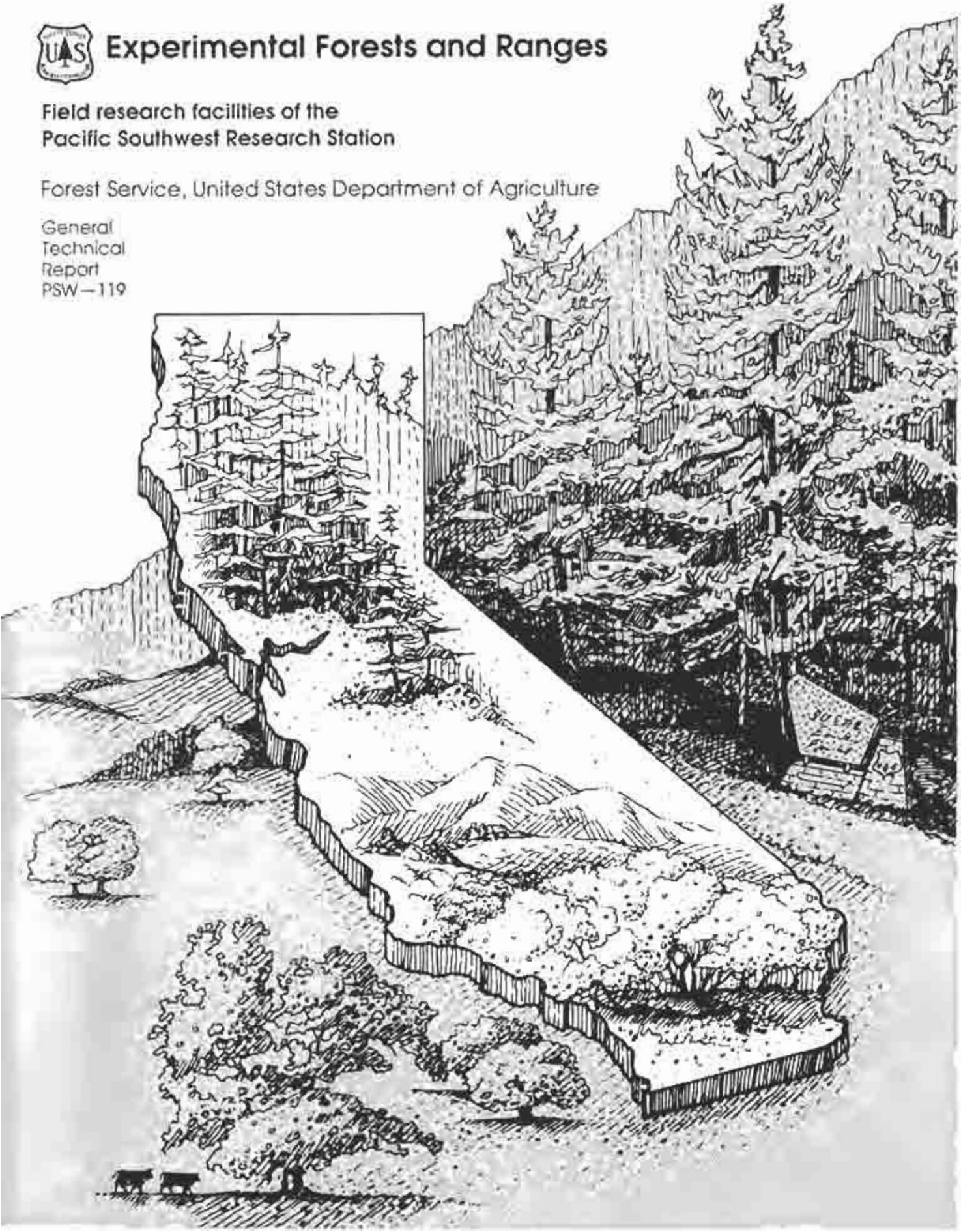
Experimental Forests and Ranges

Field research facilities of the Pacific Southwest Research Station

Forest Service, United States Department of Agriculture

General Technical Report PSW—119



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The 10 experimental forests and ranges in California administered by the Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, are described. The purposes of these facilities, and how to request their use for approved scientific study are given, and the natural resource base, data bases, studies, and general features of each are also described.

Retrieval Terms: forestry, forestry research, wildland research, experimental forests and ranges, California, Pacific Southwest Research Station

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Experimental Forests and Ranges of the Pacific Southwest Research Station

Neil H. Berg, *Technical Coordinator*

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INTRODUCTION

The Pacific Southwest Research Station administers 10 experimental forests and ranges in California (*see map opposite*). Experimental forests and ranges are established by the Chief of the Forest Service, U.S. Department of Agriculture, to provide outdoor laboratories and to serve as sites for pilot testing and demonstrating integrated management techniques (USDA Forest Serv. 1985). They are suitable for short-term studies and are especially useful for long-term studies where close control of land management activities and experimental conditions are needed.

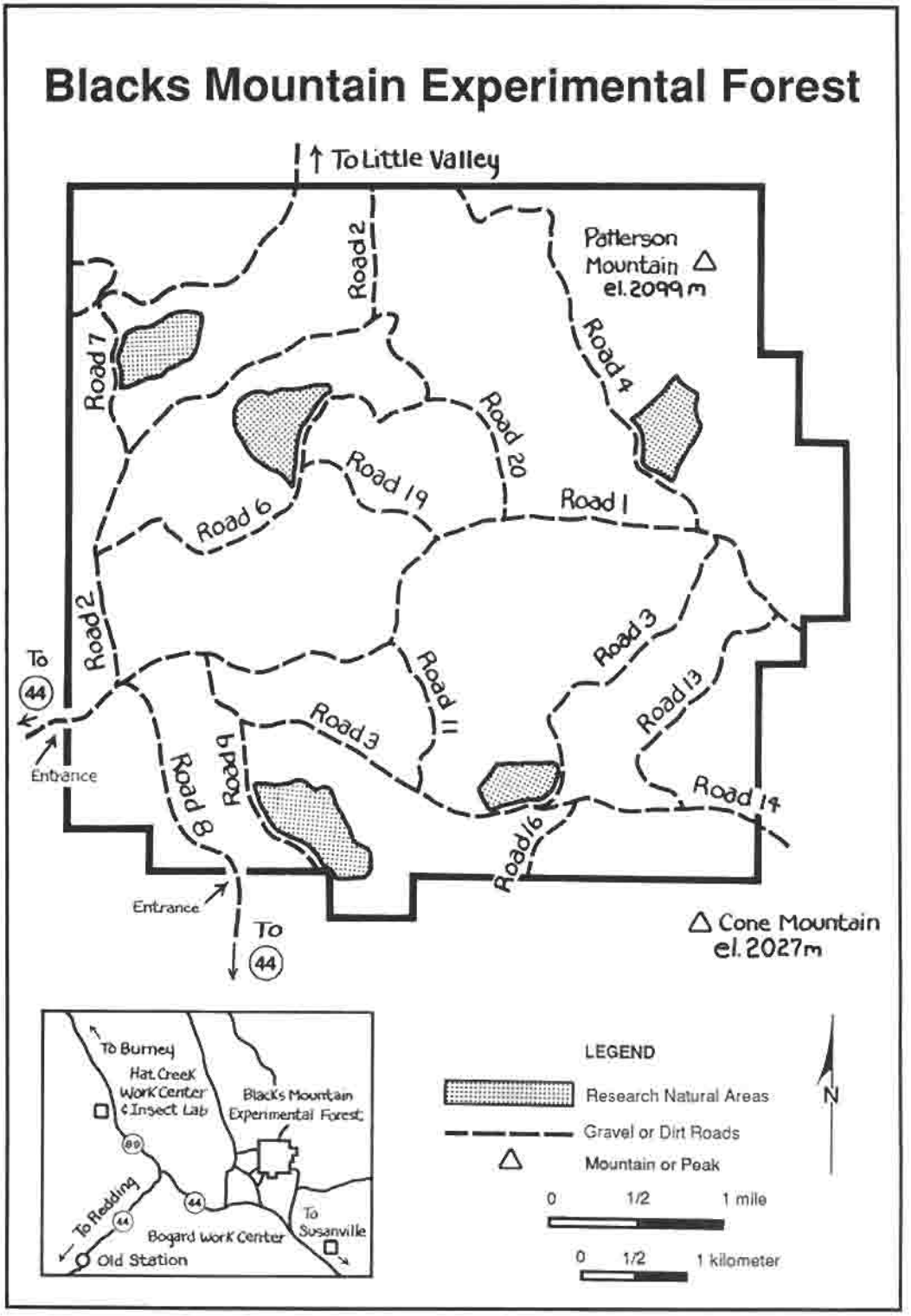
Current levels of research activity vary from high (Swain Mountain and San Dimas) to low (Blacks Mountain, Stanislaus-Tuolumne, and North Mountain). In most cases, the activity is limited to maintenance and monitoring of existing studies and installation of a few new ones. Timber is routinely harvested only at Swain Mountain and Blacks Mountain, and periodically at Yurok Redwood Experimental Forest. San Joaquin is grazed by cattle. North Mountain Experimental Area is under the jurisdiction of the Bureau of Land Management, U.S. Department of the Interior.

The Station Director has responsibility for planning and executing research on experimental forests and ranges and for determining if any proposed uses are compatible with the research objectives (USDA Forest Service 1987). Coordination of activities is generally assigned to a specified project leader of a research work unit associated with key research activities on the experimental forest or range. The Regional Forester, Pacific Southwest Region, in most cases, has primary responsibility to protect the area and to develop and maintain improvements that serve the needs of the general public. Normally, this responsibility is delegated to the Supervisor of the local National Forest.

These experimental forests and ranges are available to scientists from the Forest Service and cooperating institutions for conducting manipulative and non-manipulative research studies. The location and cover type of each experimental forest and range are summarized in *table 1*, and major features are described in the following sections of this report. Included for each forest are subsections on Climate, Soils, Main Communities, Data Bases, Examples of Research, and Facilities. Information on using the forests and on current research is available from the contact listed near the end of each section, or from the Station Director in Berkeley. A study plan that outlines study objectives, procedures, resource commitments, and duration—along with maps of study locations—will ordinarily need approval by the designated project leader and review by the local National Forest Supervisor before new work can begin.

Table 1—*Experimental forests and ranges of the Pacific Southwest Research Station, in California*

Name	Location	Dominant cover type
Blacks Mountain Experimental Forest	Lassen County	Interior ponderosa pine
Challenge Experimental Forest	Yuba County	Pacific ponderosa pine, Sierra Nevada mixed conifer, Pacific ponderosa pine–Douglas-fir
North Mountain Experimental Area	Riverside County	Chamise-chaparral
Onion Creek Experimental Forest	Placer County	Red fir, white fir, Jeffrey pine
San Dimas Experimental Forest	Los Angeles County	Chaparral, coastal sagebrush, California mixed hardwood
San Joaquin Experimental Range	Madera County	Annual grassland, blue oak–digger pine
Stanislaus-Tuolumne Experimental Forest	Tuolumne County	Sierra Nevada mixed conifer, red fir
Swain Mountain Experimental Forest	Lassen County	Red fir, white fir, lodgepole pine
Teakettle Creek Experimental Forest	Fresno County	Red fir, ponderosa pine–sugar pine–fir, meadows
Yurok Redwood Experimental Forest	Del Norte County	Redwood


Blacks Mountain Experimental Forest
↑ To Little Valley
Patterson Mountain △ el. 2099 m
Road 2
Road 7
Road 4
Road 20
Road 19
Road 6
Road 1
Road 2
Road 3
Road 11
Road 13
Road 3
Road 9
Road 8
Road 14
Road 16
To (44)
Entrance
Entrance
To (44)
△ Cone Mountain el. 2027 m
To Burney
Hat Creek Work Center & Insect Lab
Black's Mountain Experimental Forest
89
To Redding
44
44
To Susanville
Bogard Work Center
Old Station
LEGEND
Research Natural Areas
Gravel or Dirt Roads
Mountain or Peak
N
0 1/2 1 mile
0 1/2 1 kilometer

BLACKS MOUNTAIN Experimental Forest

The Blacks Mountain Experimental Forest was formally designated in 1934 as the Station's principal site for management studies in the interior ponderosa pine (*Pinus ponderosa* Dougl. ex Laws. var. *ponderosa*) type. Studies going back as far as 1910 had resulted in new theories of management, silviculture, and insect control. A primary objective of the Experimental Forest was to develop these theories into a system of management and to test, demonstrate, and improve the system through continuous operation of a timber tract on a commercial scale.

Before full scale operations began, the approximately 4200-hectare forest was subdivided into 100 compartments of about 40 hectares each. An intensive road system, the first in the West specifically designed for truck hauling, was laid out such that every compartment was bordered by a road. Compartments and roads have been continuously maintained.

