SIGNATURE PAGE
For
RESEARCH NATURAL AREA ESTABLISHMENT RECORD

Antelope Creek Lakes Research Natural Area

Klamath National Forest

Siskiyou 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 _____ Date_____
Sheauchi Cheng, Ecologist
Pacific Southwest Research Station

Recommended by _____ Date_____
Laura Allen, District Ranger
Goosenest Ranger District

Recommended by _____ Date_____
Margaret J. Boland, Forest Supervisor
Klamath National Forest

Recommended by _____ Date_____
James R. Sedell, Station Director
Pacific Southwest Research Station

Recommended by _____ Date_____
Jack Blackwell, Regional Forester
Pacific Southwest Region

TITLE PAGE

Establishment Record for

Antelope Creek Lakes Research Natural Area

within the Klamath National Forest

Shasta County, California

Antelope Creek Lakes Research Natural Area

MAPS

Map 1: Boundaries
Map 2: Access and Location
Map 3: Vegetation
Map 4: Soils

A. INTRODUCTION

The Research Natural Area (RNA) system is a nation-wide network of permanently protected areas to represent widespread and unique ecosystem types for the purposes of maintaining biological diversity, research, monitoring, and fostering education. Only non-manipulative research, observation, and study are allowed in the RNA. There are more than 300 RNAs already established in the nation.

Forest Service's RNA system in California is intended to accurately reflect the natural diversity of vegetation types on California Forest Service lands and leads to the long term study of each. The selection of candidate RNAs is based on the identification of "target elements", which include plant communities described in various ecological reference works, such as California Flora (Munz 1968), Society of American Foresters' (SAF) forest cover type (Eyre 1980), Terrestrial Natural Communities of California (Holland 1986), and California Native Plant Society's (CNPS) California vegetation type (Sawyer and Keeler-Wolf 1995), and unique ecosystems, such as geologically unusual or aquatic areas.

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

The Antelope Creek Lakes Research Natural Area (ACLRNA) is located on the Goosenest Ranger District, Klamath National Forest and lies adjacent to the Shasta-Trinity National Forests. It is approximately 12 miles (19 km) northeast of the summit of Mt. Shasta, 20 miles (32 km) east of Weed, and 24 miles (39 km) south of Macdoel in Siskiyou County, California.

The entire Section 20 T42N, R1W, Mount Diablo Base and Meridian (MDBM) (USGS 7.5' Rainbow Mountain quad and 15' Bartle quad) is occupied by the RNA except the quarter mile square section of NE1/4 NW1/4 and a small area in southwest.

The RNA contains the headwaters of Antelope Creek and Butte Creek, and is quite remote, receiving few visitations. There is a long history of fishery activities down-stream of both creeks. California Department of Fish and Game has been stocking Butte Creek since 1928 and Antelope Creek since 1930. One of the four lakes in the RNA, Northern Antelope Creek Lake, has brook trout (*Salvelinus fontinalis*[1]) and rainbow trout (*Oncorhynchus mykiss*) stocking and fishing has been the major recreational use of the general area.

[1] Authorities for animal names are: Moyle (2002) for fish, Stebbins (1985) for amphibians, Robbins *et al*. (1983) for birds, and Ingles (1965) for mammals.

ACLRAN was nominated to represent the Montane Meadow target element in the Southern Cascades Ecological Section (M261D) (Miles and Goudey 1997) by the Klamath National Forest. A member of the Pacific Southwest Region's RNA committee conducted a reconnaissance of the area in 1980 (Horton 1981). Following the reconnaissance, the Antelope Creek Lakes area was approved as a candidate RNA. The ecological survey was completed by Fiedler and Leidy in 1987. In 1989 under a cooperative agreement with the Natural Conservancy, Tedd Keeler-Wolf prepared a draft Establishment Record, upon which this report is based.

The ACLRNA, as described in this establishment record, lies entirely within land managed by the Klamath National Forest. However, the RNA is surrounded by lands not under the jurisdiction of Klamath National Forest. Private lands abut the RNA in most directions. A small area over the ridge to the southwest of the RNA in Section 20 T42N, R1W is Forest Service land under the jurisdiction of Shasta-Trinity National Forests. It is within McCloud Flats Management Area under Management Prescription VIII (Timber Management) (Shasta-Trinity National Forests 1993) (Appendix A).

1) Land Management Planning

The establishment of Antelope Creek Lakes RNA is recommended and evaluated in the Klamath National Forest Land and Resource Management Plan (LRMP) and the Final Environmental Impact Statement (EIS) (Klamath National Forest 1995a-c); copies of relevant pages in LRMP and EIS can be found in Appendix B and C of this document. The land allocation for Antelope Creek Lakes RNA was decided by the signing of the Record of Decision for the LRMP by the Regional Forester in 1995. The establishment of the RNA will be completed by the signing of this Establishment Record by the Regional Forester with the concurrence of the Station Director.

Antelope Creek Lakes RNA is in Management Area 1, Research Natural Areas. Management directions follow the Klamath National Forest Forest-wide standards and guidelines (Appendix B1) and Management Area standards and guidelines (Appendix B2).

B. OBJECTIVES

The ACLRNA is established to represent the wet montane meadow (Holland type: 45110, CNPS type: montane meadow habitat) target element for the Southern Cascades Ecological Section (M261D) of California. The wet montane meadow in ACLRNA is the only representative of its kind currently in established or candidate RNAs in Southern Cascades Ecological Section of California. A small percentage of the Soda Ridge and Cub Creek RNAs on the Lassen National Forest (Modoc Plateau Ecological Section) is classified as meadow, but these meadows are not as diverse or extensive as those of ACLRNA (Conard and Robichaux 1980, Taylor and Randall 1978).

The objective of establishing ACLRNA is to protect the unique aquatic system and the associated meadows of the area. Antelope Creek Lakes RNA includes four small shallow subalpine lakes and the headwater of Antelope and Butte creeks. The lakes vary somewhat in their physical characteristics and faunal composition. Including lakes, springs, seeps, seasonal creeks, and permanent streams, the variety of water regimes in the RNA creates many different types of meadow. Of the five meadow types described by Benedict and Major (1982) in the Sierra Nevada, three occur at ACLRNA. Vegetatively, ACLRNA contains representatives of 10 of the 21 vegetative series described by Ratliff (1982) for Sierra Nevada meadows.

C. JUSTIFICATION STATEMENT FOR ESTABLISHMENT OF AREA

Although the principal target element covers only a small percentage of the total acreage, their variety in form as well as in species composition provides a diversity of research possibilities. A detailed description of meadow vegetation is discussed in the flora section.

In addition to the meadows, the four subalpine lakes harbor diverse aquatic life. These lakes are second or third order dimictic (temperate) lakes (Fiedler and Leidy 1987). They are shallow (less than 13 ft [4 m] deep) and small (3-5 acres, or 1-2 ha), with mucky-to-gravelly bottoms. The submerged aquatic plant, Bolander's quillwort (*Isoetes bolanderi*), is abundant, covering much of the bottom area of all the lakes. The Northern Antelope Creek Lake supports a reproducing population of introduced brook trout and rainbow trout stocked by the California Department of Fish and Game, and the others have populations of amphibians such as Pacific tree frogs (*Hyla regilla*) and southern long toed salamanders (*Ambystoma macrodactylum sigillatum*), as well as numerous aquatic insects and other invertebrates.

The surrounding forests of Shasta red fir (*Abies magnifica*[2] [var. *shastensis*][3]) and mountain hemlock (*Tsuga mertensiana*) are represented by several subtypes. There are also small areas of whitebark pine (*Pinus albicaulis*) subalpine forest, montane riparian scrub, and two forms of montane chaparral.

The mountain hemlock and Shasta red fir forests are extensive and diverse. Mountain hemlock forest occurs on most of the sheltered slopes with north-, northwest-, northeast-, and east-facing exposures. These forests range from dense, young stands in avalanche or snow accumulation areas to large mature stands with trees 4 ft (1.2 m) in dbh (diameter at breast height) and 120 ft (36.6 m) tall. Shasta red fir forest occupies more exposed west-, south-, southeast-, and southwest-facing slopes. It also occurs in a range of types from young dense stands succeeding montane chaparral, through pure

[2] Nomenclature for plants follows Munz (1968), except trees which follow Little (1979).

