbellatum* var. *umbellatum*, *E. ursinum*, and *E. marifolium*. Other characteristic plants include *Penstemon speciosus*, *P. deustus*, *Crepis occidentalis*, *Wyethia mollis*, *Thelypodium flexuosum*, *Calamagrostis purpurescens*, *Galium grayianum*, *Poa epilis*, *Allium platycaule*, *Brickellia greenei*, *Pellaea breweri*, *Onychium densum*, *Orobanche corymbosa*, *Arabis platysperma*, and *Castilleja applegatei*. Just over the south side of the ridge Jeffrey pine intermixes with this type, forming an open woodland.

b. Mixed Montane Chaparral (37510): Montane chaparral occurs at both Mud Lake and Wheeler Peak. Much more of it occurred at Mud Lake several decades ago (evidenced by senescent and dead shrubs in forest), but due to its largely successional nature, has decreased greatly. The most extensive remaining areas at Mud Lake are on the north side of the ridge extending east from Eisenhower Peak. Here thickets border on the Big sagebrush scrub and are mixed with stands of red and white fir and the uppermost cypress groves. pinemat manzanita (*Arctostaphylos nevadensis*) dominates the rocky margins

while taller species such as tobacco brush (*Ceanothus velutinus*), green-leaf manzanita (*Arctostaphylos patula*), bitter cherry (*Prunus emarginata*), and bush chinquapin (*Chrysolepis sempervirens*) dominate the areas adjacent to successional forest. A similar type of successional chaparral occurs at Wheeler Peak in openings on the north side of the ridge. These openings may have been at least partially created by selective logging practices in 1957-1959.

A semi-climax type of montane chaparral occurs in the upper cirque basin at Mud Lake (photo 5). Here the soil is very thin and rocky and covered with flattened boulders of andesite. Trees are not advancing nearly as fast on this area as in the previous form of chaparral. Pinemat manzanita dominates this type with tobacco brush, mountain whitethorn (*Ceanothus cordulatus*), mountain snowberry (*Symphoricarpos vaccinioides*), mountain maple (*Acer glabrum* ssp. *torreyi*), Sierra coffeeberry (*Rhamnus rubra* ssp. *obtusissima*), white squaw currant (*Ribes cereum*), rose-colored meadow-sweet (*Spiraea densiflora*), and serviceberry (*Amelanchier pallida*). A number of herbs also occur in this form due to the relatively open, yet moist conditions. Eighteen species are listed as typical by Keeler-Wolf (1985) with the most numerous being mountain pride (*Penstemon newberryi*), and mountain pennyroyal (*Monardella odoratissima* ssp. *pallida*).

c. Wet Montane Meadow (45110): Interspersed with riparian shrubs and trees along the outlet from Mud Lake and along its shores are small areas of wet meadow vegetation. These areas are too small to indicate on the vegetation map. They include numerous species such as *Glyceria elata*, *Carex heteroneura*, *Mimulus primuloides*, *Sisyrinchium idahoense*, *Viola macclloskeyi*, *Danthonia intermedia*, *Puccinella pauciflora*, and *Agrostis variabilis*.

d. Dry Montane Meadow (45120): This meadow type, which dries appreciably by mid-summer, is more extensive than the previous type. About 20 species are listed as being characteristic of this association by Keeler-Wolf (1985). Among them are: *Calamagrostis inexpansa*, *Phleum pratense*, *Agrostis thurberiana*, *A. diegoensis*, *A. idahoensis*, *Sidalcea oregona* ssp. *spicata*, *Deschampsia elongata*, *D. caespitosa*, *Juncus xiphioides*, *J. nevadensis*, *J. tenuis* var. *congestus*, *Perideridia*

gairdneri, *Carex jonesii*, *Achillea lanulosa*, and *Trisetum spicatum*.

e. Montane Freshwater Marsh (52430): This type occurs in Mud Lake itself (Photo 6). It is represented by shallow-rooted hydrophytes and floating leaved hydrophytes including *Sparganium multipedunculatum*, *Potamogeton natans*, and *Carex rostrata*. The latter species forms a dense band around the lake, while the former two are scattered in the shallow, open water.

f. Aspen Riparian Forest (61520): This type is limited to a few acres along the outlet stream from Mud Lake. It is not well-developed, with only scattered moderate-sized aspen trees. It is closely associated with the meadow and the montane riparian thicket communities and is not mapped because of its small extent.