Early timber harvests were primarily for insect control. An insect risk-rating system developed at Blacks Mountain was tested (Salmon and Bongberg 1942). When it was demonstrated that the average cut of 35 cubic meters per hectare could be logged economically, and that the cutting reduced the annual rate of tree killing, sanitation-salvage was adopted widely. Duncan Dunning proposed the mosaic of small even-aged groups of trees (the prevailing stand structure at Blacks Mountain) rather than individual trees as the subject for management (Hallin 1954). This concept of "unit area control" was tested operationally during the 1950's. More recent cuttings have been designed to convert large areas of the forest to young-growth stands needed for future research. Today, the forest includes a wide range of stand structures and age classes from young plantations to old-growth stands (*fig. 1*) in five uncut compartments designated Research Natural Areas.

CLIMATE

The climate is characterized by warm, dry summers and cold, wet winters. Annual precipitation, mostly snow, for the period 1935 to 1953 varied from 229 to 737 millimeters and averaged 457 millimeters. About 90 percent of the precipitation falls during October through May. Air temperatures during the year usually range from -9°C to 29°C. Frost may occur in any month. Relative humidity is usually low—10 to 20 percent on summer afternoons except during storms.

SOILS

Soils supporting conifers cover about 70 percent of the forest and are members of the mixed, frigid families of Ultic Haploxeralfs and Ultic Haploxerolls. These soils are 3 to 5 feet deep over lava bedrock. Mixed, frigid Ultic Argixerolls underlay sagebrush flats. Site Index varies narrowly between 60 and 80 and averages 72 (Meyer 1938).

Figure 1—*A wide range of stand structures and age classes from young plantations to old-growth stands are found on Blacks Mountain Experimental Forest.*

MAIN COMMUNITIES

Interior Ponderosa Pine (SAF 237), which occupies 3715 hectares, is the only forest cover type on the Experimental Forest (Eyre 1980). Species composition varies within the type, however. White fir (*Abies concolor* var. *lowiana* [Gord.] Lemm.) and incense-cedar (*Libocedrus decurrens* Torr.), absent in stands within the lower portion of the basin, become increasingly abundant at higher elevations. The remaining 437 hectares are poorly drained flats occupied by sagebrush and grass.

DATA BASES

Road and topographic maps are available. In 1933 and 1934 the Experimental Forest was completely inventoried on a 1-hectare grid. Timber type maps and inventories were prepared by compartments and revised after various harvests. Computerized stem maps and inventories are available for 20-year periods on 48 8-hectare parcels. The Lassen National Forest staff has mapped the soils to the family level.[1] This survey supersedes a more detailed survey conducted by University of California, Berkeley, students in 1940.[2]

EXAMPLES OF RESEARCH

- Growth of stagnated stands after thinning
- Long-term effects of partial cutting
- Comparing even-aged and uneven-aged silvicultural systems.

FACILITIES

The Blacks Mountain Experimental Forest has no facilities. Temporary office space, equipment storage, and gasoline may be available at the Forest Service's Bogard Work Center (19 road km southeast) or Hat Creek Work Center and the Forest Insect Laboratory of the Pacific Southwest Research Station (48 road km northwest). Gasoline and food can be obtained at Old Station (32 road km west). Complete services are available in Susanville, 64 road kilometers southeast of Blacks Mountain.

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[1]Available from the Lassen National Forest, Susanville, Calif.
[2]Data on file at the Pacific Southwest Research Station, Redding, Calif.

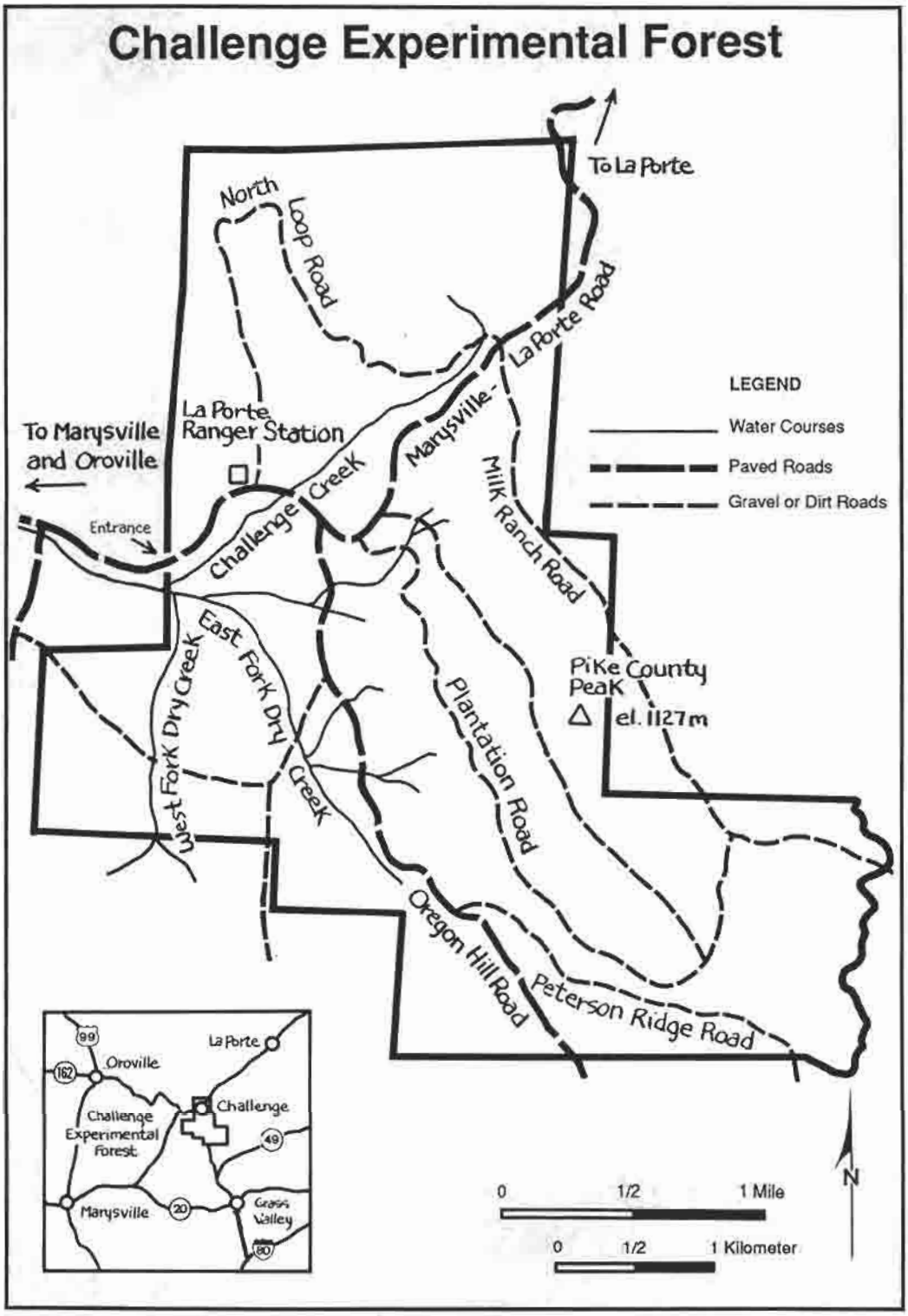
CONTACT ADDRESS

Project Leader
Silviculture of California Conifer Types
Silviculture Laboratory
2400 Washington Avenue
Redding, California 96001
(916) 246-5342

LOCATION

Blacks Mountain Experimental Forest (lat. 40°40′ N., long. 121°10′ W.) lies within portions of T. 33 N., R. 7 E. and T. 33 N., R. 8 E., MDM., 64 road kilometers northwest of Susanville, Lassen County (see map). About half of the Forest lies in a gently rolling basin; the remainder extends up the moderate slopes of Blacks Mountain to the north and of Patterson and Cone Mountains to the east. Elevations range from 1700 to 2100 meters.

Access to within 8 kilometers of the Experimental Forest is available all-year via State Route 44. Access to the boundary and within the Forest is available during summer and fall via an intensive system of surfaced and unsurfaced roads. None of these roads is maintained in the winter, and many may be impassable when wet.


Challenge Experimental Forest
To La Porte
North Loop Road
La Porte Road
LEGEND
Water Courses
Paved Roads
Gravel or Dirt Roads
La Porte Ranger Station
To Marysville and Oroville
Marysville
Entrance
Challenge Creek
Milk Ranch Road
West Fork Dry Creek
East Fork Dry Creek
Plantation Road
Pike County Peak
el. 1127m
Oregon Hill Road
Peterson Ridge Road
La Porte
Oroville
Challenge
Challenge Experimental Forest
Marysville
Grass Valley
99
162
49
20
80
0 1/2 1 Mile
0 1/2 1 Kilometer
N

CHALLENGE
Experimental Forest

The Challenge Experimental Forest comprises 1446 hectares surrounding the town of Challenge. The property was deeded to the U.S. Government as a place for field studies and for demonstration of forest management practices on stands of second-growth ponderosa pine (*Pinus ponderosa* Dougl. ex Laws. var. *ponderosa*) and associated species *(fig. 2)*. Results of studies conducted here were expected to be directly applicable to more than 800,000 hectares of low elevation, highly productive sites on the west slope of the northern Sierra Nevada.

The Experimental Forest, formally designated in 1942, was not activated until 1958. Early research sought answers to two major questions: (1) How to grow and harvest young-growth (80-100 years old) ponderosa pine to ensure adequate regeneration, and (2) how to dispose of logging slash to reduce fire hazard and ensure

Figure 2—*Clearcutting with natural regeneration was successfully applied to the second-growth stands of ponderosa pine and associated species on the Challenge Experimental Forest.*

adequate regeneration. Both even-aged (clearcutting, seedtree, and shelterwood) and uneven-aged (group- and single-tree selection) management systems were studied. Timber harvesting was accomplished through a cooperative agreement with the Soper-Wheeler Company[3] of Strawberry Valley, California. Management of native California hardwoods, field testing of hybrid and introduced pine species, and amount and pattern of soil moisture depletion by individual trees were other important early studies. Experiment Station personnel were stationed at Challenge from 1958 until 1982 with office and laboratory facilities in the La Porte Ranger Station. The number of permanent, full-time personnel reached a maximum of two research foresters, two technicians, and a secretary when most of the regeneration cutting experiments were installed in the early 1960's.

Stand conditions are as follows. Uncut or partially cut sawtimber stands occupy about 930 hectares in which volumes of the conifer component average 322 cubic meters per hectare. Regenerated clearcuts as old as 25 years occupy about 514 hectares. Many of the clearcuts occupied by woody shrubs and poorly stocked with conifers were mechanically cleared of shrubs and interplanted with ponderosa pine and Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco var. *menziesii*) during 1982-1987.

CLIMATE

The climate is Mediterranean in that summers are warm and dry, and winters are cool and wet. Mean annual precipitation is 1727 millimeters, 98 percent of which falls between October and May. Occasional snowfalls melt rapidly leaving the ground free of snow most of the winter. Mean annual temperature is 13°C. Mean maximum temperature of 21°C is reached in July, and mean minimum temperature of 6°C is reached in January.

SOILS

Most soils are old and deep. The Aiken and Sites Series cover most of the Experimental Forest. Site index (Powers and Oliver 1978) averages 100.

[3]Mention of trade names or products is for information only and does not imply endorsement by the U.S. Department of Agriculture.

MAIN COMMUNITIES

Pacific Ponderosa Pine (SAF 245) is the major forest cover type (Eyre 1980). Sierra Nevada Mixed Conifer (SAF 243), California Black Oak (SAF 246), and Pacific Ponderosa Pine–Douglas-fir (SAF 244) types also are present.

DATA BASES

Precipitation and maximum and minimum temperatures have been recorded at the Challenge Ranger Station since 1938.[4] Soils have been mapped both by the Cooperative Soil Vegetation Survey[5] and the University of California, Davis, in cooperation with Yuba County (Herbert and Begg 1969). The timber was inventoried in 1938 and 1939, and again in 1979.

EXAMPLES OF RESEARCH

- Management of native hardwoods
- Effect of timber harvesting on soil nitrogen transformations and mobility
- Influence of initial spacing and woody understory vegetation on growth and development of planted ponderosa pine
- Regeneration following single-tree and group selection cutting
- Interspecies relationships in California mixed conifers
- Influence of crown mass on litter decomposition and nutrient release
- Evaluation of ponderosa and sugar pine progeny derived from phenotypically superior trees.

[4]Data on file at the Pacific Southwest Research Station, Redding, Calif.

[5]Maps and legends for quadrangles 39 D-3 and 50 A-2 are available from California State Cooperative Soil-Vegetation Survey, California Department of Forestry and Fire Protection, Sacramento.

FACILITIES

The Challenge Experimental Forest has no facilities other than a small shed for storage of field equipment. Temporary office space and equipment storage may be available at the La Porte Ranger Station. Gasoline and general merchandise can be obtained in the town of Challenge, but not lodging. The nearest accommodations are in Oroville or Marysville.