[3] Munz (1968) distinguish the Shasta red fir as a variety of red fir.

mature even-aged stands, to stands with senescent canopies and dense trees in younger age classes.

On the ridge forming the southern boundary of the RNA, whitebark pine dominates along a narrow strip from approximately 6900 ft (2103 m) to 7200 ft (2195 m) elevation. This narrow subalpine forest is the lowest elevation whitebark pine forest represented in the California RNA system (Keeler-Wolf 1990). Associated with it and on adjacent north-facing cliffs and rocky slopes are several subalpine plants which are also typically found at much higher elevations. These include alpine bitter-cress (*Cardamine bellidifolia*), mountain sorrel (*Oxyria digyna*), *Potentilla glandulosa* ssp. *pseudorupestris*, *Arnica longifolia* ssp. *myriadenia*, alpine goldenrod (*Solidago multiradiata*), alpine lady fern (*Athyrium alpestre* var. *americanum*), holly fern (*Polystichum lonchitis*), and *Aquilegia formosa* var. *pauciflora*. Holly fern is a CNPS-List 3 sensitive plant (Tibor 2001).

A few rare and endangered animal species have been sighted in adjacent areas and are suspected to occur in the RNA, including northern goshawk (*Accipiter gentiles*, California State Species of Special Concern and Forest Service-listed Sensitive Species), willow flycatcher (*Empidonax trailii*, Forest Service-listed Sensitive Species), wolverine (*Gulo gulo*, California State-listed Threatened Species and Forest Service-listed Sensitive Species), and northern spotted owl (*Strix occidentalis*, Federally-listed Threatened Species).

Bald eagle (*Haliaeetus leucocephalus*, Federally-listed Threatened species), American marten (*Martes americana*, Forest Service-listed Sensitive Species), Townsend's big-eared bats (*Corynorhinus townsendii*, Forest Service-listed Sensitive Species), and Cascades frog (*Rana cascade*, Forest Service-listed Sensitive Species) are species likely to occur in the RNA.

D. PRINCIPAL DISTINGUISHING FEATURES

The lakes, numerous meadows, and predominant forest vegetation of red fir and mountain hemlock are the major features of ACLRNA.

In the RNA both the Butte and the Antelope Creek valleys were heavily glaciated. The four small lakes were created by morainal damming during the Pleistocene (Keeler-Wolf 1989). Two lakes each occur in the Antelope and Butte creek drainages. The Northern Antelope Creek Lake and both Butte Creek lakes appear to be formed by damming of lateral moraines, while the Southern Antelope Creek Lake was formed in a cirque bowl following damming by a recessional moraine. Meadows fringe all of the four lakes with those at the Eastern Butte Creek and Northern Antelope Creek lakes being most extensive (photos 2, 3, and 4).

The low arete forming the divide between the Butte and Antelope drainages is largely forested due to its moderate steepness and lack of extensive outcrops. Forests are

dominated by Shasta red fir on the western side and mountain hemlock on the eastern side. The divide becomes steeper and rockier as it rises to the south to meet the main Dry Creek Peak ridge, which forms the RNA's southern boundary. The upper glacially carved north-facing slopes of this ridge are steep and rocky, topped by whitebark pine stands (see photo 2). The lower slopes of the main ridge are cloaked in a dense mountain hemlock forest (photo 5).

The valley of Butte Creek is relatively broad and flat-bottomed near the northwestern corner of the RNA, occupied by meadows, riparian scrub, and intervening forest. From the valley, slopes ascend steeply to the northeast across an area of volcanic talus to the highest point of the RNA along its northern border (photo 6).

E. LOCATION (reference maps 1 and 2)

(1) National Forest Involved

The ACLRNA is located entirely on the Klamath National Forest and lies adjacent to the Shasta-Trinity National Forests. No other Forest System lands are involved. It is within the High Cascade Ecological Subsection (M261Df) in the Southern Cascades Section (M261D).

(2) Latitude and Longitude

The approximate mean latitude and longitude of the area is 41°28'30"N, 121°59'30"W.

(3) Boundary Description

ACLRNA occupies the majority of Section 20 T42N R1W, MDBM. Its boundaries (Map 1) correspond exactly to the land administered by the Klamath National Forest within the Section, more particularly described as follows:

Beginning at the northeast corner of Section 20 T42N R1W, MDBM (point a)

(a) thence southerly in a direct line following the eastern section line of Section 20 for approximately one mile (1.6 km) to the southeast corner of Section 20 (point b);

(b) thence westerly in a direct line following the southern section line of Section 20 for approximately 1350 ft (412 m) to the point where the section line tops the ridge west of Dry Creek Peak at approximately 7200 ft (2195 m) elevation (point c);

(c) hence following the top of ridge, which is also the borderline between the Klamath National Forest and Shasta-Trinity National Forests, westerly for approximately 0.9

mile (1.5 km) to the point where the western section line of Section 20 is met (point d); elevation of this point is approximately 6960 ft (2121 m);

(d) thence northerly in a direct line following the section line for approximately 0.8 mile (1.2 km) to the northwest corner of Section 20 (point e);

(e) thence easterly following the northern section line of Section 20 for approximately 0.25 mile (402 m) to the northwest corner of NE1/4 NW1/4 Section 20 (point f);

(f) thence southerly in a direct line following the demarcation of private ownership for approximately 0.25 mile (402 m) to the southwest corner of NE1/4 NW1/4 Section 20 (point g)

(g) thence easterly in a direct line following the demarcation of private ownership for approximately 0.25 mile (402 m) to the southeast corner of NE1/4 NW1/4 Section 20 (point h);

(h) thence northerly in a direct line following the demarcation of private ownership for approximately 0.25 mile (402 m) to the northeast corner of NE1/4 NW1/4 Section 20 (point i);

(i) thence easterly in a direct line following the northern section line of Section 20 for approximately 0.5 mile (805 m) to the northeast corner of Section 20, point of beginning (point a).

(4) Acreage

The total acreage of the ACLRNA as described above is 544 (220.3 ha).

(5) Elevations

Elevations in the ACLRNA range from slightly below 6000 ft (1829 m) in the extreme northwestern corner to 7361 ft (2244 m) at the triangulation point in NE1/4 Section 20 T42N R1W. The total elevation range within the RNA is slightly over 1361 ft (415 m).

(6) Access

Access (Map 2) to the ACLRNA is easiest from the north via the following route:

Beginning from the Goosenest Ranger Station approximately 3.5 miles (5.6 km) south of Macdoel, one travels south on U.S. Highway 97 for approximately 8.5 miles (13.7 km) to the junction with County Road 6P01, Tennant Road.

At this point one turns east and follows this paved road southeast toward Tennant for about 9.5 miles (15.2 km) to the junction with the Stevens Pass Road (Primary Forest Route 6, 43N13).

One then takes Route 6 south up the Antelope Creek drainage continuing for about 6 miles (9.7 km) to the junction with Forest Route 42N16.

At this point one turns westward and travels on this dirt road up the Antelope Creek drainage for approximately 5 miles (8 km) to a junction with an unnumbered road which branches off to the left just before 42N16 crosses the bridge over Antelope Creek.

At this point two routes can be taken to reach the ACLRNA:

(i) Access to the eastern boundary of ACLRNA:

At the intersection of 42N16 and 42N26 one turns left and meets a locked gate. One may cross the gate and walk up the drainage, using recently constructed logging spurs to access the eastern edge of the RNA in approximately 1.5 hours. This walk covers a distance of approximately 2 to 2.5 miles (3.2-4.0 km), with the northernmost spur running up to the edge of the RNA approximately 0.25 miles (0.4 km) north of the outlet of the Northern Antelope Creek Lake.

The driving time from the Goosenest Ranger Station to the locked gate near the edge of Section 21 is approximately 1 hour. The total mileage using this route is approximately 30.5 (49.1 km).

(ii) Access to the northern boundary of the RNA:

The alternate route affording access to the northern boundary of the RNA continues across Antelope Creek on Forest Route 42N16 and up through the private land (not posted) of sections 8 and 9 T42N R1W. At a saddle in the southern portion of Section 8 one turns left (southeast) on an old logging spur which ascends into Section 17 and ends at an elevation of about 7200 ft (2195 m) on the northeast slope of peak 7533 (2296 m).