g. Montane Riparian Scrub (63500): This association occurs along the edges of Mud Lake, in several small seepy areas surrounded by forest, and sporadically along the outlet stream from Mud Lake. It may be dominated by the willows *Salix ligulifolia*, *S. pseudocordata*, and *S. drummondiana* var. *subcoerulea*, or in somewhat shadier locations by mountain alder (*Alnus tenuifolia*). The herbaceous understory of this type is typically well-developed and includes such species as: *Mertensia ciliata*, *Bromus marginatus*, *Elymus glaucus*, *Cirsium andersonii*, *Aster occidentalis*, *A. integrifolius*, and *Senecio triangularis*. In the ecological survey (Keeler-Wolf 1985) this type was included with the aspen riparian forest.

h. Northern Interior Cypress Forest (83220): This classification only covers a small portion of the vegetation containing Baker cypress (see Maps 6 and 7). Large areas at the Mud Lake unit have only scattered cypresses and are better treated as mixed conifer or white fir forest. Only the few pure upper elevation stands at both Mud Lake and the more extensive groves bordering the ridge top at Wheeler Peak may be classified as this type. At Mud Lake this type is limited to the interface area between successional montane chaparral and young encroaching fir forest. Here the trees are crowded and spindly (photo 7). Some may be only a few inches dbh, but are over 80 years old (photo 8). As the surrounding firs continue to grow these groves will be shaded out and die. In contrast, the long-established groves near

the ridge top at Wheeler Peak are not in imminent danger of senescence. They appear to be healthy, though some may be quite dense. They are exposed to more sun and much less competition as a result of their positions adjacent to the largely uncolonized ridgetop scabland (photo 9). Due to the typical high density and duff accumulation, the understory vegetation of this type is poorly developed.

i. Sierran Mixed Conifer Forest (84230): The majority of the mature forest at both Mud Lake and Wheeler Peak may be classified as this type. White fir (*Abies concolor*) is probably the universal dominant, however there are significant admixtures of sugar pine (*Pinus lambertiana*), Jeffrey pine, and incense-cedar (*Libocedrus decurrens*) at both sites. At Wheeler Peak Douglas-fir (*Pseudotsuga menziesii*) is an important codominant, while at the higher elevation Mud Lake unit red fir (*Abies magnifica*) is important. The understory is variable, with montane chaparral shrubs dominating in openings, while only scattered herbaceous species such as *Chimaphila umbellata*, *C. menziesii*, *Pyrola picta*, and *Coralorrhiza maculata* occur in the densest phases.

j. Sierran White Fir Forest (84240): Most of the forest that burned ca. 100 years ago at Mud Lake may be considered this type. At present the trees average only ca. 6 inches (15 cm) dbh, although some are as much as 20 inches (51 cm) dbh. Canopy height is 90-100 ft (27-30 m) in the areas with deeper soil. Tree density is high (334/0.1 ha) with white fir accounting for 77% of the stems. Basal area cover is correspondingly low, averaging $7.7 \text{ m}^2/0.1 \text{ ha}$, with white fir accounting for 69% of the total. Baker cypress is the major subdominant in this forest at Mud Lake accounting for 16% of the stems and 20% of the cover. Other species of lesser importance include red fir, Jeffrey pine, and *Salix scouleriana*. The understory vegetation is poorly developed.

k. Red Fir Forest (85310): This forest occurs locally near the head of the Mud Lake cirque at elevations above 7000 ft. (2134 m). It is associated with the semi-climax form of montane chaparral and does not form closed ranks, typical of more extensive stands to the west on

the upper north-facing slopes of Eisenhower Peak. Some of the successional forest above 6800 ft. (2073 m) in the SE 1/4 of Section 23 T 27N, R11E MDBM may also be considered this type, although there is usually a significant amount of *A. concolor* and *C. bakeri* intermixed.

1. Lodgepole Pine Forest (86100): This type is also limited in extent, and forms an intermittent border lying between the white fir and the riparian scrub, aspen, and meadow communities along the outlet stream below Mud Lake. Lodgepole pine (*Pinus contorta* ssp. *murrayana*) dominates with occasional individuals of aspen, red fir, white fir, and Jeffrey pine intermixed. Occasional individuals of Baker cypress occur in these groves and include some of the largest specimens at the Mud Lake unit (up to 30 inches or 76 cm dbh). The understory is shady and mesic and contains some of the more shade-tolerant species of the riparian and meadow associations.