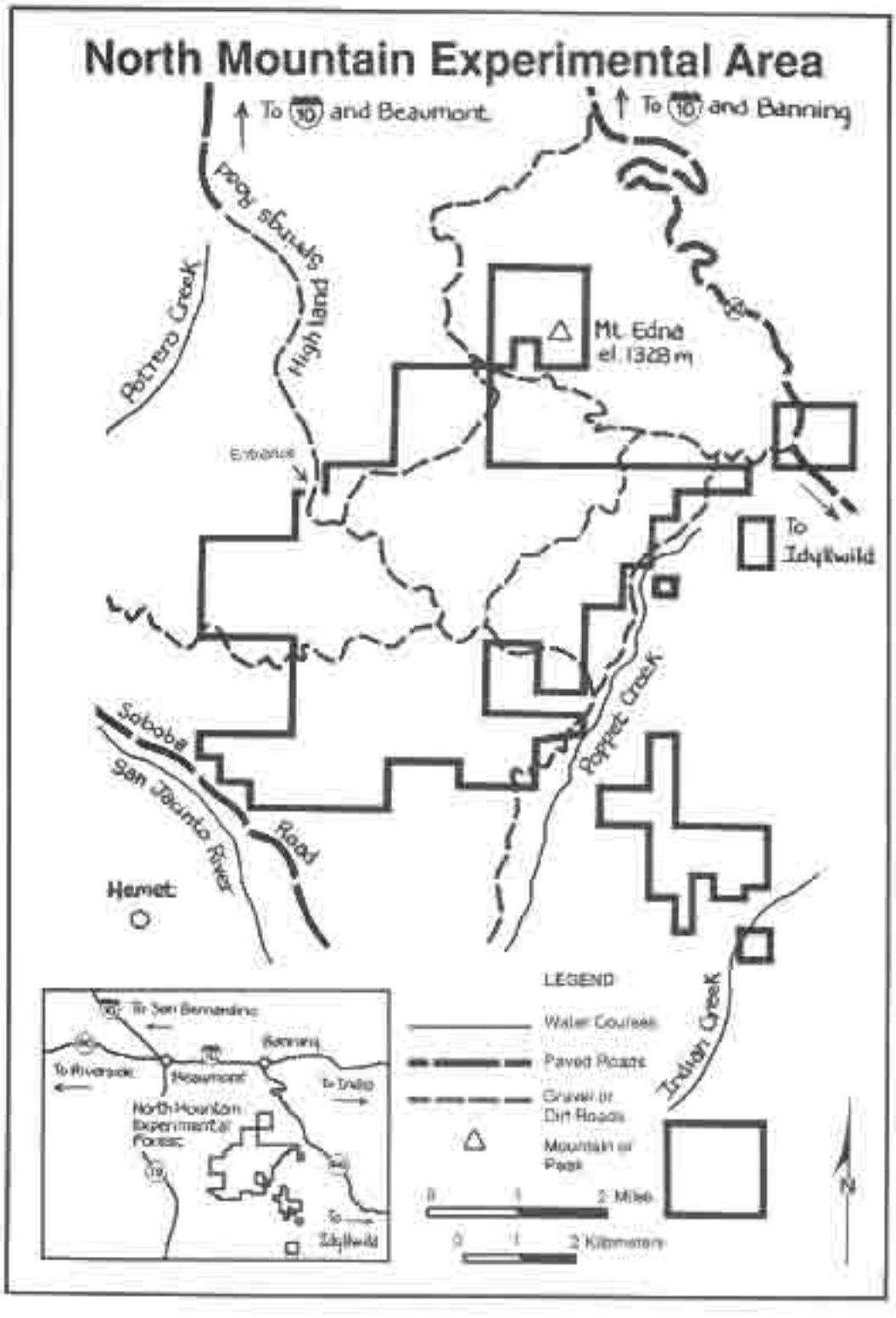
CONTACT ADDRESS

Project Leader
Silviculture of California Conifer Types
Silviculture Laboratory
2400 Washington Avenue
Redding, California 96001
(916) 246-5342

LOCATION

The Challenge Experimental Forest surrounds the small community of Challenge, Yuba County, which is 42 road kilometers southeast of Oroville and 56 road kilometers northeast of Marysville (see map). It occupies portions of T. 19 N., R. 7 E., MDM (lat. 39°28′ N., long. 121°13′ W.). Elevations range from 730 to 1130 meters.

Access to the Experimental Forest is available all-year via the paved Marysville-La Porte Road. Access within the Experimental Forest is available most of the year via one paved road and a system of graveled but unplowed roads.


North Mountain Experimental Area
To 10 and Beaumont
To 10 and Banning
Potrero Creek
Highland Springs Road
Mt. Edna
el. 1328 m
Entrance
To Idyllwild
Poppet Creek
Soboba
San Jacinto River
Road
Hemet
Indian Creek
LEGEND
Water Courses
Paved Roads
Gravel or Dirt Roads
Mountain or Pass
2 Miles
2 Kilometers
N
To San Bernardino
Banning
To Riverside
Beaumont
To Indio
North Mountain Experimental Forest
To Idyllwild

NORTH MOUNTAIN
Experimental Area

The North Mountain Experimental Area (NMEA) was established on January 8, 1964, when land previously administered by the Bureau of Land Management, U.S. Department of the Interior, was withdrawn from all appropriation under the Public Land laws including mining/mineral leasing laws by Public Land Order 3221. This withdrawal occurred by authority of the President, and pursuant to Executive Order 10355 of May 26, 1952.

The NMEA contains a total of 4348 hectares. Nearly the entire area is covered with chaparral that is representative of southern California, low elevation, interior nontimbered wildlands. No unique or special features are found within the NMEA. The Bureau of Land Management land examiner described the area as "badlands," created apparently by uplifting along the Hot Springs Fault line. Three major drainages dissect the NMEA: Potrero, Poppet, and Indian Creeks. All three are ephemeral. Since 1983, nearly all of the vegetation on the Experimental Area has burned. A major fire in 1932 burned over 80 percent of the area, and again in 1967 the Bailiff Fire burned about 60 percent of the NMEA. Use of the Area is subject to valid existing rights and is limited to activities directly related to research in problems of prevention and control of forest and range fires.

Early studies at the North Mountain Experimental Area centered on fuelbreaks and fuel properties *(fig. 3)*. Plant control

Figure 3—*This fuelbreak along the Castile Truck Trail was a part of the extensive fuelbreak research conducted by the Forest Fire Laboratory in Riverside.*

research was conducted in two main categories *(fig. 4)*: (1) the eradication of either selective brush plants or all vegetation, and (2) the reduction of plant growth with growth-inhibiting substances. The research centered around the use of herbicides which were believed to give the most effective and economical control of brush regrowth in established fuelbreaks. Another study concerned shrub seed production, dispersal, and deposition on chaparral vegetation to develop better techniques for reducing the volume of hazardous brush fuels.

Other studies involved development of a low volume shrub that would slow down or repel fires and the use of sheep to reduce fuel volume on fuelbreaks. Studies to determine fuel properties affecting fire behavior of chamise (*Adenostoma fasciculatum*) and other species were included. North Mountain was also the site of wind pattern investigations to compare collected wind data with predictions from theoretical models of valley convections *(fig. 5)*.

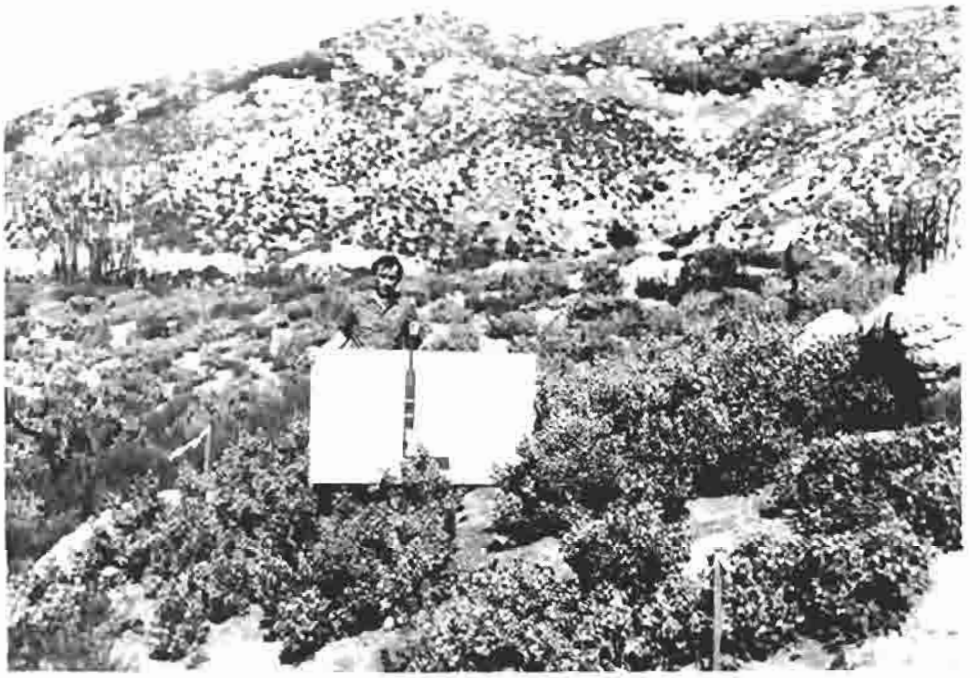


Figure 4—*The use of growth inhibitors on this previously burned site decreased the vegetative growth of the sprouts.*

CLIMATE

The climate of the NMEA is typically Mediterranean. Due to its inland location, summers can be quite hot and dry, and winters cool and wet. Mean maximum temperatures over 30°C and relative humidity values below 35 percent are typical for California inland stations.

Mean temperatures for Hemet (8 km southwest) are as follows:

	January	July
Minimum	3°C	15°C
Maximum	16°C	32°C

The annual precipitation is only about 250 millimeters. Rain falls primarily between October and April. January is typically the wettest month, with some 50 millimeters of precipitation.

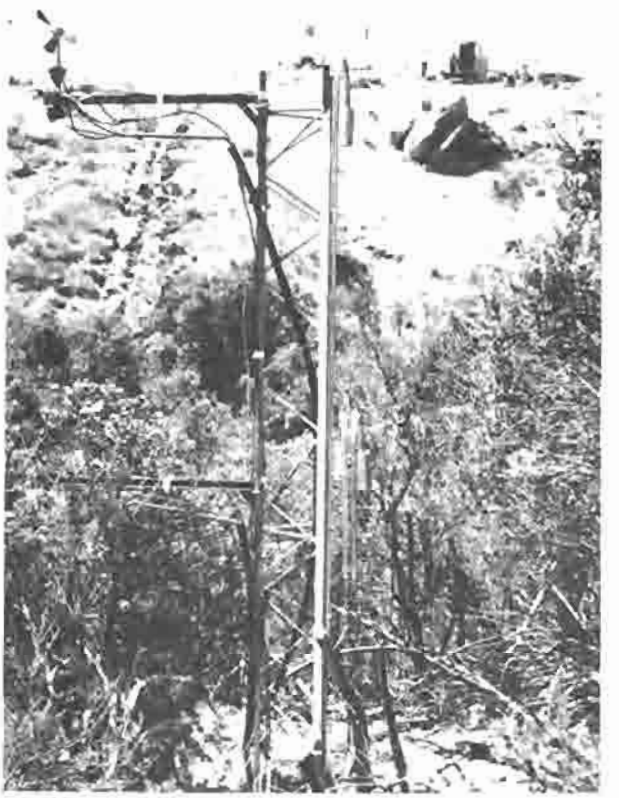


Figure 5—*Surface weather data were used for meteorological research related to predicting wind velocities.*

SOILS

Soils throughout most of the Experimental Area are derived from granitic rocks. They vary considerably in depth, are low in organic matter, are moderately coarse to very coarse, and neutral to slightly acid with the pH ranging from 6.5 to 5.8. They are low in fertility and have relatively low water holding capacity. Some soils on rolling-to-steep uplands are moderately coarse Lithosols developed from mica schists. The surface texture of these soils is predominately sandy loam, but grades into clay loam a few inches below the surface. These soils are also low in fertility, and are moderately permeable with medium to rapid runoff. Structural development is lacking throughout the profile.

MAIN COMMUNITIES

The plant community is primarily of the Shrub Formation (Paysen and others 1980). The major subformations are the Chaparral Subformation (Chamise, Manzanita, Ceanothus, Mountain Mahogany, and Scrub Oak Series) and the Soft Chaparral Subformation (California Buckwheat Series). Several other series are present in minor and varying amounts.

DATA BASES

Aerial photographs are available: 1:20,000 vertical aerial photographs (1961), and oblique aerial photographs (1964). A variety of maps are available: 7.5- and 15-minute topographic maps, 7.5-minute orthophotographic maps, and field-drawn vegetation maps at the series level. Wildfire history maps go back to about the 1930's.[6]

[6]Available from the San Bernardino National Forest, San Bernardino, Calif.; and the California Department of Forestry and Fire Protection, Sacramento.

EXAMPLES OF RESEARCH

- Fuel physical and chemical properties, and arrangement
- Short- and long-term recovery from prescribed fires under varying conditions *(fig. 6)*
- Factors that affect hydrologic processes, vegetation dynamics, air pollution, and nutrient cycling
- Ecological and physiological studies of chaparral.