This road does not show on the 1983 edition of the 7.5 minute Bartle NW U.S.G.S topographic map, but does show on the 1961 edition of the Bartle 15 minute U.S.G.S. map.

At the end of this spur, which was negotiable by a high clearance two-wheel drive vehicle in September 1988, it is a short up-hill walk to the top of the ridge, of which peak 7533 is a part. From the top of this ridge it is approximately 0.5 mile (0.8 km) walk down to the northern boundary area near the triangulation point 7361 (2244 m).

Using this route it is approximately a 40-minute walk from the end of the logging spur to the edge of the RNA. The drive from the Antelope Creek crossing to the end of the spur is about 5 miles (8 km).

Travel within the RNA is moderate to easy, facilitated by the relatively short distances between all of the lakes and the easily negotiable low divide separating the Antelope and Butte Creek drainages.

F. AREA BY COVER TYPES

SAF TYPES (Eyre 1980)	percent	acres	hectares
Mountain Hemlock (205)	44.4	241	97.6
Red Fir (207)	35.7	194	78.6
Whitebark Pine (208)	0.7	4	1.6
unclassified	19.2	105	42.5
TOTALS	100.0	544	220.3
KUCHLER TYPES (Kuchler 1966)			
Fir-Hemlock (4)	44.4	241	97.6
Red Fir Forest (7)	35.7	194	78.6
Lodgepole Pine-Subalpine Forest (8)	0.7	4	1.6
Chaparral (29)	2.9	16	6.5
unclassified	16.3	89	36.0
TOTALS	100.0	544	220.3
HOLLAND TYPES (Holland 1986) [CNPS type (Sawyer and Keeler-Wolf 1995)]			
Montane Chaparral (37510) [Greenleaf manzanita series]	2.9	16	6.5
Wet Montane Meadow (45110) [Montane meadow habitat]	5.0	27	10.9
Montane Freshwater Marsh (52430) [Bur-reed series]	1.8	10	4.1
Montane Riparian Scrub (63500) [Mountain alder series]	0.9	5	2.0
Red Fir Forest (85310) [Red fir series]	35.7	194	78.6
Whitebark Pine-Mountain Hemlock (86210) [Mountain hemlock series]	45.1	245	99.2
Alpine Talus and Scree Slope (91200) [Alpine habitat]	8.6	47	19.0
TOTALS	100.0	544	220.3

G. PHYSICAL AND CLIMATIC CONDITIONS

The ACLRNA is in the southern Cascades. It occupies the headwaters of Butte and Antelope creeks. These two permanent creeks drain the northern sides of Dry Creek Peak, Rainbow Mountain and other unnamed peaks which form a cluster of andesitic mountains rising to the northeast of the huge composite cone of Mount Shasta, the most massive of all the Cascade volcanoes in California (MacDonald 1966). The center of the RNA lies approximately 12 miles (19 km) northeast of the summit of Mt. Shasta (photo 1) and the whole RNA is in the precipitation shadow of Mt. Shasta. The relatively high elevations and proximity to the mountain, the position north of latitude 41°N, and the location of the area to the east of the main Cascade crest near the cold-desert climate of the Modoc Plateau combine to create a cold and relatively severe climate, compared to most other mountainous areas of California.

The geomorphology of the drainage basins of Antelope, Butte, and other nearby creeks suggests that immense valley glaciers existed here in the Pleistocene. The glacier that filled the Butte, Alder, and Pomeroy creek drainages was over 13 miles (21 km) long (Jennings *et al*. 1977). The huge amount of snow that must have accumulated to create such glaciers appears to have been a local phenomenon, unmatched by other mountains of similar size only a few miles to the east. This may be due in part to the proximity of the huge mass of Mt. Shasta with its large snowfields, glaciers, and pronounced cold-air drainage (Keeler-Wolf 1984a). It is already known (Masson 1949) that other cold-climate geomorphic features, such as patterned ground, occur at their lowest elevations in California adjacent to Mt. Shasta.

The lakes, numerous meadows, and predominant forest vegetation of red fir and mountain hemlock also indicate that considerable snow still falls in the area. Present snow depths, estimated by the height of *Letharia* lichen growth on trees, average between 5 and 12 ft (1.5-3.7 m) depending upon slope exposure.

There are no precipitation recording stations in or near the RNA and the closest weather stations are in areas with substantially different climates. However, the isohyets in Rantz (1972) indicate the precipitation in the RNA averages slightly under 40 inches (1016 mm) annually. This estimated total is surprisingly light considering the average winter snow depth. This suggests that cold winter temperatures may allow the snow to accumulate without the amount of melt-off between storms present in warmer, but wetter mountains at similar elevations to the west (e.g. the Salmon Mountains).

The relative coolness of the area is supported by the low elevation dominance locally of such typically high montane trees as whitebark pine and mountain hemlock. At ACLRNA, mountain hemlock dominates forests as low as 6100 ft (1859 m) and whitebark pine dominates on ridges as low as 6900 ft (2103 m). At approximately the same latitude to the west in the eastern Klamath mountains, mountain hemlock does not dominate below about 6800 ft (2072.6 m), and whitebark pine does not dominate below about 7500 ft (2286 m) (Keeler-Wolf 1982, 1984b, 1987).

In summary, although in the precipitation shadow of wetter mountains, the area is able to maintain its mesic aspect and high-mountain character apparently by virtue of its relatively cold climate.

Temperatures at the RNA can be estimated by the temperature records from the Mount Hebron Ranger Station. This site has been taking temperature records since 1952. It is located near the town of Macdoel at latitude 41°47'N, longitude 122°02'W. It is approximately 24 miles (39 km) north of the RNA at an elevation of 4250 ft (1295 m). The mean January temperature over a 22-year period was 25.7 °F (-3.5 °C), the mean July temperature was 62.5 °F (16.9 °C), and the mean annual temperature was 43.9 °F (6.6 °C). The mean maximum temperature over a 12 year period from 1974 to 1985 was 95.6 °F (35.3 °C). Over the same period the mean minimum temperature was -6.6 °F (-21 °C).

Using the above temperatures as bases, assuming a lapse rate of 3 °F/1000 ft (1.7 °C/305 m), the corresponding temperatures at 7250 ft (22010 m) elevation in the RNA would be: mean January, 16.7 °F (-8.5 °C); mean July, 53.5 °F (11.9 °C); mean annual, 34.9 °F (1.6 °C); mean maximum, 86.6 °F (30.3 °C); and mean minimum, -15.6 °F (-6.4 °C).

Precipitation is mostly in the form of snow. In the northern Sierra Nevada snow accounts for 60-90 percent of the total precipitation between 6000 and 7000 ft (1829-2134 m) (Kahrl 1979). At the RNA it is likely that snow accounts for at least this much of the total at comparable elevations.

The area does experience the typical California pattern of most precipitation falling from November through March. However, due to its northerly montane location, slightly more precipitation probably falls during the summer months than at comparable elevations in the central and northern Sierra. The number of summer thundershowers is relatively high. This is indicated regionally by the fact that the Klamath National Forest ranks among the top five National Forests in California for the number of lightning caused fires (Keeley 1982). Records from Mount Hebron Ranger Station and Mount Shasta City indicate that in 1974 through 1985, July precipitation accounted for 0.9 percent (Mt. Shasta) and 2.7 percent (Mt. Hebron) of the average annual precipitation. Not all summer precipitation is in the form of thundershowers. Fiedler and Leidy (1987) report a frontal snow storm which blanketed the RNA with several inches of snow in mid-July 1986.

H. DESCRIPTION OF VALUES

(1) Flora

The flora of the ACLRNA is not well documented. A partial list of 74 taxa of vascular plants is given by Fiedler and Leidy (1987). In mid-September 1988 on a one day visit to the area an additional 87 taxa of vascular plants were noted by Keeler-Wolf (1989). The entire list of 162 taxa is given as Appendix D.

No Federal-, State-, or Forest Service-listed sensitive plants are known to occur in the RNA. However, one CNPS List 3 plant (Tibor 2001), holly fern, is found occasionally among cliffs and talus on north-facing slopes along the southern border of the RNA.