2) Fauna

The fauna of the MLRNA is typical of montane California. No endangered or threatened species are known from the area. Pileated woodpeckers (*Dryocopus pileatus*) have been seen in the area and evidence of their presence is common (photo 10). Black bear (*Ursus americanus*) have also been seen in the area as have blue grouse (*Dendragapus obscurus*). A large population of Pacific tree frogs (*Hyla regilla*) occupies the shallow water and bordering vegetation at Mud Lake. A spotted owl territory (Forest Sensitive species) is present near the Wheeler Peak unit, but not within the unit (Appendix 3). The mature logged mixed conifer forest at Wheeler Peak may provide marginal foraging habitat for spotted owl. Several Forest Sensitive goshawk (*Accipiter gentilis*) territories are known from the Antelope Management Unit (Appendix 3). It is likely that this species forages within at least the Mud Lake unit at times.

3) Geology

Both units are underlain by Tertiary volcanic rocks. The Mud Lake Unit appears to be underlain largely by Penman Formation andesite (Durrell

1966). The flattened gray blocky boulders at the head of the Mud Lake cirque are typical of the Penman andesite, which was extruded in the Pliocene. According to Denny Churchill, soils scientist on the Plumas N.F. the Mud Lake unit may also contain some andesite from the Ingalls formation (pers. comm. August 1988). The Ingalls formation is a typically dark colored rock, probably Oligocene in age.

The Wheeler Peak unit also is underlain in part by andesite, primarily at the lower elevations near the road. This may be Penman or Ingalls formation. It is typically gray, peppered with hornblende. The scabland at the summit of the ridge is capped with a mudflow breccia containing basaltic lava (perhaps from the Eocene Lovejoy formation, which originated in western Nevada), rhyolite, some andesite, and some rounded pebbles of Eocene non-marine sediments (chert and limestone, primarily). This aggregation of rocks was swept along as a pyroclastic flow and probably is best considered as part of the Delleker or Bonta formations of Miocene age (*vide* Durrell 1966).

A small glacier evidently existed at Mud Lake in the Pleistocene. The resulting cirque is small and ice was probably no thicker than 300 feet (91 m) during the glacial maximum. A small lateral moraine forms the west side of the Mud Lake basin and part of the unit boundary. The lowest extent of the ice probably did not reach more than 400 yards (366 m) below the present outlet of Mud Lake.

4) Soils

An unpublished order three soils survey is available for the entire Plumas N.F. (Denny Churchill, Greenville R.D., pers. comm. May 1988). The soils underlying the Mud Lake unit are all of one complex and hence no soil map is included in this report. They consist of the Inville-Woodseye-Goodlow complex. This is derived from andesitic tuff with some greenstones and basalt. The Inville makes up 45% of the complex with the Woodseye comprising 25% and the Goodlow 20%. The Goodlow is a moderately deep soil that is the wettest type of the three families. It is likely to occur in the Mud Lake basin. The Woodseye is the most shallow of the three families in the complex and probably is represented on the steeper upper slopes and ridges. Inville probably underlies the majority of the Baker cypress forest.

The Wheeler Peak unit is also underlain entirely by one complex and thus is also not mapped here. It is covered by the Inville-Woodseye complex, similar to the previous complex, but without the wetter Goodlow soils present. The Woodseye family is probably present on the summit and upper slopes of the ridge, while the Inville family probably covers the majority of the lower north-facing slopes.

5) Lands

All lands within both units of the MLRNA are Plumas National Forest-controlled. No private inholdings are involved.

6) Cultural

The area was part of the Maidu Nation in the recent past (Riddell 1978). Because of the relatively high elevations and lack of important staple foods, the areas were probably only sporadically visited as hunting grounds and gathering areas for conifer seeds and manzanita berries in the summer months. There are no signs of Indian habitation or use at either of the units.

7) Other

No other significant natural features are present in the MLRNA.

I. IMPACTS AND POSSIBLE CONFLICTS

1) Mineral Resources

There are no known mineral deposits within either of the two units of the MLRNA. The volcanic rocks present are not known to contain any economically valuable resources and there is no evidence of former claims within or adjacent to the two units. Thus, there should be no conflicts with the withdrawal of the area from mineral entry following its establishment.

2) Grazing

According to records on file at the Plumas S.O., there is no current grazing at either unit. However, the Mud Lake unit is on the Taylor Lake allotment which has been in use sporadically since 1910. Peak use was in 1916 when 5700 head of sheep were allowed to graze between June 11 and October 20. The Taylor Lake allotment is not currently in use. The last permitted use was in 1978. It has been recommended in the draft forest plan that the allotment be eliminated (Bill Lachenmyer, Plumas S.O., pers. comm., September 1987). In the summer of 1987 there was some evidence of recent cattle grazing in the meadow area below the log landing at the end of the road. Whether these cattle were run illegally or were in trespass from an adjacent allotment is not known. At present grazing presents little threat to the vegetation. There is no current special management concern relating to grazing. Nonetheless, the area should be sporadically visited and monitored for illegal grazing use. If future use appears to be negatively impacting the meadow and riparian area, fencing and/or removal of animals will be necessary.