There is also a need to establish a long-term meteorological study site or sites in southern California brush fields, to avoid site-use conflicts from possible vegetation manipulations and to help better understand the meteorological components of management. North Mountain has such areas and is particularly attractive from this standpoint.

Figure 6—*Associated with fuelbreak research, prescribed fire was studied as an alternative treatment to mechanical and chemical methods.*

FACILITIES

No offices, laboratories, or living facilities are within the NMEA. The Forest Fire Laboratory and the University of California in Riverside are within an hour's drive of the Area.

The Vista Grande Ranger Station (San Bernardino National Forest) is located approximately 5 kilometers from the east entrance to the NMEA.

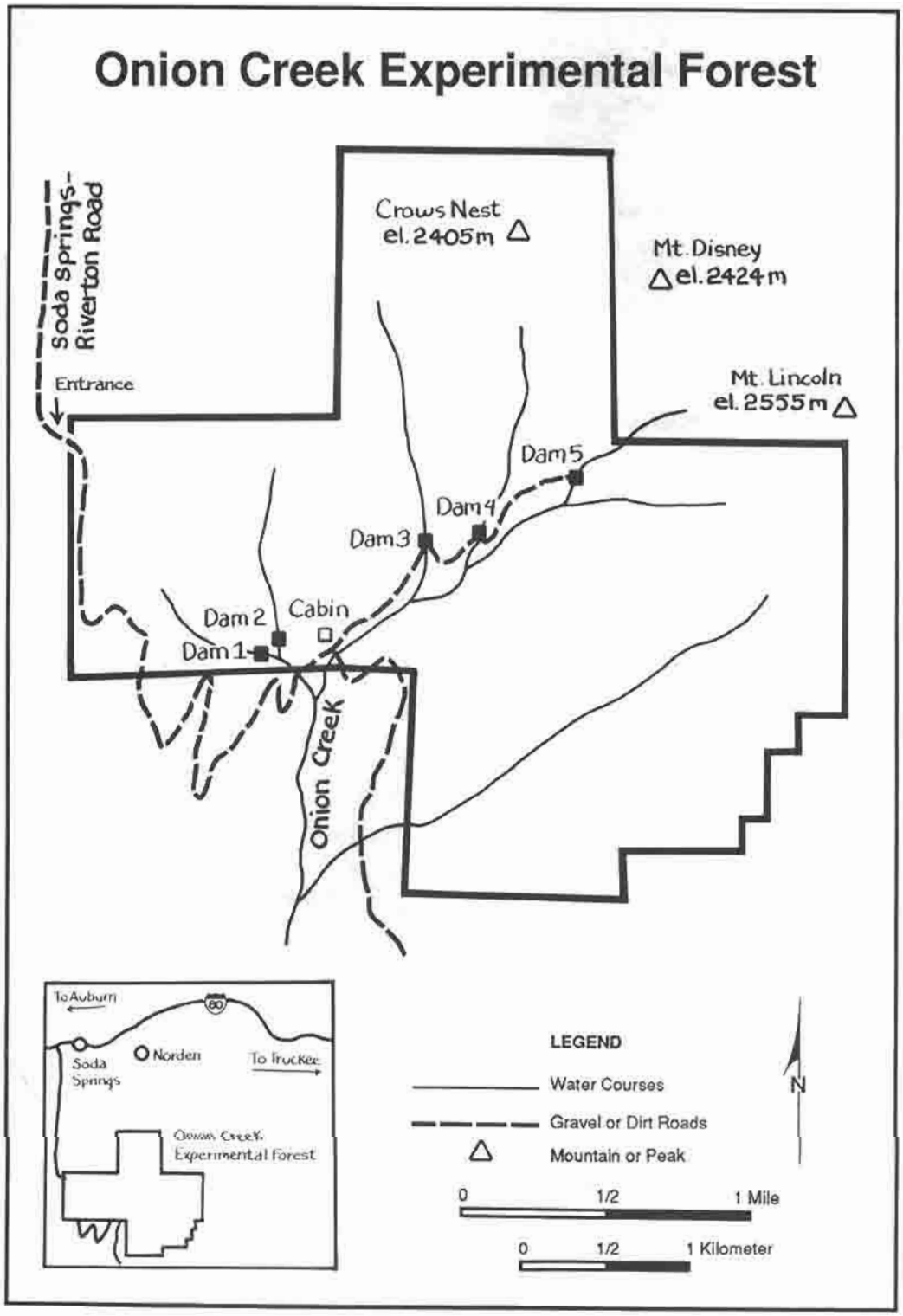
CONTACT ADDRESS

Project Leader
Prescribed Fire for California Chaparral and Associated Ecosystems
Forest Fire Laboratory
4955 Canyon Crest Drive
Riverside, California 92507
(714) 351-6570

LOCATION

The NMEA is located in Riverside County. The nearest full facility community is Banning—located 5 kilometers north of the NMEA boundary (see map). Beaumont and Hemet are also within 8 kilometers of the boundary. Elevation ranges from 460 meters to 1328 meters.

Road access to the NMEA is best from Banning/Idyllwild Highway, State Route 243. Due to the limited use of the area, road maintenance is infrequent and minimal, at this writing.


Onion Creek Experimental Forest
Soda Springs-Riverton Road
Entrance
Crows Nest el. 2405m
Mt. Disney el. 2424m
Mt. Lincoln el. 2555m
Dam 5
Dam 4
Dam 3
Dam 2
Dam 1
Cabin
Onion Creek
To Auburn
80
Norden
Soda Springs
To Truckee
Onion Creek Experimental Forest
LEGEND
Water Courses
Gravel or Dirt Roads
Mountain or Peak
N
0 1/2 1 Mile
0 1/2 1 Kilometer

ONION CREEK
Experimental Forest

The Onion Creek Experimental Forest (OCEF) was established in 1958 to develop techniques for increasing water yields from forested lands in the Sierra Nevada snow zone. OCEF encompasses about 1200 hectares in five main subbasins. The aspect is variable but generally southwest.

Harvest disturbance is minimal. Approximately 20 percent of the northwestern portion of OCEF was harvested in the early 1900's.

Mapped geologic units include Miocene pyroclastics with Andesitic mudflow breccias, volcanic conglomerate, and some tuff. Quaternary glacial deposits include Pleistocene moraines, glacial drift and fluvioglacial sand and gravel. No mineralization of economic significance is known to exist and no mining claims are recorded. A portion of OCEF is formally withdrawn from mineral entry.

An ecological survey of a portion of the Experimental Forest listed major forest plant species including red fir *(Abies magnifica* A. Murr.), white fir *(A. concolor* var. *lowiana* [Gord.] Lemm.), sugar pine *(Pinus lambertiana* Dougl.), Jeffrey pine *(P. jeffreyi* Grev. & Balf.), western white pine *(P. monticola* Dougl.), lodgepole pine *(P. contorta* Dougl. ex Laud.), incense-cedar (*Libocedrus decurrens* Torr.), mountain hemlock *(Tsuga mertensiana* [Bong.] Carr.), and western juniper *(Juniperus occidentalis* Hook.) (Talley 1977).

Grazing continues on OCEF. Approximately 200 animals pass through it over a 3- to 4-day period twice each year.

Atmospheric deposition has not been measured on the Forest. However, annual hydrogen ion loading at the nearby Central Sierra Snow Laboratory of the Pacific Southwest Research Station has ranged from 7 to 10 milligrams per square meter since 1983. Mean sulfate ion loading since 1983 is 4.5 grams per square meter per year at the Snow Laboratory.

CLIMATE

The climate is typically Mediterranean, with moist, relatively mild winters and dry, warm summers. Annual precipitation is about 1060 millimeters at 1830 meters elevation, with 85-90 percent falling as snow during the winter. Mean monthly air temperatures range from -1°C in January to 15°C in July. Monthly minimum temperatures vary from a low of -14°C in January to 1°C in July while monthly maximum temperatures range from about 13°C in January to 30°C in July.

SOILS

Soils are volcanic Xerumbrepts and have been classified as follows: Ahart/rock outcrop (15 pct of the Experimental Forest area), Ahart/Waca (25 pct), Gefo variate (5 pct), Meiss (5 pct), Tallac (15 pct), Waca/Meiss (5 pct), Waca/Windy (5 pct), miscellaneous (20 pct). Cation exchange capacities are 25-35 milliequivalents per 100 grams (sum of cations) or 20-30 milliequivalents per 100 grams (ammonium acetate). A Soil Resource Inventory map (third order soil survey) is available.

MAIN COMMUNITIES

Red Fir (SAF 207), White Fir (SAF 211), Jeffrey Pine (SAF 247), and dry meadow are the main plant communities (Eyre 1980).

DATA BASES

Climatic Data

Air temperature, relative humidity, and precipitation (continuous strip chart) data are available since 1976. Coverage before 1976 is sporadic.

Hydrologic Data

Continuous stream discharge records are available at five subbasins with areas and mean annual discharges as follows:

Area	Discharge
km^2	m^3/yr
[1]2.1	1.3×10^6
[2]1.7	1.3×10^6
[2]1.0	7.7×10^5
[2]1.2	1.1×10^6
[2]0.5	3.8×10^5

[1] October 1958 to September 1964.
[2] October 1958 to September 1964, and October 1965 to September 1967.

A sixth gauging station monitors the entire 9.3-km^2 basin. The 20-year mean annual discharge (1960 to 1980) for the basin is 8.8 x 10^6 cubic meters per year. The "main stem" gauge has been in operation since August 1959, except for a 2-year period in the early 1980's. The gauge on the smallest subbasin was reactivated in 1983, and has been in operation since then. Snowpack depth and water equivalent have been monitored monthly at a snow course since 1937.

EXAMPLES OF RESEARCH

- Snow hydrology
- Freshwater aquatic biology
- Materials evaluation.

FACILITIES

Facilities are minimal: one small cabin with bunk beds for four and an outbuilding; no drinking water. Commercial accommodations are available 11 kilometers away at Soda Springs. The Central Sierra Snow Laboratory is 11 kilometers distant.

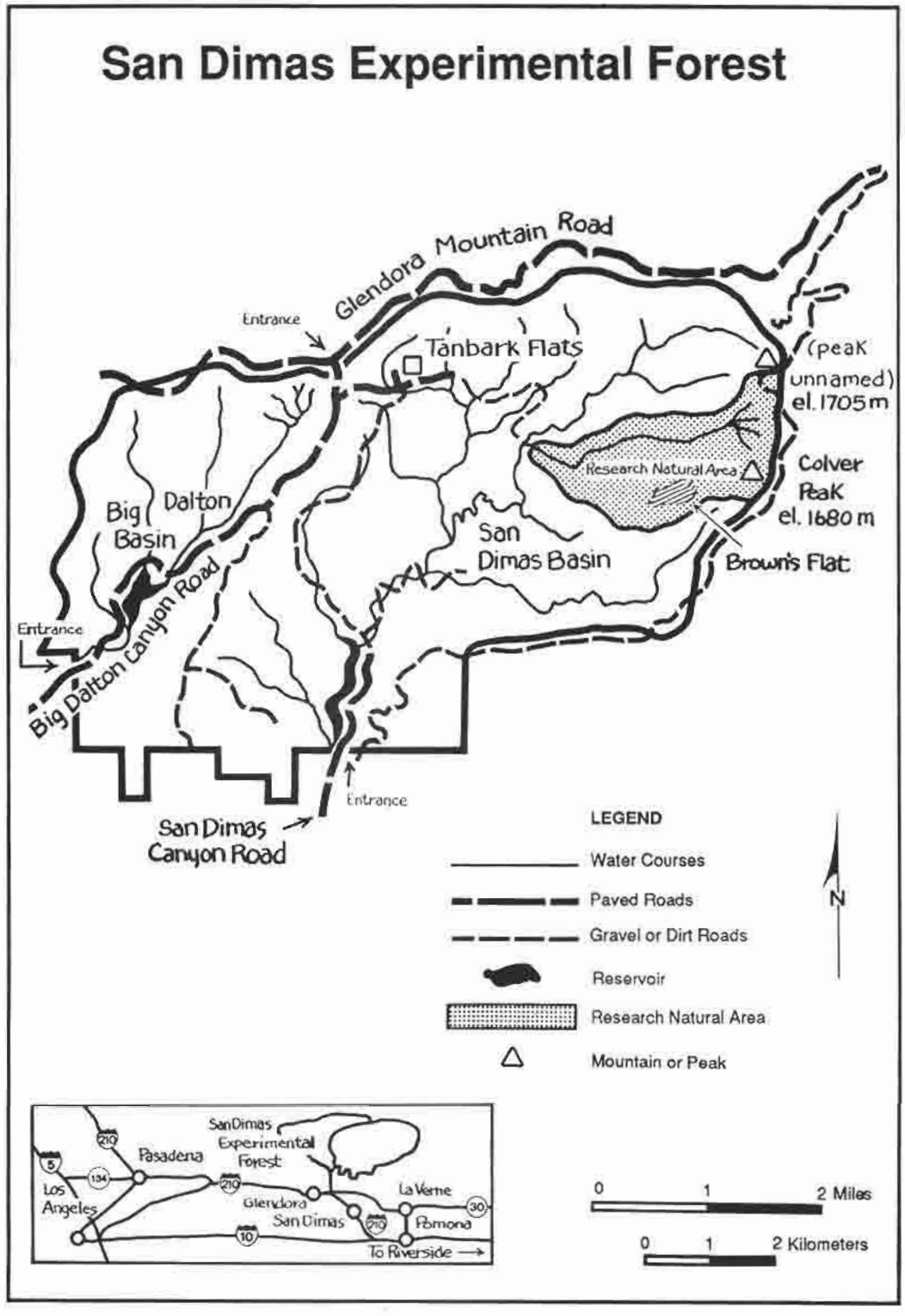
CONTACT ADDRESS

Project Leader
Environmental Hydrology of the California Snow Zone
Pacific Southwest Research Station
P.O. Box 245
Berkeley, California 94701
(415) 486-3456

LOCATION

The forest is in the north drainage of the American River about 20 kilometers west of Truckee, on the Tahoe National Forest (see map). It is 11 kilometers south of Soda Springs, off Old Highway 40. Latitude is 39°17′ N., longitude is 120°21′15″ W. Elevation ranges from 1830 to 2590 meters.