The following is a brief account of the major vegetation types occurring at the ACLRNA. These are depicted on the vegetation map (Map 3). The types are listed in the order they are presented in Holland (1986), with equivalent CNPS (Sawyer and Keeler-wolf 1995), Kuchler (1966), and SAF (Eyre 1980) vegetation type names. Code numbers are given in parentheses following the names.

(a) Montane Chaparral (37510)
CNPS: Greenleaf manzanita series
Kuchler: Chaparral (29)
SAF: no equivalent type

At least two forms of montane chaparral occur in the RNA. The more extensive one occurs in the vicinity of the triangulation point 7361 (2243.6 m) on the north side of the RNA. This subtype may be called the *Holodiscus microphyllus-Chrysothamnus nauseosus* ssp. *albicaulis* (small-leafed rock spiraea-white-stemmed rabbitbrush) association. It occupies stabilized talus and ridgetops at high elevations with xeric exposures (see photo 1). Other important species include: sulphur flower (*Eriogonum umbellatum*), *Haplopappus bloomeri*, bitterbrush (*Purshia tridentata*), and bush chinquapin (*Castanopsis sempervirens*).

The other type of mountain chaparral occurs in small openings within ridgetop-stands of red fir forest. This type is dominated by pine mat and green leaf manzanitas (*Arctostaphylos nevadensis* and *A. patula*), with tobacco brush (*Ceanothus velutinus*) and bush chinquapin. On southwest-facing slopes in the Butte Creek drainage tobacco brush often dominates this type. It appears that this form of montane chaparral is succeeded in the latter locations by red fir, but may be more permanent in the rocky ridgetop openings.

(b) Wet Montane Meadow (45110):
CNPS: Montane meadow habitat
Kuchler: no equivalent type
SAF: no equivalent type

This vegetation type is the target element for the RNA establishment. The meadows occur as isolated patches throughout this largely forested area. They are of two principal types, stringer meadows and lake-margin meadows. The stringer meadows are found primarily along the permanent portions of Butte Creek while lake-margin meadows fringing the shores of all four lakes. Using the terminology of Benedict and Major (1982) these would correspond to type IC (stream or stringer

meadows) and type IA2 (topographic basin meadows caused by lateral or recessional moraine damming).

In addition to these two principal types of meadows there are also smaller meadows associated with springs issuing from bedrock or bases of glacial moraines (types IB2 and IB1, respectively of Bennidict and Major, or hanging types SENSU, Ratliff 1985). These meadows are usually associated with riparian thickets of mountain alder (*Alnus tenuifolia*) and occur adjacent to the stringer meadows of the Butte Creek drainage.

This vegetation type is subdivided into several subtypes based upon species composition (dominance) and physical characteristics. Ratliff (1985) offers a method for classifying meadows based on vegetative series, hydrologic series, topographic position, general plant belt (e.g. montane or subalpine), and meadow margin type. However, the present scanty knowledge of the locally occurring meadows precludes this type of detailed analysis. The following categories of dominance types are based in large part on vegetative series described by Ratliff (1982, 1985).

(1) Tufted hairgrass (*Deschampsia caespitosa*):

This is the dominant form around the south end of Northern Antelope Creek Lake (see photo 3) and Eastern Butte Creek Lake. It is dominated by this tufted hairgrass. The ground is moist but not saturated late in the summer. Other important species include alpine shooting star (*Dodecatheon alpinum*) and long-stalk clover (*Trifolium longipes*). At Eastern Butte Creek Lake, corn lily (*Veratrum californicum*) and swamp onion (*Allium validum*) are also common. According to Ratliff (1982) this series is sensitive to grazing. Its extensive stands locally indicate low grazing pressure at the lakes.

(2) Beaked sedge (*Carex rostrata*):

This type characterizes all of the lake margins and the temporary pond to the west of the Eastern Butte Creek Lake. It requires permanent moisture and flooding for part of the growing season.

(3) Mountain heather-Gray's lovage (*Phyllodoce breweri-Ligusticum grayi*):

This type occupies the borders between red fir or mountain hemlock forest and other meadows such as type 1. It may also have such small woody species as western blueberry (*Vaccinium occidentale*) and dwarf huckleberry (*V. arbuscula*).

(4) Blue-joint (*Calamagrostis canadensis*):

This type occurs in patches along the margins of lakes. The indicator species is a relatively tall grass which tends to strongly dominate where it occurs.

(5) Slender spikerush (*Heleocharis acicularis*):

This type is restricted to muddy shores of lakes. The small dominant begins growing in shallow water and as the water level drops through the year it covers the drying lakeside mud.

(6) Sedge (*Carex* sp.) meadow:

This form is not given a specific name because it was impossible to identify the dominant sedge due to cattle grazing. It occurs in saturated hanging meadows with small permanent springs adjacent to the stringer meadows along Butte Creek. In addition to the sedge, other species include *Scirpus criniger*, *Luzula parviflora*, tinker's penny (*Hypericum anagaloides*), American speedwell (*Veronica americana*), and *Sidalcea oregana* ssp. *spicata*.

(7) Pullup muhly (*Muhlenbergia filiformis*):

This type frequently distributes on the grazed hanging meadows adjacent to Butte Creek. It also occurs in patches in the fringing meadow around Southern Antelope Creek Lake. The soil is wet to moist in the early summer, but dry by late summer. This type is tolerant of grazing, but is not an invasive species (Ratliff 1982).

(8) Long-stalk clover:

This type occurs in similar positions as the tufted hairgrass type around the south shore of Northern Antelope Creek Lake. *Deschampsia caespitosa*, *Phleum alpinum*, and *Dodecatheon alpinum* are also common.

(9) Common monkeyflower (*Mimulus guttatus*):

This type occurs as a fringe along the permanent stream and rivulets in the Butte Creek valley. In addition to the dominant, *Senecio triangularis*, *Carex aquatilis*, *Aquilegia formosa* var. *truncata*, and *Aconitum columbianum* are also

common. This type is typically closely associated with montane riparian thickets. This type is not discussed by Ratliff (1982, 1985).

(10) Carpet clover (*Trifolium monanthum*):

This is a minor type typically closely associated with the pullup muhly type. It tends to occur in small patches in permanently moist areas adjacent to rocks or forest edges. It was most apparent at the Southern Antelope Creek Lake. Associated species include *Mimulus primuloides* and *Sibbaldia procumbens*.

(c) Montane Riparian Scrub (63500)
CNPS: Mountain alder series
Kuchler: no equivalent type
SAF: no equivalent type

This type is dominated by mountain alder. It is found surrounding springs, rivulets and in patches along the main Butte Creek channel in the northwestern portion of the RNA. Associated with the thicket of mountain alder are occasional willows (*Salix* sp.), mountain ash (*Sorbus cascadensis*) and numerous herbaceous species. Many of the herbs are also characteristic of the common monkeyflower meadow type.

(d) Montane Freshwater Marsh (52430)
CNPS: Bur-reed series
Kuchler: no equivalent type
SAF: no equivalent type

This vegetation type is poorly developed in the ACLRNA. The depauperate plant type occurs in all lakes. The most characteristic members include *Sparganium angustifolium*, *Carex rostrata*, and *Potemogeton richardsonii*.

(e) Red Fir Forest (85310):
CNPS: Red fir series
Kuchler: Red Fir Forest (7)
SAF: Red Fir (207)

This forest type is dominated by Shasta red fir and occurs on sunny, exposed slopes throughout the area. It is incorrectly mapped in Fiedler and Leidy (1987). The most extensive occurrence of this type is on west-facing slopes of the Butte Creek drainage. There it typically forms even-aged mature stands of trees 2-3 ft (0.6-9 m) dbh and 140-160 ft (43-49 m) tall with little understory vegetation (photo 7).

Reproduction in mature forests typically occurs in gaps. On southeast-facing slopes in the Antelope Creek drainage, some red fir forests contain a large number of senescent trees and fallen trunks creating large gaps filled with dense stands of saplings and pole-sized young trees.