3) Timber

Timber values for the Mud lake and Wheeler Peak units are low (Dennis Clemens, Greenville R.D. pers. comm. May 1988). The past fire of ca. 1890 resulted in overly dense and low-productivity white fir-dominated stands at Mud Lake. The small areas of mature mixed conifer forest surrounding the old burn have largely been logged. Apparently a large portion of the northern and western boundary areas of the Mud Lake unit was logged in 1970. An additional sale (The Policy Sale) was conducted in 1986 up to the northern border of the area. At Wheeler Peak, the mature Sierran mixed conifer forest was lightly selectively logged between 1957 and 1959. The small area covered by mature mixed conifer forest at both sites means that little economic value will be foregone with the exclusion of the RNA from timber harvesting practices.

4) Watershed Values

According to the soil scientist on the forest (Denny Churchill pers. comm. May 1988) the soils of the two units are moderately erosive. The present high cover of vegetation on the majority of the area and its moderately sloping nature suggest that erosion hazard will remain low as long as

vegetation cover remains. Mud Lake is the only source of permanent water in the RNA. An intermittent stream and several small seeps also occur in the Mud Lake unit. The gully forming the eastern boundary of the Wheeler Peak unit channels water only during runoff periods.

5) Recreation Values

Neither unit has important recreation value. Mud Lake, by virtue of its small size and shallow water is not suitable for fish stocking. The poor road and lack of water on the Wheeler Peak unit preclude recreational interest. Hunting season in late September through October is likely to be the principal time when these sites are visited. There is no evidence of ORV use, camping, or litter at either unit. There will be minimal impact on the recreational use of the site following establishment.

6) Wildlife and Plant Values

The undeveloped and largely pristine nature of the MLRNA enhances the values for wildlife and plant protection. The most significant species in the area is Baker cypress. It's persistence and continued importance in the area will rest in large part on a program of encouragement of fire (see vegetation management).

7) Wilderness et al.

The MLRNA does not occur within or adjacent to any Wilderness or roadless areas. Thus, there will be no conflicting impact with any congressionally designated areas.

8) Transportation Plans

Neither unit of the MLRNA will have any effect on current or proposed transportation systems on the Plumas National Forest.

J. MANAGEMENT PRESCRIPTION

The primary management concern with the MLRNA is the maintenance of healthy and viable populations of Baker Cypress at both units. The standard

practice of posting signs at regular intervals along the road forming the northern and western boundary of the Wheeler Peak unit and along the portion of the Mud Lake access road adjacent to the RNA. Additional signing should be placed at other accessible points along the unit boundaries. These signs should indicate the area as an RNA and list the restrictions on camping, woodcutting, removal of natural features, and vehicle entry.

1) Vegetation Management

Reproduction of Baker cypress is enhanced by fire (Vogl et al 1977). The lack of fire for at least 90 years at Mud Lake has allowed the dense thickets of shade-tolerant firs to crowd-out the cypress. In many areas a large accumulation of dead cypress stems litters the forest floor (Figure 11). The only areas where cypress is reproducing are in the recently logged portions adjacent to the main stand (at an elevation of ca. 6200 ft., or 1890 m, in the SE 1/4 of Section 23, and at ca. 6600 ft., or 2012 m, in the SW 1/4 of Section 23, see Map 2). Several seedlings less than five years old have been seen there (Figure 12). Although disturbance by logging practices may produce a few seedlings, only fire can be expected to successfully rejuvenate the stands in a natural manner. Despite the open area of largely mineral soil around the groves near the ridge top at Wheeler Peak, there are no recent seedlings or saplings associated with them.

Clearly, at the Mud Lake site, there is little chance for this species to maintain its population level as the surrounding coniferous forest continues to mature. While the Wheeler Peak stands are substantially less in danger of overcrowding and shading-out, they, too, will eventually need rejuvenation by fire.

A program of prescribed fire will be initiated immediately upon designation. This will focus on the Mud Lake stands first, because of their more advanced senescent nature.

The continuous dense white fir forest at Mud Lake presents some serious logistical concerns for controlled burning. Wind and fuel conditions will need to be carefully monitored. The tall cypress trees typical of the dispersed stands within the white fir forest will need to be subjected to

enough heat to open their cones. At the same time the surrounding dense forest of white fir needs to be largely removed to provide enough light for germination and growth of the cypress seedlings. The crown damage necessary for cone opening requires careful preparation to keep the burn in control.