Main access is along approximately 6.5 kilometers of poorly graded county road known as the Soda Springs-Riverton Road.


San Dimas Experimental Forest
Glendora Mountain Road
Entrance
Tanbark Flats
(peak unnamed) el. 1705 m
Research Natural Area
Colver Peak el. 1680 m
Big Dalton Basin
San Dimas Basin
Brown's Flat
Entrance
Big Dalton Canyon Road
Entrance
San Dimas Canyon Road
LEGEND
Water Courses
Paved Roads
Gravel or Dirt Roads
Reservoir
Research Natural Area
Mountain or Peak
N
San Dimas Experimental Forest
Pasadena
Los Angeles
Glendora
San Dimas
La Verne
Pomona
To Riverside
0 1 2 Miles
0 1 2 Kilometers

SAN DIMAS
Experimental Forest

The San Dimas Experimental Forest (SDEF) contains some of the earliest and longest records from continuously monitored, experimental watersheds in the United States. It has been designated by the Man and the Biosphere Program of the United Nations as a Biosphere Reserve and by the National Science Foundation and the Institute of Ecology as an Experimental Ecological Reserve. Fern Canyon, a 550-hectare tributary to San Dimas Canyon, was set aside in 1972 as a Research Natural Area (RNA)—a pristine area where only nondestructive research can take place. Included in the area is Brown's Flat, a locally unique, mountain meadow that supports a grove of ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.).

The Experimental Forest was established in response to the need for an outdoor laboratory in southern California to study various aspects of watershed management. The need for an experimental forest in southern California had been recognized since the founding of the California Forest Experiment Station (now Pacific Southwest Research Station) in 1926. Edward I. Kotok, Station Director, Charles J. Kraebel of the Station's research staff, and Walter C. Lowdermilk of the University of California College of Forestry evaluated several potential sites and formally recommended the San Dimas site in May 1932. Research operations began in January 1933 when J. Donald Sinclair arrived as its first director (then called scientist-in-charge), and this has long been regarded as the actual (if unofficial) beginning of the Experimental Forest. The Forest was formally established on March 28, 1934.

The Experimental Forest is located within the Angeles National Forest and comprises 6786 ha of steep, rugged terrain in the southeastern San Gabriel Mountains, with elevations ranging from 400 to 1700 m and slopes averaging 68 percent (34 degrees). It encompasses the entire upper watersheds of the Big Dalton and San Dimas drainage basins. Each of these basins is controlled by a large flood control dam, built and maintained by the Los Angeles County Department of Public Works. The two dams are located within the Experimental Forest just

Figure 7—*Stream gauging station in Volfe Canyon (Watershed 09) measuring streamflow through its 0.9-meter flume (note gate at right and slightly above flume). Directly behind is the 2.4-meter flume used for measuring high flows. Discharge shown in this photo is 450 liters/second. During low flows the gates are closed and flow is measured by a 90° v-notch wier to the left of the instrument house.*

upstream from the mountain front. For research purposes, these two basins are subdivided into 10 major watershed units with areas of 260 to 650 ha, and over 40 smaller watersheds ranging from less than 2 ha to over 40 ha. These watersheds are all equipped with stream gauging stations (*fig. 7*), and many also have debris basins for sedimentation studies.

A climatic station has been maintained at Tanbark Flats, the field headquarters within the Experimental Forest, for over 50 years. Other instruments currently in operation include eight recording raingauges, six stream gauging stations and four debris basins to measure sedimentation. Much larger networks of these instruments were maintained in the past, and data gathered from all the instruments are still available. A seismograph is located in Fern Canyon, and the U.S. Geological Survey maintains a pore-water pressure monitoring station on the east side of Bell Canyon. Tanbark Flats has an acid deposition monitoring site for the National Trends Network as part of the National Acid Deposition Program.

Figure 8—*View of a portion of the San Dimas Experimental Forest (ca. 1935) looking northwest from above the field headquarters at Tanbark Flats—the buildings in the near middleground. The large cleared area behind the buildings is the lysimeter installation for which the Experimental Forest is noted. Glendora Ridge, the level area in the background, marks the northern boundary of the Forest.*

The most elaborate research facility on the Experimental Forest is the large lysimeter installation at Tanbark Flats (*fig. 8*). It consists of 26 large lysimeters and numerous smaller ones. Although the studies for which it was originally designed in the early 1930's have ended, it is still used for a variety of experiments requiring relatively small, controlled soil environments. It remains the largest structure of its type ever built.

The course of research studies has changed considerably since the establishment of the San Dimas Experimental Forest. The original research was directed towards increasing water yield, but new problems have led to new avenues of research. Currently, the principal efforts are directed towards studying erosion and sediment movement, water quality, postfire ecosystem recovery and the effects of smog, as well as the continuation of several earlier programs. Because of its accessibility to several nearby universities, research by their staffs and faculties is an important part of the work at San Dimas. The forest also serves as an outdoor teaching laboratory for local colleges, high schools, and educational groups.

Most major chaparral species are represented on SDEF. The dominant species include chamise *(Adenostoma fasciculatum* H. & A.), *Ceanothus* spp., California scrub oak *(Quercus dumosa* Nutt.), sumac *(Rhus* spp.) and manzanita *(Arctostaphylos* spp.). Soft chaparral species include yerba santa *(Eriodictyon* spp.), California buckwheat *(Eriogonum fasciculatum* Benth.), *Lotus* spp., and lupine *(Lupinus* spp.).

Large grass covered areas in Bell and Monroe Canyons are the result of studies aimed at increasing water yield by converting brush to grass. Begun in the late 1950's, this conversion produced some unexpected results in the form of increased ground failures. The effects of this watershed manipulation are still being studied.

Many tree species, especially coast live oak *(Quercus agrifolia* Nee.), California sycamore (*Platanus racemosa* Nutt.), California bay *(Umbellularia californica* [H. & A.] Nutt.), white alder *(Alnus rhombifolia* Nutt.), and bigleaf maple (*Acer macrophyllum* Pursh) can be found in and near the riparian zones. Several old stands of bigcone Douglas-fir *(Pseudotsuga macrocarpa* [Vasey] Mayr.) are gradually disappearing, possibly because of recurring fires and smog damage. At higher elevations on north-facing slopes there are woodlands with large stands of canyon live oak *(Quercus chrysolepis* Liebm.) interspersed with bigcone Douglas-

Figure 9—*Oak woodland chaparral vegetation in the Fern Canyon Research Natural Area is typical of the higher elevations on the San Dimas Experimental Forest. Bigcone Douglas-fir* (Pseudotsuga macrocarpa) *in the right center of the photograph is a typical associate of chaparral types at this elevation—about 1515 meters. (Photo ca. 1935)*

fir plus a few ponderosa pine and sugar pine *(Pinus lambertiana* Dougl.) *(fig. 9)*. (An arboretum featuring both native and introduced trees is located at Tanbark Flats).

Wildlife is abundant and varied in the San Dimas Experimental Forest. Over 40 species of mammals and over 180 species of birds either live in the experimental forest or visit it annually. In addition there are over 35 species of reptiles and amphibians, and numerous migratory waterfowl and birds associated with urban environments.

A publication describing the research history of the Experimental Forest includes complete species lists for both plants and animals (Dunn and others 1988).

CLIMATE

The climate is typically Mediterranean with hot, dry summers and cool, wet winters. Annual precipitation at Tanbark Flats is 705 millimeters and falls primarily as rain. Snow is common only in the northeastern part of the Forest where elevations exceed 1500 meters. The rainy season runs from November through March. The coolest month of the year is January and the warmest is August. Mean monthly temperatures at Tanbark Flats are shown below:

Month	Mean temperature °C
January	8.5
February	9.1
March	9.6
April	12.1
May	14.0
June	17.6
July	22.3
August	22.6
September	21.1
October	16.6
November	12.3
December	10.0

SOILS

The soils of the Experimental Forest are generally shallow, rocky and poorly developed. Most are derived from one of two parent materials—a Precambrian complex of gneisses and schists, and a Mesozoic igneous complex (primarily tonalite, and granodiorite). The most extensive soil groups are coarse-loamy, mixed, thermic, shallow Typic Xerorthents and fine-loamy, mixed, thermic Mollic Haploxeralfs, the latter developing primarily on the granitic parent materials and the former on both types of parent material. At higher elevations (above 1370 m) these same parent materials underlie fine-loamy, mixed, mesic Mollic Haploxeralfs. Around Johnstone Peak in the southwestern part of the Forest is a small area of fine, mixed, thermic Typic Argixerolls developed over a Miocene volcanic parent material (andesite and rhyolite). On gentler slopes small areas of coarse-loamy, mixed, thermic Pachic Haploxerolls can be found. These are underlain by parent materials of schist and andesite.

MAIN COMMUNITIES

According to Kuchler's (1977) classification there are three communities on the Experimental Forest: chaparral (Kuchler 29), coastal sagebrush (Kuchler 32), and California mixed hardwood forest (Kuchler 23). Locally, chaparral is called "hard chaparral" and coastal sagebrush is called "soft chaparral." The California mixed evergreen type includes two communities that are locally recognized as distinct types—oak woodland *(Quercus* spp./*Pseudotsuga macrocarpa)* and riparian woodland *(Quercus/Alnus/Acer/Platanus)*.

DATA BASES

Reports and Publications

A master file of over 500 reports and publications has resulted from work done on the Experimental Forest. In addition to published papers, this file includes unpublished reports, surveys, study plans and miscellaneous data, as well as complete plant and animal species lists.

Long-Term Records (more than 20 years)

Available long-term records cover precipitation, temperature, relative humidity, wind direction and speed, evaporation, streamflow and sediment yield. The rainfall records include the 62-year record from Tanbark Flats and the 110-year record from Glendora. For the local area (Los Angeles County), the Glendora record is second in length only to the 113-year record from downtown Los Angeles.

Short-Term Records (less than 20 years)

Short-term records cover solar radiation, hillslope runoff and erosion, acid rainfall, dry and wet deposition of air pollutants, and chemical pollutants in streamflow (especially nitrates).

Maps and Aerial Photos

Available maps include soils, vegetation, geology and topographic features (such as slope facets, steepness, aspect). Aerial photo sets date back to the late 1930's. Most sets cover only part of the Experimental Forest.

EXAMPLES OF RESEARCH

- Fire effects and postfire recovery of watersheds
  - Effects of fire on ecosystems
  - Effects of fire on the physical environment
  - Postfire recovery of ecosystems
  - Postfire erosion and recovery
  - Postfire water yields
- Erosion and sedimentation
  - Hillslope processes
  - Sediment storage and movement in channels
  - Debris flow dynamics
  - Sediment budgets
- Chaparral and woodland ecology
- Air quality
  - Acid rain/fog
  - Atmospheric deposition
- Nutrient cycling

- Wildland hydrology
  - Water quality
  - Water yield
  - Soil water and groundwater movement
- Prescribed fire applications
- Geologic hazards
- Wildlife studies
- Climatic studies.

FACILITIES

The field headquarters at Tanbark Flats has office space, living quarters and laboratory facilities, all with running water, electricity, and telephone communications. The availability of these facilities is limited and must be scheduled in advance. Tanbark Flats also has an all-purpose shop, limited facilities for equipment storage, a fireproof vault for records storage, a dining and assembly hall, and a heliport.

Field research facilities include over 50 gauged watersheds, the lysimeter complex, the Fern Canyon Research Natural Area, two major dams and reservoirs and three plantations of domestic and introduced trees. The gauged watersheds range in area from 1 to 4200 hectares, and many have debris basins for trapping sediment.