Regeneration through forest fire is evident at one location, on the southwest-facing slopes of the Butte Creek drainage. A fire apparently swept through the canopy of a mature stand of Shasta red fir around 1899 resulting in the present high density of red fir of 10-14 inches (25-36 cm) dbh.

At elevations below 6200 ft (1890 m) in the Butte Creek drainage, red fir replaces mountain hemlock as the dominant tree on north-facing exposures. Seven point-quarter samples taken in the local red fir forest (Fiedler and Leidy 1987) indicate 100 percent frequency, 90 percent relative cover, 20 inches (52 cm) average dbh, and an average distance between trees of 20 ft (7 m). Two distinct cohorts of red fir were discerned. The mature cohort had an average dbh of 33 inches (83 cm) while the young cohort had a mean diameter of 4 inches (9 cm). This young cohort may have had its origin in a recent landslide.

(f) Whitebark Pine-Mountain Hemlock Forest (86210):
CNPS: Mountain hemlock series
Kuchler: Fir-Hemlock (4) & Lodgepole Pine-Subalpine Forest (8)
SAF: Mountain Hemlock (205) & Whitebark Pine (208)

This forest is easily divisible into two subtypes in the RNA. A mountain hemlock-dominated forest is the more extensive of the two and occurs on sheltered sites on most slopes north of due east and due west exposures above about 6200 ft (1890 m). At lower elevations and on more easterly and westerly facing slopes, mountain hemlock may co-dominate with Shasta red fir. However, it is the exclusive dominant on all upper elevation north-facing slopes.

Typical dense hemlock forest has very little understory development and a lighter litter and duff layer than dense red fir forest (photo 8). Reproduction is largely limited to areas of disturbance such as heavy snow accumulation areas or avalanche sites (see photo 2). Based on the 35 points sampled in this forest, Fiedler and Leidy reported the mean dbh of hemlock trees is 15 inches (38 cm), with 83 percent frequency, 59 percent cover, and the mean distance between trees is 15 ft (5 m). Other trees in the sample included Shasta red fir (57 percent frequency), and lodgepole pine (*Pinus contorta* var. *murrayana*) (3 percent frequency). There are many large hemlocks in the RNA, several were seen exceeding 4 ft (1.2 m) dbh.

The other phase of this community is dominated by whitebark pine and occurs in a narrow strip atop the ridge which forms the southern boundary of the RNA. Whitebark pine is typically dominant, but co-dominates in some areas with mountain hemlock and Shasta red fir. The trees are typically widely spaced, wind-

flagged, and stunted (photo 9). The understory is open with scattered shrubs of bush chinquapin, greenleaf manzanita, *Haplopappus bloomeri*, and *Stipa occidentalis*. Isolated individuals of whitebark pine also occur on rocky exposures near the northern boundary in the vicinity of the triangulation point 7361 (2243 m). However, there they typically do not form a subalpine forest. Occasionally, whitebark pines drop off the south ridge into the north-facing talus and scree community occurring as low as 6800 ft (2072.6 m).

(g) Alpine Talus and Scree Slope (91200):
CNPS: Alpine habitat
Kuchler: no equivalent type
SAF: no equivalent type

On the north-facing slopes along the southern border of the RNA, several large boulder-strewn areas occur without forest cover. These areas represent active talus, and/or areas where snow accumulation is so great as not to allow tree colonization (see photo 2). The areas are dominated by several high-montane plants. Vegetative cover is usually light, precluded by the jumble of boulders, scree and bedrock. The following species are characteristic: parsley fern (*Cryptogramma acrostichoides*), mountain heather, mountain sorrel, alpine bitter-cress, *Arnica longifolia* ssp. *myriadenia*, fireweed (*Epilobium angustifolium*), mountain red elderberry (*Sambucus microbotrys*), alpine lady fern, alpine goldenrod, holly fern, *Aquilegia formosa* var. *pauciflora*, mountain pride penstemon (*Penstemon newberryi* ssp. *berryi*, and *Potentilla glandulosa* ssp. *pseudorupestris*.

(2) Fauna

Fauna of the ACLRNA is typical of upper montane California. It has not been fully inventoried and little is known of the invertebrate species. As for vertebrates, at least four Forest Service-listed sensitive species occur in the vicinity of the RNA. They are northern goshawk, willow flycatcher, northern spotted owl, and wolverine. Northern spotted owl is also Federally-listed Threatened species. Northern goshawk is California State-listed Species of Special Concern and definitely known from the area, while the California State-listed Threatened Species wolverine is suspected to occur in the RNA, being known from adjacent areas (Fiedler and Leidy 1987, Keeler-Wolf 1989).

Bald eagle (Federally-listed Threatened species), American marten (Forest Service-listed Sensitive Species), Townsend's big-eared bats (Forest Service-listed Sensitive Species), and Cascades frog (Forest Service-listed Sensitive Species) are species likely to occur in the RNA.

Other conspicuous vertebrates known from the area include brook trout, rainbow trout, long-toed salamander (*Ambystoma macrodactylum*), Pacific tree frog, 30 species of birds, and ten species of mammals including black bear (*Ursus americanus*), coyote

(*Canis latrans*), and mountain lion (*Puma concolor*). The list of animal species can be found in Appendix E.

(3) Geology

The geology of the ACLRNA has been mapped as Pliocene volcanic rock, composed primarily of andesite (Gay and Aune 1958, Jennings *et al*. 1977). The andesite varies in color from pale cream, through pinkish, to dark brownish gray. Most of the rocks and boulders in the RNA are porphrytic andesite with small vesicles and many dark crystals of amphibole and biotite, and light crystals of plagioclase. These are set in a matrix of aphanitic plagioclase and volcanic glass.

According to MacDonald (1966), the volcanoes that grew immediately north and east of Mt. Shasta formed in the late Pliocene and early Pleistocene. All of them tended to be gradual and not explosive volcanoes and were extremely uniform in their activity. Although the two mountains closest to the RNA (Dry Creek Peak and Rainbow Mountain) are not discussed specifically, Haight Mountain (about 5 miles [8 km] north of the RNA) is composed of a series of thick flows of horneblende, andesite, and dacite. These flows erupted just before the pyroxene andesites of other nearby volcanoes such as Deer Mountain, Willow Creek Mountain and the early andesite flows of Mount Shasta. All of the andesites resemble the principal types of andesite composing many of the big cones of the High Cascade Range (MacDonald 1966). The last volcanic activity in the vicinity of the RNA was probably the issuing of olivine basalt from fissures above the Alder Creek valley only 3-5 miles (4.8-8.1 km) to the northwest.

Pleistocene glaciation strongly re-shaped the flanks of Dry Creek Peak and other volcanoes in the upper Antelope Creek and Butte Creek drainages. The 400 ft (122 m) escarpment immediately south of Southern Antelope Creek Lake (see photo 2) is the most dramatic example of the carving action of the local Pleistocene ice.

(4) Soils

The soils within the RNA are relatively homogeneous, mapped as only two units in the draft Order three Soil Survey of the area (Klamath National Forest 1981). Map 4 shows the distribution of these two units in the RNA.

(i) Sheld-Iller families complex 5-50 percent slopes (Map Unit 180)

Most of the RNA is considered part of this soil type. The soil is composed of 50 percent Sheld family and 35 percent Iller family with 15 percent inclusions of rock outcrop and soils with a thick dark surface horizon and a significant clay increase in the subsoil.

The Sheld family has the following characteristics:

Position: mountain sideslopes and volcanic uplands
Surface layer: 0-11 inches (0-28 cm) brown sandy loam, weak fine granular structure, strongly acid
Subsoil: 11-34 inches (28-86 cm), reddish brown very stony fine sandy loam, weak medium subangular blocky structure, slightly acid
Parent material: 34+ inches (86+ cm), volcanic ash, colluvium, tuff, or igneous rock

The Iller family has the following characteristics:

Position: mountain sideslopes and volcanic uplands
Surface layer: 0-12 inches (0-31 cm), grayish brown sandy loam, weak medium granular structure, slightly acid
Subsoil: 12-60+ inches (31-152+ cm), yellowish brown sandy loam, massive, slightly acid

(ii) Oosen-Avis families complex 2-15 percent slopes (Map Unit 169)

This type occupies the lower valley bottom of Butte Creek. It is composed of 65 percent Oosen family and 20 percent Avis family with 15 percent inclusions of Andic Xerumbrepts (soils with a clay increase in the subsoil).