Small areas will be burned at first. These areas can be bounded, in part, by up-slope rock outcrops as at the upper stands in the NE 1/4 of Section 23 T27 N, R11 E. They may also be bounded by low hazard intervening riparian and meadow areas as along the outlet stream to Mud Lake and adjacent to several isolated mountain alder thickets in the west-central portion of the unit. Experimentation will be done with fire intensity so that optimum conditions of germination for the species will be attained. Observation of, and reproduction of conditions at the recent wildfire that engulfed the Timbered Crater stand of Baker cypress in NE Shasta County might be useful in this regard. Numerous seedlings have sprouted there in the years following the fire (Connie Millar, pers. comm. May 1988). The stands of Baker cypress in the Siskiyou Mountains near Happy Camp that were burned in the intense fire of September 1987 (Julie Knorr, botanist, Klamath N.F. pers. comm. Sept. 1988) should also be observed for seedling densities and survival.

A large area of the northern and eastern portions of the dispersed cypress population are covered with a virtually continuous canopy. Here it may be necessary to clear small fuel breaks prior to burning. This would involve cutting and clearing swaths of trees and shrubs several yards wide. Some of this manipulation may be possible outside of the RNA, as along the recently logged portion of the northern boundary.

Clearly, manipulation will be a continuing factor in this area and the practice of cutting and thinning within an RNA may indeed be necessary to initiate safe burns in some portions of the Mud Lake unit. It may be determined that some of the most logistically difficult portions of the Mud Lake unit are virtually impossible to burn safely. In this case a let-burn policy should be enacted, should a natural fire enter the area.

The Wheeler Peak unit will be more easily managed. Although fire will be necessary here as well, its use will not be as imminent as at Mud Lake. The dispersed stand of cypress within the mixed conifer forest at

Wheeler Peak is surrounded by a more open, mature forest. The relatively low stature of the cypress at this locale may allow portions of it to be burned without endangering the canopy of dominant conifers. The burns on isolated upper slope stands can be controlled. Needless to say, if at all possible, a let-burn policy should be in effect at this unit.

Due to the intensely managed land surrounding the two units, buffer areas will be small to non-existent (see boundary description). This should be of little consequence at the Wheeler Peak unit and most of the Mud Lake unit because the majority of the land managed for timber lies downslope from the units. However, the western lobe of the Mud Lake unit that lies below road 27N34 (SE 1/4 Section 23 T27N R11E) may be affected by up-slope logging or alteration of said roadbed. If future management of this area is called for, all attempts will be made to not impact the part of the RNA lying downslope.

K. ADMINISTRATION RECORDS AND PROTECTION

The official responsibility for administration and protection of the RNA is with the District Ranger, Greenville Ranger District, P.O. Box 329 Greenville, California 95947. Attention will be given to the management through prescribed burning of the Baker cypress stands. An expert in prescribed burning shall write the prescription for the areas and head the execution of the burns. Reproduction after the fires will be carefully monitored.

L. ARCHIVING

The research coordinator is the Director, Pacific Southwest Forest and Range Experiment Station, 1960 Addison St., Box 245 Berkeley, California 94701. This person is responsible for coordinating research in the area, maintaining a file of research data, and curating herbarium and species samples collected in the area. Plant specimens will be stored primarily at the Jepson Herbarium, University of California, Berkeley, and the Institute of Forest Genetics, Placerville, California.

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APPENDIX 1
LIST OF VASCULAR PLANTS
FROM MUD LAKE RESEARCH NATURAL AREA

This following list has been excerpted from the ecological survey of Keeler-Wolf (1985). All scientific names are in accordance with Munz (1968). A few additional taxa were recorded for the area during the field reconnaissance for this Establishment Record in September 1987. These are listed immediately below.

Arenaria macrophylla; occasional understory of mature mixed conifer forest

Smilacina racemosa ssp. *amplexicaulis*; mixed conifer Wheeler Peak

Calochortus sp.; sagebrush scrub Wheeler Peak

Senecio integerrimus; mixed conifer forest Wheeler Peak

Erysimum capitatum; mixed conifer forest Wheeler Peak

Habenaria dilitata var. *leucostachys*; seep at Mud Lake

APPENDIX; VASCULAR PLANT LIST

This list of 181 taxa includes all species seen by me on August 30-31 and September 5-7, 1984. Taxonomy follows Munz (1968). Letter codes following the species indicate habitat types as follows:

mcf.....mixed conifer forest
 smc.....successional montane chaparral
 scmc.....semi-climax montane chaparral
 a.....aquatic association
 m.....meadow associations
 sr.....Salix riparian
 ar.....aspen riparian
 rbf.....riparian border forest
 rss.....ridgetop sagebrush scrub

Pteridaceae:

Pteridium aquilinum var. *pubescens*; ar, rbf, m

Cheilanthes gracillima; scmc

Onychium densum; scms, rss

Pinaceae:

Abies concolor; mcf, smc, rbf

A. magnifica; mcf, rbf, smc

Pinus lambertiana; mcf

P. murrayana; rbf

P. jeffreyi; mcf, smc, rbf, rss

Pseudotsuga menziesii; mcf (Wheeler Pk.)