Other features of the Forest include internal access via 10 roads and an extensive network of trails and availability of labor crews on request (this may be limited by other demands, especially during fire season). The entire Experimental Forest is closed to the public and entry requires the issue of a use permit and necessary keys. This helps insure that ongoing studies are subjected to a minimum of disturbance.

CONTACT ADDRESSES

Project Leader
Ecology and Fire Effects in Mediterranean Ecosystems
Forest Fire Laboratory
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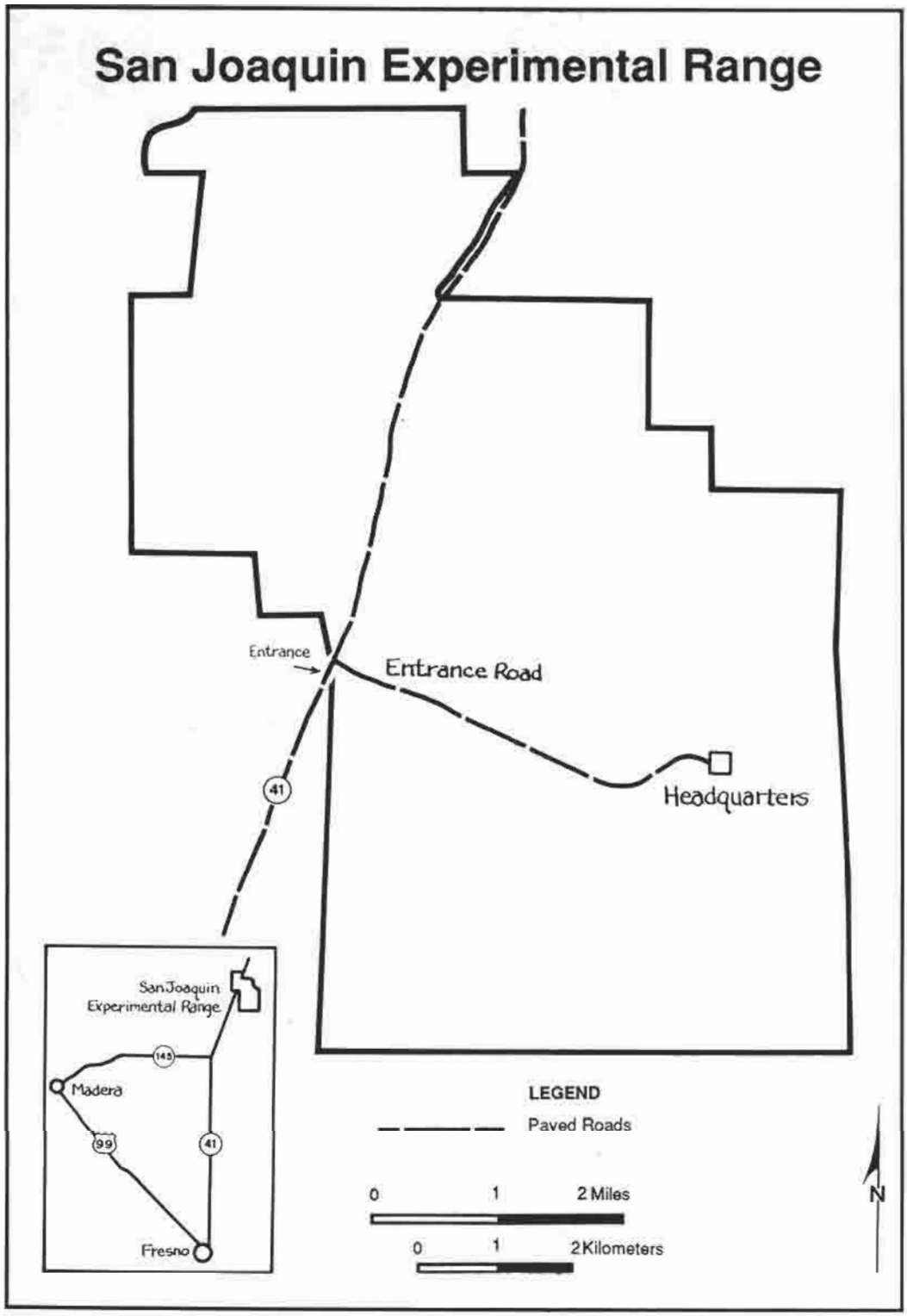
Riverside, CA 92507
(714) 351-6560
and
Forest Manager
San Dimas Experimental Forest
110 N. Wabash Avenue
Glendora, CA 91740
(818) 963-5936

LOCATION

The San Dimas Experimental Forest (lat. 34°12′ N., long. 117°46′ W.) is bordered on the south by the cities of Glendora, San Dimas, and La Verne (see map). Elevation ranges from 400 to 1700 meters.

Primary access is from Glendora via Glendora Mountain Road and Big Dalton Canyon Road. The field headquarters at Tanbark Flats is 16 kilometers from Glendora via Big Dalton Road and 24 kilometers via Glendora Mountain Road. Access is also available from the town of San Dimas.

The forest manager's office is located in Glendora at the Mount Baldy District Ranger Station. Limited office space is available at the manager's office. Also available in Glendora are clerical support to aid in searching records and access to the Forest Service-wide computer network. The Forest Fire Laboratory of the Pacific Southwest Research Station is 64 kilometers east of the Glendora office via freeway, in Riverside.


San Joaquin Experimental Range
Entrance
Entrance Road
Headquarters
41
San Joaquin Experimental Range
145
Madera
99
41
Fresno
LEGEND
Paved Roads
0 1 2 Miles
0 1 2 Kilometers
N

SAN JOAQUIN
Experimental Range

The San Joaquin Experimental Range (SJER) has been in existence since 1934. It was purchased by the Forest Service and is managed by California State University, Fresno, for research and educational purposes under a long-term agreement with the Pacific Southwest Research Station. SJER was the Annual Grassland Biome site for the International Biological Program during the 1970's and is currently a Man and the Biosphere Reserve.

SJER consists of about 1820 hectares (including a 33-ha livestock exclosure built in 1934), cross-fenced into 34 range units varying in size from 7 to 295 hectares *(fig. 10)*.

Range Unit	Total (Protected) Hectares	Range Unit	Total (Protected) Hectares
1	108 (0.7)	31	19
2	108 (0.7)	32	11
3-1	28	33	8
3-2	24 (0.7)	41	32
3-3	25	42	13
4-1	32	43	14
4-2	40	51	22 (4)
4-3	35	52	8
5-1	30	53	7
5-2	29	61	30
5-3	25	62	13
6-2	26	63	13
6-3	34	71	98
7	80	72	73
8	105	73	86 (2)
9	295	80	33 (33)
10	211	90	24
		Total	1739 (41)

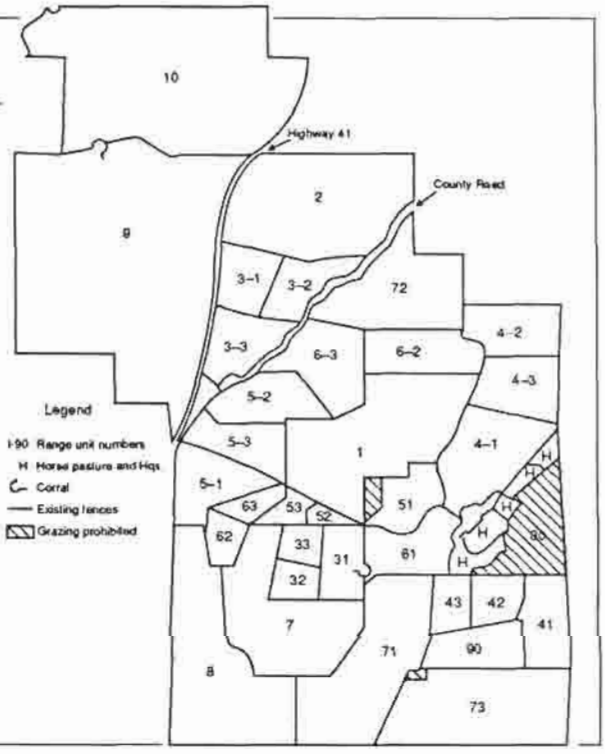


Figure 10—*Numbered range units on the San Joaquin Experimental Range. Area of range units is listed at left. Hectares protected from livestock are in parentheses.*

Vegetation on SJER includes annual grasslands and blue oak-digger pine woodlands *(fig. 11)*. Annual grasslands consist largely of introduced grass species, such as wild oat *(Avena fatua)*, soft chess *(Bromus mollis)*, ripgut brome *(Bromus diandrus)*, red brome *(Bromus rubens)*, wild barley *(Hordeum* spp.), and foxtail fescue *(Vulpia megalura)*. Common forbs include broadleaf filaree *(Erodium botrys)*, redstem filaree *(Erodium circutarium)*, true clovers *(Trifolium* spp.), popcorn flower *(Plagiobothrys nothofulvus)*, turkey mullein *(Eremocarpus setigerus)*, and many others. In the blue oak woodland, the most common trees are blue oak *(Quercus douglasii)*, interior live oak *(Quercus wislizenii)*, digger pine *(Pinus sabiniana)*, and California buckeye *(Aesculus californica)*. Wedgeleaf ceanothus (*Ceanothus cuneatus*) shrubs are also common.

Cattle on SJER consist of a breeding cow herd (about 275 cows with or without calves), owned by California State University, Fresno. Except for grazing systems experiments, grazing is continuous year-long *(fig. 12)*.

Figure 11—*Much of the San Joaquin Experimental Range consists of blue oak savanna.*

CLIMATE

The climate is typically Mediterranean, with moist, mild winters and dry, hot summers. Annual precipitation ranges from 254 to 813 millimeters, with a mean of 483 millimeters and most falling as rain between October and April. Monthly mean air temperatures range from about 6°C in January to about 27°C in July. Monthly minimum temperatures vary from a low of slightly above freezing in January to over 16°C in July. Monthly maximum temperatures range from about 10°C in January to almost 38°C in July.

SOILS

Soils are of granitic origin and most are less than 76 centimeters deep. On upland sites, Ahwahnee Series (Mollic Haplustalfs) soils are common, covering about 96 percent of SJER. These typically have A horizons that are grayish brown to brown, slightly acidic, and low in organic matter content. Visalia Series soils (Cumulic Haploxerolls) are found on alluvial or swale sites, are generally darker, deeper, and more productive than Ahwahnee Series soils.

Figure 12—*Grazing by domestic cattle is a major land use at the San Joaquin Experimental Range.*

MAIN COMMUNITIES

Blue Oak–Digger Pine (Eyre 1980), California Prairie, and Blue Oak-Digger Pine Forest (Kuchler 1977) are the main communities on the Experimental Range.

DATA BASES

Climatic Data

Daily precipitation and daily temperatures (minimum and maximum) are available since 1934.

Plant Data

Peak forage production is available since 1934. For some years, detailed seasonal production and composition data are also available. A wide variety of producer and consumer data were collected for 3 years (1973-1975) when SJER was the Annual Grassland Biome Site for the U.S. International Biological Program.

Livestock Data

Figures on stocking rates and weight gains are available for various years.

Wildlife Data

Biological data for various years are available for western rattlesnakes *(Crotalus viridis)*, red-tailed hawks *(Buteo jamaicensis)*, California quail *(Callipepla californica)*, California ground squirrels *(Spermophilus beecheyi)*, avian community structure, and other wildlife aspects.

EXAMPLES OF RESEARCH

- Oak ecology
- Wildlife habitat-relationships
- Bird population trends
- Livestock science.

FACILITIES

A variety of facilities is available *(fig. 13)*. Dormitory facilities are limited. Most summertime visitors prefer to obtain food and air-conditioned lodging in Fresno or Madera, both about 40 kilometers away. Shop and limited laboratory facilities are available for routine plant drying, sorting, and weighing. Some restrictions on facilities are imposed by previously scheduled use.