The Oosen family has the following characteristics:

Position: mountain footslopes and flats
Surface layer: 0-11 inches (0-28 cm), light yellowish brown sandy loam, weak very fine granular structure, neutral
Subsoil and substratum: 11-71+ inches (28-180+ cm), pale brown to light brownish gray loamy sand, weak medium subangular blocky structure to massive, neutral

The Avis family has the following characteristics:

Position: mountain sideslopes, flats and lava flow ridges
Surface layer: 0-6 inches (0-15 cm), very dark grayish brown sand, single grain, slightly acid
Subsoil and substratum: 6-61+ inches (15-155+ cm), yellowish brown very cobbly coarse sand, massive, neutral

(5) Lands

All land within the boundaries of the ACLRNA is under the management of the Klamath National Forest. There are no private inholdings, although the area is almost completely surrounded by private lands. Only one small area over the ridge to the southwest of the RNA in Section 20 T42N, R1W is Forest Service land under the jurisdiction of Shasta-Trinity National Forests. Approximately 3.5 miles (5.6 km) of the total 4.4 miles (7.1 km) borderline is shared with private lands.

(6) Cultural

There are no known cultural or archaeological sites in the RNA. The area was along the southern territory of the Modoc people (Kroeber 1925). The traditional border with the Achumawi was the divide marking the southern boundary of the RNA (Olmsted and Stewart 1978). Because of the high elevation of the area it was probably only infrequently visited by summer hunters. Modoc fishermen typically did not fish small streams and lakes, relying more heavily on the large lakes of the Modoc Plateau (Kroeber 1925). Thus, it is unlikely that the lakes and streams of the RNA held much attraction.

(7) Aquatic ecosystem and fire regime

The aquatic ecosystems of the four lakes are of significant ecological value. Each of these second or third order dimictic lakes is slightly different in their physical and biotic characteristics. The most eutrophic (productive) lake appears to be Southern Antelope Creek Lake. In mid-September 1988 there was a pronounced algal bloom and large populations of invertebrates (most noticeable were water boatmen [*Cenocorixa* sp.]) and amphibians (Pacific tree frog). The next most productive lakes appeared to be the two Butte Creek lakes, which also have numerous invertebrates, but have fewer algae than the Southern Antelope Creek Lake. There is also a temporary pond adjacent to the Eastern Butte Creek Lake which was dry in September but undoubtedly holds a succession of many interesting species of plants and animals in the spring and early summer (e.g. Odum 1976).

Evidence of past fire is noticed in the red fir forest. However, the regeneration of red fir in the RNA is not fire dependent. Neither the whitebark pine-mountain hemlock forest nor the wet meadow is fire-adapted. Fire has not played an important role in the ecosystem of the area.

I. IMPACTS AND POSSIBLE CONFLICTS

(1) Mineral Resources

There are no known mineral resources within the RNA. Thus, there will be no conflict when the area is removed from mineral entry following RNA designation.

(2) Grazing

The meadows of the lower Butte Creek drainage within the RNA have been grazed regularly for many years. Cattle from the Hart Cattle Company range up stream from their principal summer pastures on the private land of the lower Butte Creek area (e.g. around Hart's Camp).

Apparently, cattle do not usually disturb the meadows within the RNA until late summer. Photos taken of these meadows in mid-July by Fiedler and Leidy (1987) show no grazing impact, and no mention of cattle was made in their report. However, in mid-September 1988, at least ten cattle were using these meadows in the northwestern corner of the RNA and their impact was clearly noticeable (photo 10). Many of the wet meadow species had been cropped and clear evidence of long-term use was indicated by a series of cattle trails paralleling Butte Creek. Several dust wallows adjacent to meadow areas were noticed, and the wetter parts of the meadows suffered some trampling. The vegetation of the main body of the meadows has not been irrevocable damaged, however. No ruderal species encroachment or erosion was present.

The current level of cattle grazing may conflict with the objective of RNA and the protection of the principal target of wet montane meadow.

(3) Timber

No timber harvesting occurred in the RNA. However, there have been 3 loggings occurred in Section 21 T42N R1W, in 1985-1986, early 1990s, and 1997-1998. It is estimated that at least three quarters of the section was logged with a 40-acre (16 ha) clear cut just to the east of the Northern Antelope Creek Lake (Stout 2003, personal communication). Section 21 is downslope and downstream from the RNA, therefore, the logging impact on the RNA is minimal.

There is no detailed analysis of the ACLRNA's timber value in the 1995 Klamath National Forest EIS for the LRMP. However, in the 1989 draft Establishment Record Keeler-Wolf stated:

"...The area includes approximately 336 acres (140 ha) of high elevation timberland, producing about 149,500 board feet of utilizable volume per year. Site

class is relatively low because of the severe climate and the relatively slow growth rates of mountain hemlock...."

Based on the above estimation and the fact that all the alternatives of the Forest Plan recommended the establishment of ACLRNA, the impact of RNA establishment on the timber resource of the area is minimal.

(4) Watershed Values

Both Butte and Antelope creeks are important permanent streams which rise within the RNA. Downstream from the RNA they both provide important sport fisheries as a result of regular plantings of several species of trout (see Appendix in Fiedler and Leidy 1987). The water in these two streams is largely supplied by springs and seeps and not from overflow of the lakes within the RNA. Outlets of all four lakes are typically dry by mid-summer (Fiedler and Leidy 1987). Springs provide a large volume of water year-round, particularly in the Butte Creek drainage (NW1/4 Section 20 T42N, R1W).

Establishment of the ACLRNA will provide the necessary protection of the area to ensure its watershed values.

(5) Recreation Values

Little recreational use in the RNA has been observed. Keeler-Wolf did not notice any evidence of camping or other visitation within the RNA during his visit in September 1988. Area along the eastern shore of Northern Antelope Creek Lake (outside of the RNA on private land) does have a lightly used campsite and light litter, probably associated with fishing visitation. This lake is the most accessible of the four and the only one with a fish population. The rest of the area showed no sign of recreational use.

The present level of recreational use of the area is compatible with the objectives of RNA establishment. Establishing the ACLRNA will have no impact on the recreation values of the area.

(6) Wildlife and Plant Values

Establishment of the ACLRNA will maintain the pristine nature of the area and insure its continued value for the wildlife and downstream fish populations. The old growth hemlock and red fir forests and the lakes, as well as the meadows and talus slopes, are important habitat for the sensitive bird species.

The meadows show little evidence of encroachment by surrounding forest types. Lodgepole pine, a common invader of many montane meadows in California (Ratliff 1985), is uncommon in the RNA. However, it is generally accepted that grazing pressure will increases the likelihood of invasion by lodgepole pine (Ratliff op. cit.).

(7) Special Management Area Values

The ACLRNA is not within any special management area. Establishment of ACLRNA will have no conflict with the values of Special Management Area.

(8) Transportation Plans

There are no plans to construct roads within or near the area. Therefore, establishing ACLRNA will have no impact on the transportation plans of the area.

J. MANAGEMENT PRESCRIPTION

The Klamath National Forest Land and Resource Management Plan (LRMP) presents the standards and guidelines that provide a framework for the land management decision for the lands on the Klamath National Forest. Management standards and guidelines for Research Natural Areas are stated in the Klamath National Forest LRMP on pages 3-11, 4-8, 4-16, and 4-73 through 4-77 (USDA forest Service 1995a). Please see Appendix B in this Establishment Report for a copy of the RNA management standards and guidelines.

1) RNA Management Strategy

The Klamath National Forest will develop a specific management strategy to maintain the target element and other resource values in the best possible condition. These are to maintain ACLRNA in a natural condition and to limit use to research, study, observation, monitoring and educational activities that are nondestructive and non-manipulative.

K. ADMINISTRATION RECORDS AND PROTECTION

The official responsibility for administration and protection of the Antelope Creek Lakes RNA is with the District Ranger, Goosenest Ranger District, 37805 Highway 97, Macdoel, California 96058. Attention will be given to the effective exclusion of cattle from the northwestern portion of the RNA and preservation of the ecological integrity of lakes and surrounding meadows.