Cupressaceae:

Calocedrus decurrens; mcf, smc

Cupressus bakeri; mcf, smc

Ranunculaceae:

Delphinium nuttallianum; sr, ar

Thalictrum fendleri; scmc, m, ar

Malvaceae:

Sidalcea oregana ssp. *spicata*; m

Linaceae:

Linum lewisii; scmc

Violaceae:

Viola purpurea; mcf

V. macloskeyi; sr

Hypericaceae:

Hypericum anagalloides; m

Fumariaceae:

Dicentra formosa; scmc

Cruciferae:

Thelypodium flexuosum; rss

Barbarea orthoceras; ar, m

Arabis holboellii var. *retrofracta*; mcf, smc

A. platysperma; rss

Caryophyllaceae:

Sagina saginioides var. *hesperia*; m, sr

Silene montana; scmc, rss

Polygonaceae:

Eriogonum umbellatum; scmc, rss

E. mariifolium; scmc, rss

E. ursinum; rss

Polygonum davisiae; rss

Ericaceae:

Arctostaphylos nevadensis; scmc, smc, mcf

A. patula, scmc, smc, mcf

Pyrolaceae:

Pyrola picta; mcf

P. picta ssp. *integra*; mcf

Chimaphila menziesii, mcf

C. umbellata var. *occidentalis*; mcf

Pterospora andromedea; mcf

Sarcodes sanguinea; mcf

Apocynaceae:

Apocynum pumilum; scmc, scmc

Convolvulaceae:

Calystegia malacophyllus; smc, mcf

Polemoniaceae:

Ipomopsis aggregata; mcf, rss (Wheeler Pk.)

Linanthus ciliatus; rss, (Wheeler Pk.)

Hydrophyllaceae:

Phacelia mutabilis; mcf

Boraginaceae:

Mertensia ciliata; ar

Hackelia californica; mcf

Scrophulariaceae:

Mimulus primuloides; m

M. floribundus; sr

M. guttatus; m, sr

Verbascum thapsus, m, mcf

Penstemon deustus; rss

P. speciosus; rss

P. gracilentus; mcf, smc, rss

P. newberryi; scmc

Collinsia torreyi; mcf

Pedicularis semibarbata; mcf, smc

Orthocarpus copelandii var. *cryptanthus*; rss

Castilleja applegatei; scmc, rss

Orobanchaceae:

Orobanche corymbosa; rss

Labiatae:

Agastache urticifolia; scmc

Stachys rigida ssp. *rivularis*; ar, m

Monardella odoratissima ssp. *pallida*; mcf, rss, scmc

Saxifragaceae:

Ribes cereum; mcf, scmc, rss

R. viscosissimum; mcf

R. roezlii; mcf, smc

R. nevadense; mcf (Wheeler Pk.)

Rosaceae:

Spiraea densiflora; scmc

Potentilla glandulosa ssp. *nevadensis*; m, ar

Fragaria californica; rbf

Purshia tridentata; rss

Rubus parviflorus; ar

Prunus emarginata; smc, scmc

Amelanchier pallida; mcf, scmc

Leguminosae:

Lupinus sp. (*albicaulis*?); rss, mcf

Trifolium variegatum var. *pauciflorum*; m

Betulaceae:

Alnus tenuifolia; sr

Fagaceae:

Chrysolepis sempervirens; smc, scmc

Salicaceae:

Populus tremuloides var. *aurea*; ar

Salix ligulifolia; sr

S. pseudocordata; sr, ar

S. drummondiana ssp. *subcoerulea*; ar, sr

S. scouleriana; mcf, rbf

Onagraceae:

Epilobium angustifolium; scmc

E. brevistylum(?) m

E. adenocaulon; sr

Gayophytum diffusum ssp. *parviflorum*; scmc, rss

Rhamnaceae:

Rhamnus rubra ssp. *obtusissima*; scmc

Ceanothus velutinus; smc, scmc, mcf

Ceanothus prostratus; mcf, rss, scmc

C. cordulatus; mcf, scmc

Loranthaceae:

Arceuthobium campylopodium; mcf

Aceraceae:

Acer glabrum var. *torreyi*; scmc

Umbelliferae:

Sanicula graveolens; mcf, rss

Osmorhiza occidentalis; scmc

Perideridia gaidneri; m

P. parishii; m, rss

Angelica breweri; scmc

Cornaceae:

Cornus stolonifera; sr

Rubiaceae:

Galium grayanum; rss

Kelloggia galioides; mcf, scmc

Caprifoliaceae:

Sambucus caerulea; scmc

Symphoricarpos acutus; mcf, scmc

S. vaccinoides; rss, mcf, scmc

Compositae:

- Madia glomerata*; m
Cirsium vulgare; smc, mcf
C. arvense; smc, mcf
C. andersonii; ar, mcf
Stephanomeria lactucina; mcf
Tragopogon porrifolius; m
Chrysopsis breweri; mcf, scmc
^e*Hiracium* _A *albiflorum*; mcf
Wyethia mollis; m, scmc, rss
Artemisia douglasiana; m, scmc
A. tridentata; rss
Aster occidentalis; m, ar
A. occidentalis var. *intermedius*; ar
A. integrifolius; m, ar
Erigeron inornatus; smc, mcf, scmc
Eupatorium occidentale; scmc
Crepis occidentalis; rss
Haplopappus bloomeri; rss
Chrysothamnus nauseosus var. *albicaulis* rss
Balsamorhiza deltoidea; rss
Brickellia greenei; rss
Gnaphalium thermale; m
Achillea lanulosa; m, rbf
Senecio triangularis; sr

Potamogetonaceae:

Potamogeton natans; a

Liliaceae:

Smilacina stellata; ar

Zigadenus paniculatus; rss

Veratrum californicum; m, sr

Fritillaria recurva; rss

Lilium washingtonianum; mcf

L. kelleyanum; sr

Sparganiaceae:

Sparganium angustifolium; a

Amaryllidaceae:

Allium validum; sr

A. campanulatum; mcf, scmc

A. platycaule; rss

Iridaceae:

Sisyrinchium idahoense; m

Orchidaceae:

Habenaria elegans; mcf

Corallorhiza maculata; mcf

Juncaceae:

Juncus xiphioides; m
J. nevadensis; m
J. tenuis var. *congestus*; m
J. balticus; m
J. longistylis; m
Luzula comosa; m, rbf

Cyperaceae:

Carex sp. (dry adapted Wheeler Pk.)
C. stipata; m, rbf (above listed elevation)
C. jonesii; m
C. heteroneura; m, scmc
C. aquatalis; m
C. gymnoclada; m, a
C. rostrata; a

Gramineae:

Bromus marginatus; mcf, m
B. richardsonii; m, rbf
Puccinella pauciflora; m, a
Glyceria elata; m
Poa pratensis; m
P. nevadensis; m
P. epilis; rss
Dactylis glomerata; m
Elymus glaucus; ar, mcf
Sitanion hystrix var. *californica*; rss, scmc

Hordeum brachyantherum; m
Koeleria cristata; rss
Trisetum spicatum; m
Deschampsia elongata; m
D. caespitosa; m
Danthonia intermedia; m
Calamagrostis purpurascens; rss
C. inexpansa; m
Agrostis thurberiana; m
A. diegoensis; m, sr
A. variabilis; m
A. idahoensis; m
Phleum pratense; m
Muhlenbergia filiformis; m
Stipa williamsii; m, rbf