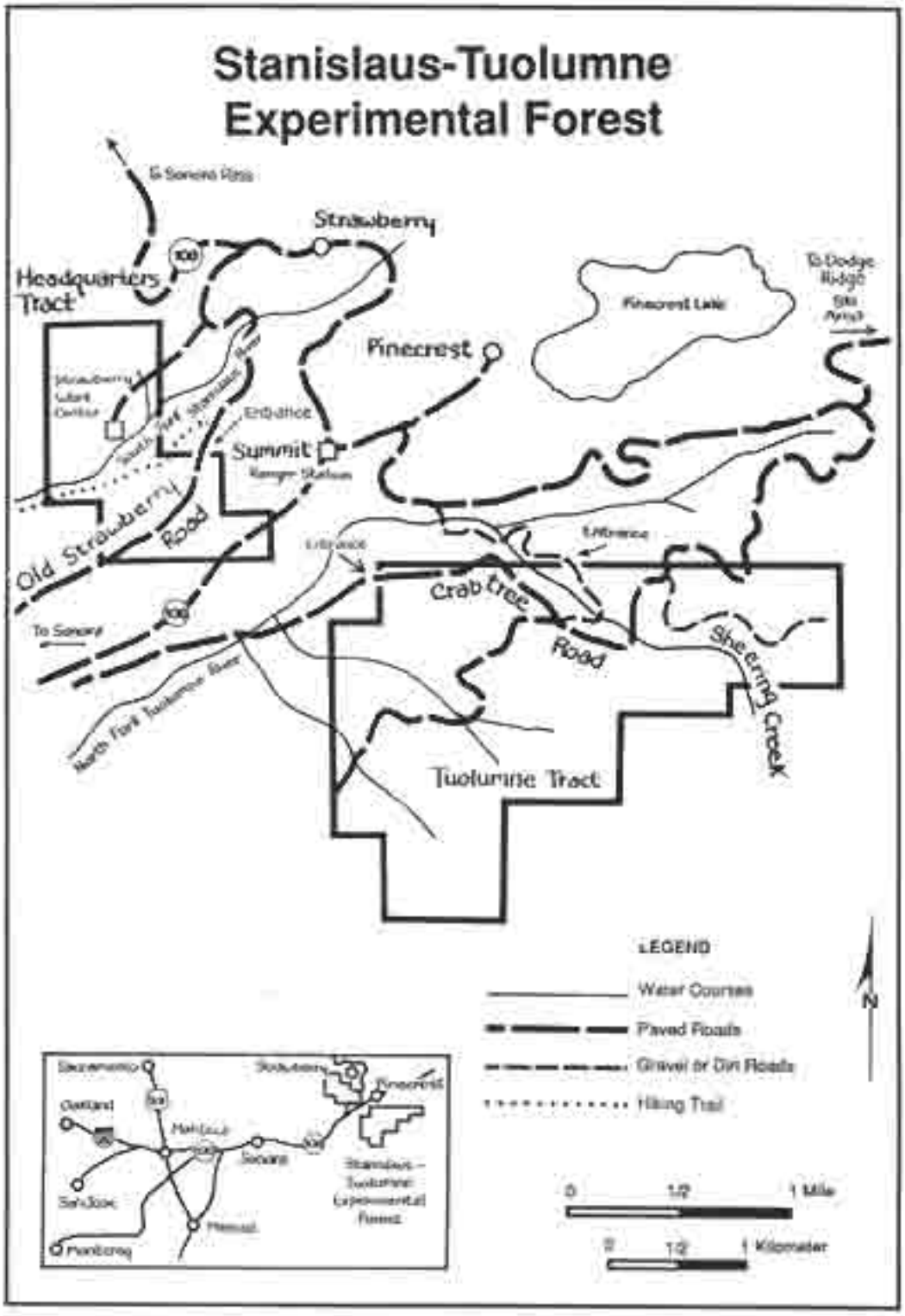
CONTACT ADDRESS

Manager
San Joaquin Experimental Range
24075 Highway 41
Coarsegold, CA 93614
(209) 868-3349

LOCATION

The San Joaquin Experimental Range is located about 40 kilometers north of Fresno, on Highway 41, in Madera County (see map). Latitude is 37°05′ N., and longitude is 119°45′ W. Elevation ranges from 210 to 520 meters.

Figure 13—*The office building also contains laboratory and conference facilities.*


Stanislaus-Tuolumne
Experimental Forest
To Sonora Pass
Strawberry
Headquarters
Tract
108
Pinecrest
Pinecrest Lake
To Dodge
Ridge
Ski
Area
Strawberry
Visitor
Center
North Fork Stanislaus River
Entrance
Summit
Ranger Station
Old Strawberry
Road
Entrance
Entrance
Crab tree
Road
Sheep Creek
To Sonora
108
North Fork Tuolumne River
Tuolumne Tract
LEGEND
Water Courses
Paved Roads
Gravel or Dirt Roads
Hiking Trail
N
0
1/2
1 Mile
0
1/2
1 Kilometer
Sacramento
Stockton
Pinecrest
Oakland
580
Modesto
120
Stanislaus -
Tuolumne
Experimental
Forest
San Jose
Merced
Pacheco

STANISLAUS-TUOLUMNE
Experimental Forest

The Stanislaus-Tuolumne Experimental Forest was formally designated on December 6, 1943, as a place for field studies and for demonstration of forest management practices in the Sierra Nevada mixed-conifer type. The Forest was selected, specifically, as typical of the high quality stands of the middle west slope of the Sierra Nevada.

Early research included studies on reproduction, planting, pruning, slash disposal, and lumber recovery. More recent studies involved climate, insects, mistletoe, harvest cutting, site preparation, herbicides, and root rots.

The Experimental Forest of about 600 hectares consists of two tracts. The Headquarters Tract, which straddles the South Fork of the Stanislaus River *(fig. 14)*, contains about 80 hectares. The Tuolumne Tract, which lies on the lower slope of Dodge Ridge on the south side of the North Fork of the Tuolumne River, contains about 520 hectares. About 57 hectares of the Headquarters Tract were logged in 1927 by the selection system. And 262 hectares of the Tuolumne Tract were harvested in 1948 and 1949 to convert old-growth to managed stands.

Figure 14—The Headquarters Tract of the Stanislaus-Tuolumne Experimental Forest is bisected by the South Fork of the Stanislaus River.

Obtaining adequate reproduction of sugar pine *(Pinus lambertiana* Dougl.) by natural seeding and planting was stressed by seedtree cuttings and small clearcuttings. Several plantations, areas of natural young-growth, and large blocks of diverse species and age classes that virtually are uncut, provide great potential for silvicultural and ecological research in this important and complex forest type *(fig. 15)*. This research potential was recognized by the United Nations Educational, Scientific and Cultural Organization's Program on Man and the Biosphere, which formally recognized the Forest as part of an international network of Biosphere Reserves in 1977.

CLIMATE

The climate is characterized by warm, dry summers and cold, wet winters. Annual precipitation averages 940 millimeters, more than half falling as snow between December 1 and March 31. Snow, in exceptional winters, may accumulate to depths over 3 meters. Some drifts persist until about May 20. Little precipitation falls during June through September. Air temperatures during the year usually range from -23°C to 35°C. Average monthly minimum and maximum air temperatures range from -7°C and 7°C for January to 6°C and 27°C for July. The growing season is about 112 days.

Figure 15—Large blocks of diverse species and age classes on the Stanislaus-Tuolumne Experimental Forest provide great potential for silvicultural and ecological research.

SOILS

Moderately deep, sandy to fine sandy loam soils of the Holland Series are widespread in the Experimental Forest. The soils are residual, derived from granite or diorite. On the higher slopes and ridges, soils from the lava caps are shallow and support poor tree growth. Overall, however, site quality is high. Site Index is estimated to be about 110 (Meyer 1938).

MAIN COMMUNITIES

The forest cover type on 546 hectares is Sierra Nevada Mixed Conifer (SAF 243), although it can be considered a variant because Douglas-fir *(Pseudotsuga menziesii* [Mirb.] Franco var. *menziesii)* is absent and Jeffrey pine *(Pinus jeffreyi* Grev. & Balf) is present (Eyre 1980). The Red Fir Forest Cover Type (SAF 207) covers 61 hectares.

DATA BASES

Climatological measurements including air and soil temperatures, relative humidity, barometric pressure, wind velocity, cloudiness, precipitation, and soil moisture were recorded at five sites. Beginning in 1932 and 1933, records were kept for 30 years at one site, 19 years at another site, and 11 years at the other three sites.[7] Trees in the Tuolumne Tract have been inventoried by stand-condition classes within 1-hectare divisions.[7]

Topographic maps and detailed maps of vegetation and ground conditions (each tree, boulder, downed log, and shrub) were prepared in the early 1930's on about 15 3-hectare plots.[7] The Stanislaus National Forest has mapped the soils to the family level.[8] This soil survey supersedes a more detailed survey conducted by University of California, Berkeley, students in 1942.[7]

EXAMPLES OF RESEARCH

- Population dynamics of dwarf mistletoe
- Control methods, and physiological effects of disease and insect pests on conifers.

[7]Data on file at the Pacific Southwest Research Station, Redding, Calif.
[8]Available from the Stanislaus National Forest, Sonora, Calif.

FACILITIES

The Stanislaus-Tuolumne Experimental Forest has no facilities. Temporary office space and equipment storage may be available at the Summit Ranger Station, Stanislaus National Forest, adjacent to the Experimental Forest. Food and lodging can be obtained in the communities of Pinecrest and Strawberry. Pinecrest is a large summer and winter recreation area, with resorts, campgrounds, organization camps, summer homes, swimming, boating, fishing, and hunting. Dodge Ridge Ski Area is nearby. Strawberry is a smaller summer-home and resort community.

CONTACT ADDRESS

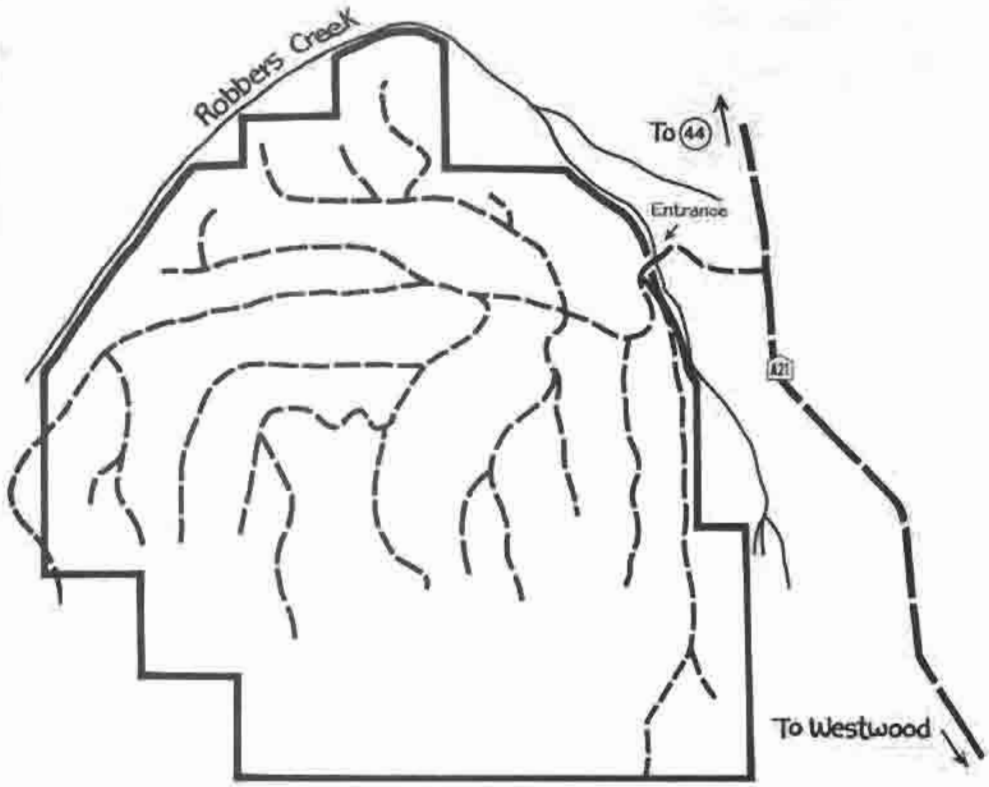
Project Leader
Silviculture of California Conifer Types
Silviculture Laboratory
2400 Washington Avenue
Redding, California 96001
(916) 246-5342

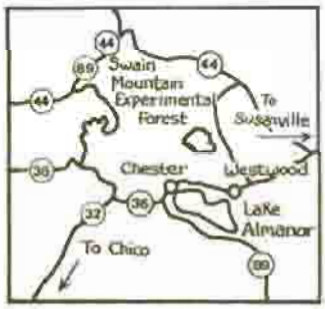
LOCATION

The Experimental Forest's two tracts (lat. 38°03'N., long. 119°57'W.) lie within T. 4 N., R. 18 E., MDM. The Headquarters Tract, 1.6 kilometers south of Strawberry, and the Tuolumne Tract, 1.6 kilometers south of Pinecrest, are 51 road kilometers east of Sonora, Tuolumne County (see map). Elevations range from 1590 to 1950 meters.

The Forest can be reached via State Route 108, an all-weather road. The road network within the Forest is unpaved except for Crabtree Road (4N26). None is maintained during the winter to avoid conflict with designated cross-country ski trails.

Swain Mountain Experimental Forest





LEGEND

Water Courses

Paved Roads

Gravel or Dirt Roads

0 1/2 1 Mile

0 1/2 1 Kilometer

N

SWAIN MOUNTAIN
Experimental Forest

The Swain Mountain Experimental Forest was formally designated on March 22, 1932, as a place for field studies and demonstration of forest management practices in the true-fir types of California. Chosen specifically for the quality and extent of the fir timber present, the 2492-hectare Experimental Forest occupies all of Swain Mountain, a volcanic cone composed of vesicular andesite and ash. Stand volume can be high, up to 2058 cubic meters per hectare on one 1.6-hectare block, although the uncut virgin stands more commonly contain 840-1120 cubic meters per hectare.