The research coordinator is the Director, Pacific Southwest Research Station, 800 Buchanan Street, Albany, California 94710. This person is responsible for approving and coordinating observational or non-manipulative applied research, and maintaining a research data file.

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.

M. REFERENCES

Benedict, N.B.; Major, J. 1982. A physiographic classification of subalpine meadows of the Sierra Nevada, California. Madrono 29:1-12.

Conard, S.; Robichaux, R. 1980. Ecological survey of the proposed Soda Ridge Research Natural Area, Lassen National Forest, California. Unpublished report on file at Pacific Southwest Research Station, Albany, California.

Eyre, F.H. (ed.) 1980. Forest cover types of the United States and Canada. Washington, D.C.: Society of American Foresters; 148 p.

Fiedler, P.L.; Leidy, R.A. 1987. Ecological survey of the Antelope Creek Lakes proposed Research Natural Area. Unpublished report on file at Pacific Southwest Research Station, Albany, California.

Gay, T.E. Jr.; Aune, Q.A. 1958. Geologic map of California, Alturas Quadrangle. San Francisco, CA: Calif. Div. Mines and Geology.

Holland, R. 1986. Preliminary descriptions of the terrestrial natural communities of California. Unpublished mimeo available from Calif. Dept. Fish and Game, Sacramento, California.

Horton, L.E. 1981. Reconnaissance report, proposed Antelope Creek Lakes Research Natural Area, Klamath National Forest. Unpublished report on file at Pacific Southwest Research Station, Albany, California.

Ingles, L.G. 1965. Mammals of the Pacific States. Palo Alto, CA: Stanford University Press.

Jennings, C.W.; Strand, R.G.; Rogers, T.H. 1977. Geologic map of California. Sacramento, CA: California Div. Mines and Geology.

Kahrl, W. (ed.) 1979. The California water atlas. Sacramento, CA: State of California.

Keeler-Wolf, T. 1990. Ecological surveys of Forest Service Research Natural Areas in California. Gen. Tech. Rep. PSW-125. Berkeley, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 177 p.

--- 1989. Draft Establishment Record of the Antelope Creek Lakes Research Natural Area, within Klamath National Forest in Siskiyou County, California. Unpublished report on file at Pacific Southwest Research Station, Albany, California.

--- 1987. An ecological survey of the proposed Crater Creek Research Natural Area, Klamath National Forest. Unpublished report on file at Pacific Southwest Research Station, Albany, California.

--- 1984a. An ecological survey of the Mount Shasta Mudflow Research Natural Area. Unpublished report on file at Pacific Southwest Research Station, Albany, California.

--- 1984b. Vegetation map of the upper Sugar Creek drainage, Siskiyou County, California. Unpublished report on file at Pacific Southwest Research Station, Albany, California.

--- 1982. An ecological survey of the proposed Cedar Basin Research Natural Area, Shasta-Trinity National Forests, Siskiyou County, California. Unpublished report on file at Pacific Southwest Research Station, Albany, California.

Keeley, J.E. 1982. Distribution of Lightning- and man-caused wildfires in California. In: Conrad, C.E.; Oechel, W. C. (Technical Coordinators) Dynamics and management of Mediterranean-type ecosystems. Gen. Tech. Rep. PSW-58. Berkeley, California: Pacific Southwest Research Station, U.S.D.A. Forest Service.

Klamath National Forest, U.S.D.A. Forest Service. 1995a. Land and Resource Management Plan.

---- 1995b. Environment Impact Statement, Land and Resource Management Plan.

---- 1995c. Environment Impact Statement Appendices, Land and Resource Management Plan.

---- 1981. Draft soil survey of the Klamath National Forest, California. Unpublished maps and report on file at Klamath National Forest Supervisor's Office, Yreka, California.

Kroeber, A.L. 1925. Handbook of the Indians of California. Washington, D.C.: Bureau of American Ethenology Bull. 78.

Kuchler, A.W. 1966. Potential natural vegetation. U.S. Dept. Interior. Geol. Survey. 1969.

Little, E.L., Jr. 1979. Checklist of United States Trees (Native and Naturalized). Agriculture Handbook No. 541. Washington, D.C.: U.S. department of Agriculture; 375 p.

MacDonald, G.A. 1966. Cascade Range, Modoc Plateau, and Great Basin provinces. In: Bailey, E. H. (ed.) Geology of Northern California. Calif. Div. Mines and Geol. Bull. 190.

Masson, P. 1949. Circular soil structures in northern California. Calif. Div. Mines Bull. 151:61-71.

Miles, S.R.; Goudey, C.B. 1997. Ecological subregions of California. San Francisco, CA: USDA Forest Service, Pacifica Southwest Region; various paging.

Moyle, P.B. 2002. Inland fishes of California. Berkeley and Los Angeles, CA: University of California Press; 502 p.

Munz, P.A. 1968. A California Flora and supplement. Berkeley and Los Angeles, CA: University of California Press.

Odum, E.P. 1976. Fundamentals of ecology, fourth edition. Philadelphia, PA: W.B. Saunders.

.

Olmsted, D.L.; Stewart, O.C. 1978. Achumawi. In: R.F. Heizer (ed.) Handbook of North American Indians, Volume 8, California. Washington, D.C.: Smithsonian Institution.

Rantz, S.E. 1972. Mean annual precipitation in the California Region. Menlo Park, CA: U.S.G.S. (Map).

Ratliff, R.D. 1985. Meadows in the Sierra Nevada of California: state of knowledge. Gen. Tech. Rep. PSW-84. Berkeley, California: Pacific Southwest Research Station, U.S.D.A. Forest Service.

---- 1982. A meadow site classification for the Sierra Nevada, California. Gen. Tech. Rep. PSW-60. Berkeley, California: Pacific Southwest Research Station, U.S.D.A. Forest Service.

Robbins, C.S.; Brunn, B; Zim, H. 1983. Birds of North America, a guide to field identification. New York, NY: Golden Press.

Sawyer, J.O.; Keeler-Wolf, T. 1995. A manual of California vegetation. Sacramento, CA: California Native Plant Society; 471 p.

Shasta-Trinity National Forests. 1993. Proposed Forest Land and Resource Management Plan. San Francisco, CA: USDA Forest Service, Pacific Southwest Region; various pages.

Stebbins, R. 1985. A field guide to western reptiles and amphibians. Boston, MA: Houghton-Mifflin Co.

Stout, J. Resource Officer, Klamath National Forest, Goosenest Ranger District. Personal communication. Nov. 6, 2003.

Taylor, D.W.; Randall, D.C. 1978. Ecological survey of the vegetation of the Cub Creek watershed, Lassen National Forest. Unpublished report on file at Pacific Southwest Research Station, Albany, California.

Tibor, D.P. (ed.) 2001. Inventory of rare and endangered vascular plants of California (sixth edition). Sacramento, CA: California Native Plant Society; 387 p.

APPENDICES:

A: Information excerpted from the Shasta-Trinity National Forests Proposed Forest Land and Resource Management Plan (Shasta-Trinity National Forests 1993)

B: Information excerpted from the Klamath National Forest Land and Resource Management Plan (Klamath National Forest 1995a)

B1: Forest-wide Standards and Guidelines

B2: Management Area Standards and Guidelines, Management Area 1 – Research Natural Area

C: Information excerpted from the Klamath National Forest Environmental Impact Statement, Land and Resource Management Plan (Klamath National Forest 1995b,c)

D: Vascular plants known from the Antelope Creek Lakes RNA

E: Vertebrates known from the Antelope Creek Lakes RNA

Appendix A: Information excerpted from the Shasta-Trinity National Forests Proposed Forest Land and Resource Management Plan (Shasta-Trinity National Forests 1993)

Appendix B: Information excerpted from the Klamath National Forest Land and Resource Management Plan (Klamath National Forest 1995a)

B1: Forest-wide Standards and Guidelines

Appendix B: Information excerpted from the Klamath National Forest Land and Resource Management Plan (Klamath National Forest 1995a)

B2: Management Area Standards and Guidelines, Management Area 1 – Research Natural Area

Appendix C: Information excerpted from the Klamath National Forest Environmental Impact Statement, Land and Resource Management Plan (Klamath National Forest 1995b,c)

Appendix D: Vascular plants known from the Antelope Creek Lakes RNA

This list is a combination of the list given as Appendix 1 in the ecological survey report (Feidler and Leidy 1987) and those species noted during the reconnaissance work for the draft establishment record on September 13, 1988 by Todd Keeler-Wolf (Keeler-Wolf 1989).