Display of the "target" research natural area system for the California Region

MAJOR ELEMENTS	NOTES	CHARACTERISTIC SPECIES	PHYSIOGRAPHIC PROVINCES									
			1	2	3	4a	4b	5a	5b	7a	7b	8a
Forest Elements												
Aspen	SAP 217	Populus tremuloides									X	X
California Black Oak	SAP 246	Quercus kelloggii		X					X		X	X
Bristlecone Pine	SAP 209	Pinus aristata (P. longaeva)						X				
Douglas-Fir - Western hemlock	SAP 230	Pseudotsuga menziesii, Tsuga heterophylla	X						X			
Interior Ponderosa Pine	SAP 237	Pinus ponderosa, Artemisia tridentata, Purshia tridentata			X						X	
Jeffrey Pine	SAP 247	Pinus jeffreyi			X		X				X	X
Knobcone Pine	SAP 248	Pinus attenuata	X	X					X	X		
Limber Pine	SAP 219	Pinus flexilis						X				
Lodgepole Pine	SAP 218	Pinus contortat app. murrayana						X				
Sierra Nevada Mixed Conifer	SAP 243	Pinus ponderosa, P. lambertiana, Abies concolor, Calocedrus decurrens Pseudotsuga menziesii	X	X							X	
Douglas-fir - Tanoak - Pacific Madrone	SAP 234	Lithocarpus densiflorus, Arbutus menziesii	X						X	X		
Mountain Hemlock	-	Tsuga mertensiana									X	
Pacific Douglas-fir	SAP 229	Pseudotsuga menziesii	X						X			
Pacific Ponderosa Pine	SAP 245	Pinus ponderosa, Quercus kelloggii, Chamaebatia foliolosa, Arctostaphylos spp.									X	X
Ponderosa Pine - Douglas-Fir	SAP 244	Pinus ponderosa, Pseudotsuga menziesii	X	X					X		X	
Port Orford-cedar	SAP 231	Chamaecyparis lawsoniana	X									
Red fir	SAP 207	Abies magnifica (including var. shastensis)	X	X							X	X
Redwood	SAP 232	Sequoia sempervirens							X	X		
Sugar Pine-White Fir	-	Pinus lambertiana, Abies concolor									X	
White Fir	SAP 211	Abies concolor	X	X						X	X	X
Woodland Elements												
Black Cottonwood-Willow	SAP 222	Populus trichocarpa, Salix spp.	X						X			
Blue Oak-Digger Pine	SAP 250	Quercus douglasii, Pinus sabiniana		X							X	X
California Coast Live Oak	SAP 255	Quercus agrifolia										X
Engelmann Oak	-	Quercus engelmannii										
Foothill Woodland	K-26	Quercus spp., annual grass spp.	X						X	X	X	X
Oregon White Oak	SAP 233	Quercus garryana							X			
Pinyon-Juniper	SAP 239	Pinus monophylla, Juniperus osteosperma							X			X
Western Juniper	SAP 238	Juniperus occidentalis			X							

MAJOR ELEMENTS	NOTES	CHARACTERISTIC SPECIES	PHYSIOGRAPHIC PROVINCES									
			1	2	3	4a	4b	5a	5b	7a	7b	8a
Scrub and Chaparral Elements												
Chamise Chaparral	K-29	Adenostema fasciculatum, Arctostaphylos spp., Ceanothus spp.						X			X	X
Coastal Sage	K-30	Artemisia californica, Salvia spp., Eriogonum fasciculatum							X			X
Coulter Pine-Chaparral		Pinus coulteri, Quercus spp., chaparral species							X			X
Montane Chaparral	K-31	Quercus, Ceanothus, Arctostaphylos, Castanopsis	X								X	X
Mountain Mahogany		Cercocarpus spp.										X
Serpentine Chaparral		Quercus durata, Ceanothus jepsonii, Arctostaphylos viscida, viscida, Heteromeles arbutifolia						X				
Grassland and Meadow Elements												
Alpine Meadow		Carex spp., Centiana spp.										X
Fescue-Oatgrass	K-40	Festuca idahoensis, Danthonia californica						X	X			
Montane Wet Meadow		Carex spp., Juncus spp., Camassia sp., Veratrum sp.										X
Subalpine Wet Meadow		Carex spp., Centiana spp., Deschampsia spp.										X
Marsh and Bog Elements												
Darlington Bog		Darlingtonia californica	X								X	
Moss Bog		Sphagnum spp.	X						X		X	
(Special Elements)												
Alpine Fellfields		Cushion plants, forbs, and dwarf shrubs	X					X				X
Bigcone Douglas-Fir		Pseudotsuga macrocarpa								X		X
Brewer Spruce		Picea breweriana	X									
Cuyamaca Cypress		Cupressus arizonica var. stephensonii										
Enriched Conifer		Numerous coniferous species in association	X									
Foxtail Pine		Pinus balfouriana	X									X
MacNab Cypress		Cupressus macnabiana		X					X		X	
Modoc Cypress		Cupressus bakeri	X	X	X						X	
Parry Pinyon		Pinus quadrifolia										
Piute Cypress		Cupressus arizonica var. nevadensis										X
Santa Lucia Fir		Abies bracteata								X		
Sargent Cypress		Cupressus sargentii										X
Sierra Redwood (Giant Sequoia)		Sequoiadendron gigantea									X	X
Tecate Cypress		Cupressus guadalupensis (Syn. C. forbesii)										
Washoe Pine		Pinus washoensis										X
Other Unique Ecosystems		Determined case by case	X	X	X	X	X	X	X	X	X	X