Taxonomy follows Munz (1968) except for trees which are listed in accordance with Little (1979). The total number of taxa listed is 162. This is not a complete list and it is likely that a number of other species occur particularly in the meadow areas. Names followed by a "?" indicate uncertain identifications or taxa listed by Fiedler and Leidy which are questionable.

Abies concolor
Abies magnifica var. *shastensis*
Acer glabrum var. *torreyana*
Achillea millefolium
Aconitum columbianum
Agrostis alba
Agrostis diegoensis
Agrostis exarata
Agrostis thurberiana
Allium vallidum
Alnus tenuifolia
Antennaria sp.
Apocynum pumilum
Aquilegia formosa var. *truncata*
Aquilegia formosa var. *pauciflora*
Arabis platysperma
Arctostaphylos nevadensis
Arctostaphylos patula
Arenaria aculeata; western limits, not reported W of Modoc Co
Arnica longifolia ssp. *myriadenia*
Arnica mollis
Artemisia douglasiana
Aster elatus
Aster occidentalis
Athyrium alpestre ssp. *americanum*
Athyrium felix-femina
Bromus marginatus
Calyptridium umbellatum
Cardamine bellidifolia
Carex aquatalis
Carex jonesii

Carex rostrata
Carex sp.
Carex sp.; pale leaved w/ few perigyna, dry open forests
Carex vesicaria
Cassiope mertensiana?
Castilleja applegatei
Castilleja sp.
Ceanothus prostratus
Ceanothus velutinus
Cercocarpus ledifolius
Cheilanthes gracillima
Chimaphila menziesii
Chimaphila umbellata var. *occidentalis*
Chrysolepis sempervirens
Chrysothamnus nauseosus ssp. *albicaulis*
Corallorhiza maculata
Cryptogramma acrostichoides
Cystopteris fragilis
Delphinium sp.
Deschampsia caespitosa
Dodecatheon alpinum
Dydleya sp. ?
Elymus glaucus
Epilobium angustifolium
Epilobium sp.
Erigeron tener?
Eriogonum sp.
Eriogonum umbellatum
Gayophytum sp.
Habenaria sparsiflora
Hackelia jessicae
Hackelia sp.
Haplopappus bloomeri
Heleocharis acicularis
Heracleum lanatum
Hieracium albiflorum
Hieracium horridum
Holodiscus microphyllus
Hypericum anagalloides
Isoetes bolanderi
Juncus balticus
Juncus bufonius
Juncus drummondii
Juncus mertensianus
Juncus nevadensis
Juncus parryi

Juncus spp.
Koeleria micrantha
Ligusticum grayi
Luetkea pectinata; may be easternmost locale in N. California
Lupinus obtusilobus
Lupinus polyphyllus
Lupinus sp.
Luzula comosa
Luzula parviflora
Mimulus guttatus
Mimulus primuloides
Mimulus sp.
Mitella breweri?
Monardella odoratissima ssp. *pallida*
Onychum densum
Osmorhiza chilensis
Oxyria digyna
Pedicularis attollens
Pedicularis sp.
Penstemon deustus
Penstemon gracilentus
Penstemon newberryi ssp. *berryi*
Penstemon sp.
Phacelia mutabilis
Phalaris tuberosa?
Phleum alpinum
Phlox diffusa
Phyllodoce breweri
Physocarpus capitatus
Pinus albicaulis
Pinus contorta var. *murrayana*
Pinus jeffreyi
Poa sp.
Polygonum davisiae
Polystichum lonchitis
Potemogeton richardsonii
Potentilla drummondii
Potentilla glandulosa ssp. *nevadensis*
Potentilla glandulosa ssp. *pseudorupestris*
Prunus emarginata
Pteridium aqualinum var. *pubescens*
Purshia tridentata
Pyrola picta
Pyrola picta ssp. *dentata*
Pyrola secunda
Quercus vaccinifolia

Ranunculus sp.
Ribes montigenum
Ribes roezlii
Ribes sp.
Sagina saginoides var. *hesperia*
Salix sp.
Sambucus microbotrys
Saxifraga aprica?
Saxifraga punctata ssp. *arguta*
Scirpus criniger
Scirpus microcarpus
Senecio triangularis
Sibbaldia procumbens
Sidalcea oregana ssp. *spicata*
Silene montana
Sitanion hystrix
Solidago multiradiata
Sorbus cascadensis
Sparganium angustifolium
Stephanomeria sp.
Stipa occidentalis
Stipa sp.
Taraxacum officinale
Thalictrum fendleri
Tragopogon sp.?
Trifolium longipes
Trifolium monanthum
Trisetum spicatum
Tsuga mertensiana
Vaccinium arbuscula
Vaccinium occidentale
Veratrum californicum
Veronica alpina var. *alterniflora*
Veronica americana
Viola adunca
Viola glabrata
Viola macloskeyi
Viola purpurea
Viola sp.

Appendix E: Vertebrates known from the Antelope Creek Lakes RNA

This list includes species observed during the reconnaissance for the draft Establishment Record on September 13, 1988 made by Todd Keeler-Wolf (Keeler-Wolf 1989). Portions are also excerpted from Appendices B, C, and D of Fiedler and Leidy (1987). Only those species actually noticed within the RNA are listed.

Authorities for names are Moyle (2002) for fish, Stebbins (1985) for amphibians, Robbins *et al*. (1983) for birds, and Ingles (1965) for mammals.

FISH

Rainbow trout (*Oncorhynchus mykiss*)
Brook trout (*Salvelinus fontinalis*)

AMPHIBIANS

Southern long-toed salamander (*Ambystoma macrodactylum sigillatum*)
Pacific tree frog (*Hyla regilla*)
Cascades frog (*Rana cascadae*)

BIRDS

Red-tailed hawk (*Buteo jamacensis*)
Northern harrier (*Circus cyanus*)
Cooper's hawk (*Accipiter cooperii*)
Goshawk (*Accipiter gentilis*)
Golden eagle (*Aquila chrysatos*)
Prairie falcon (*Falco mexicanus*)
Turkey vulture (*Cathartes aura*)
Common snipe (*Gallinago gallinago*)
Killdeer (*Charadrius vociferus*)
Band-tailed pigeon (*Columba fasciata*)
Common nighthawk (*Chordeiles minor*)
Pileated woodpecker (*Dryocopus pileatus*)
White-headed woodpecker (*Picoides albolarvatus*)
Hairy woodpecker (*Picoides villosus*)
Red-breasted sapsucker (*Sphyrapicus ruber*)
Common flicker (*Colaptes auratus*)
Clark's Nutcracker (*Nucifraga columbiana*)
Steller's jay (*Cyanocitta stelleri*)
Mountain chickadee (*Parus gambeli*)

Red-breasted nuthatch (*Sitta canadensis*)
Brown creeper (*Certhia americana*)
Hermit thrush (*Catharus guttatus*)
Townsend's solitaire (*Myadestes townsendi*)
Robin (*Turdus migratorius*)
Golden-crowned kinglet (*Regulus satrapa*)
Orange-crowned warbler (*Vermivora celata*)
Yellow-rumped warbler (*Dendroica coronata*)
Hermit warbler (*Dendroica occidentalis*)
Townsend's warbler (*Dendroica townsendi*)
Dark-eyed junco (*Junco hymalis*)
Rufous-sided towhee (*Pipilo erythrophthalmus*)

MAMMALS

Pika (*Ochotona princeps*)
Mazama pocket gopher (*Thomomys mazama*)
Townsend's chipmunk (*Eutamais townsendii*)
Meadow mouse sp. (*Microtus* sp.)
Golden-mantled ground squirrel (*Otospermophyllus lateralis*)
Chickaree (*Tamiasciurus douglasii*)
Mountain lion (*Felis concolor*)
Black bear (*Euarctos americana*)
Coyote (*Canis latrans*)
Mule deer (*Odocoileus hemonius*)