The Experimental Forest largely sat idle for about 20 years until, in the early 1950's, preparation for an active program of regeneration research began with forest type mapping and construction of the initial road system. Initial research was to determine factors related to wind damage in the old-growth stands and to develop criteria for selection of wind firm seed trees. Seed dispersal was measured for both red fir *(Abies magnifica* A. Murr.) and white fir *(A. concolor* var. *lowiana* [Gord.] Lemm.). Relationships between natural regeneration and site factors such as soil temperature and moisture, insolation intensity, site preparation, and competing vegetation were explored. Snow surveys were taken for nearly 15 years in the clearcut and unlogged stands. Cone production in uncut stands and along clearcut strips was followed for 16 years.

The second round of heavy research cutting in the early 1970's centered again on natural regeneration and the impact of shelterwood density and clearcut size and shape. During the 1960's and 1970's, studies of impacts of dwarf mistletoe and fertilization began as did studies of growth and yield of mixed fir stands. Long-term studies of response of severely suppressed true fir to release from overstory competition were installed. The information gained from this work constitutes the basis for true fir management in California.

The third and current period of heavy cutting is to extend the shelterwood research results to operationally large areas and create extensive acreage of fir regeneration for future research. To these ends about one third of the Forest is currently being regenerated through shelterwood cutting.

CLIMATE

The climate at Swain Mountain can be classified as cool and moist even though there is a 4- to 5-month summer dry spell. Precipitation averages from 1243 to 1270 millimeters per year, almost all of which falls between October and March. Eighty percent of the moisture falls as snow, and snowpacks of 3 to 4 meters are common in February. In exceptionally wet years with late spring snows, drifts can persist until late July. Between April (or May) and October, precipitation is negligible and from scattered thunder showers. Winter temperatures generally do not fall below -23°C and summer temperatures only occasionally exceed 29° C. Average monthly minimum and maximum air temperatures range between -17°C and 4°C for January and between 4°C and 27°C for July.

SOILS

Soils vary from 0.6 to 2.4 meters deep and are generally well drained except in association with small "shoestring" meadows. The soils are derived in place from weathering of the andesite and associated ash. The lava flows that formed the mountain are occasionally visible at the surface. Soil series have not been mapped. Site quality varies but in general is good—a Dunning Site II or Site Index 150 at 300 years.

MAIN COMMUNITIES

The forest cover types on the Experimental Forest include large areas of Red Fir (SAF 207), White Fir (SAF 211), and small areas of Lodgepole Pine (SAF 218) cover types (Eyre 1980). White fir predominates at the low to mid elevations (1737 to 1890 m) with the proportion of red fir increasing with increasing eleva-

tion to the top at 2149 meters. Together the true fir occupy 1821 hectares (*fig. 16*). Lodgepole pine (*Pinus contorta* Dougl. ex Laud.) grows throughout the forest associated with meadows, but forms pure stands only on the lowest elevations and in areas of shallow soils or high water tables. There are 178 hectares in lodgepole pine. Approximately 445 hectares on the south slope of the mountain are occupied by an old brushfield that has been planted to ponderosa and Jeffrey pine (*P. ponderosa* Dougl. ex Laws and *P. jeffreyi* Grev. & Balf).

DATA BASES

Several types of maps are available: topographic map (1:15,840); timber type/age class map of original forest cover (1:15,840); a map created in 1956 from cruise data and aerial photos, and a map of all experimental cutting sites on the Forest.

Figure 16—This old-growth true fir forest composed of mature and overmature red and white fir with scattered regeneration of predominantly red fir, is typical of the forest on Swain Mt. Experimental Forest.

Low altitude color aerial photos, approximate scale 1:3800 are available. Flights were made in 1980 and 1981 and show all experimental cuttings to that date.

EXAMPLES OF RESEARCH

- Natural regeneration
- Growth and yield
- Pathology
- Site preparation
- Effects of insects on cone crops
- Mortality prediction for old-growth fir.

FACILITIES

There are no facilities on the Forest, and no surface water is available. Unimproved campgrounds are along Robbers Creek, which forms part of the boundary of the Forest. Water from the creek is not potable.

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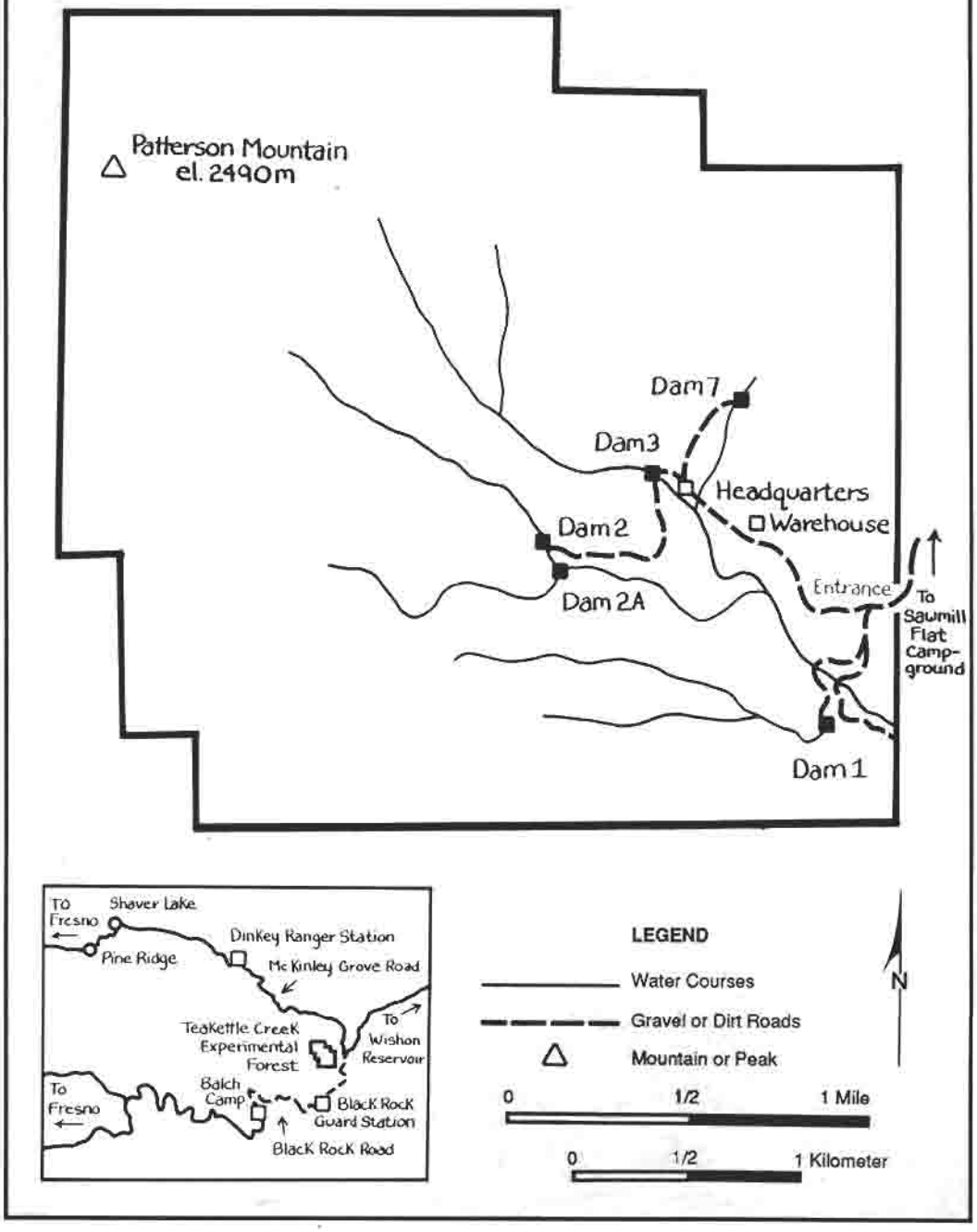
LOCATION

Swain Mountain lies at latitude 40°25′ N. and longitude 121°06′ W., 13 kilometers north of Westwood (see map). The Experimental Forest covers the entire mountain and rises from 1737 to 2149 meters above mean sea level.

The Forest can be reached via County Road A-21, a paved road that is kept clear of snow all winter. Neither the approximately 1.6 kilometers of all-weather road between the highway and the Forest, nor the extensive road network on the Forest are kept open during winter. Access between approximately mid-December and early May is limited to snowmobile, skis, or similar transportation. All of the current 41.8 kilometers of all-weather road is accessible by automobile, except when limited by snow. All parts of the Forest are easily reachable by short walks over gentle terrain.

Teakettle Creek Experimental Forest



TEAKETTLE CREEK
Experimental Forest

Three 200-hectare watersheds were first selected for study in 1934. Streamgauging stations were constructed on five subdrainages in the mid 1930's, and data on snow accumulation and melt, and precipitation and streamflow were collected. In 1942 the work was halted due to World War II. Studies were resumed in 1957 and the approximately 1300-hectare Experimental Forest was formally dedicated in 1958. The original objective was to determine methods of managing watersheds in representative fir and fir-pine types for the maximum beneficial yield of water consistent with control of floods and erosion.

An ecological survey of a portion of the Experimental Forest was written in 1975. Major forest species listed in that study include red fir (*Abies magnifica* A. Murr.), white fir (*A. concolor* var. *lowiana* [Gord.] Lemm.), sugar pine (*Pinus lambertiana* Dougl.), Jeffrey pine (*P. jeffreyi* Grev. & Balf.), western white pine (*P. monticola* Dougl.), incense-cedar (*Libocedrus decurrens* Torr.), mountain hemlock (*Tsuga mertensiana* [Bong.] Carr.), and western juniper (*Juniperus occidentalis* Hook.). Lodgepole pine (*P. contorta* Dougl. ex Laud.) grows on the higher portions of the Experimental Forest. Subordinate species include *Arctostaphylos nevadensis* A. Gray, *Arctostaphylos patula* Greene, *Ceanothus cordulatus* Kellogg, *Chrysolepis sempervirens* [Kellogg] W. Dud., *Prunus emarginata* [Dougl. ex Hook.] Walp., and *Quercus kelloggii* Newb. (Griffin 1975).

Atmospheric deposition has not been measured onsite. Hydrogen ion loading has been monitored since 1980 at Giant Forest in Sequoia National Park, 55 kilometers south southwest. At Giant Forest hydrogen loading in 1982 was 10 milligrams per square meter with a 4-year mean (1980-1984) of 4.5 milligrams per square meter per year. The 1982 sulfate ion loading at Giant Forest was 3.9 grams per square meter with the 4-year mean (1980-1984) 3.5 grams per square meter per year.

Harvest disturbance is minimal. A minor "sanitation" cut in 1979 along roads to the gauging stations is the only known timber removal.

Mapped geologic units are primarily Triassic metamorphics, mainly quartzite, with some Miocene olivine basalt on top of the quartzite. Only the lower elevation southeastern corner of the Forest is granodiorite. The entire Experimental Forest is withdrawn from mineral entry.

CLIMATE

The climate is typically Mediterranean, with moist, relatively mild winters and dry, warm summers. Annual precipitation is about 1120 millimeters at 2100 meters elevation, with most falling as snow between November and May. Mean, maximum, and minimum July air temperatures are 17°C, 30°C, and 3°C. Winter records are unavailable.

SOILS

Soils are generally Xerumbrepts and Xeropsamments typical of the southwestern slope of the Sierra Nevada. Mapped series, with percentage of Forest area in parentheses, include Cagwin (15 pct), Cannell (15 pct), Sirretta (10 pct), Ledford (15 pct), Toem (10 pct), Umpa (5 pct), Waca (5 pct), Windy (5 pct), Shaver/Ledford (5 pct), and miscellaneous (15 pct). The cation exchange capacity, determined by the sum of cations method, is 25-30 milliequivalents per 100 grams.

MAIN COMMUNITIES

Red Fir (SAF 207), Ponderosa Pine-Sugar Pine-Fir (SAF 243), and wet and dry meadows are the main communities (Eyre 1980).

DATA BASES

Climatic Data

Data available for 1977 to the present are air temperature, relative humidity,

and precipitation (continuous strip chart and daily maximum/minimum air temperatures) for nonwinter months. Coverage is sporadic during earlier years.

Hydrologic Data

Stream discharge records are continuous for five subbasins with areas and 15-year mean annual discharges as follows:

Area	Discharge
km²	*m³/yr*
[1]0.3	1.1×10^5
[2]2.2	1.5×10^6
[2]2.2	1.3×10^6
[2]0.7	4.6×10^5
[2]2.0	1.4×10^6

[1]October 1957 to September 1963.
[2]October 1957 to September 1969, and May 1977 to present.

Continuous strip chart records are available for stream temperature at three sites during snow-free months between 1980 and 1984. Data have been reduced to daily maximum/minimum values and temperatures at 0000, 0600, 1200, and 1800 hours.

Soil Moisture Data

Twelve sites were monitored by neutron probe a minimum of three times during snow-free months between 1977 and 1985.

EXAMPLES OF RESEARCH

- Snow hydrology
- Monitoring methods for avian populations
- Forest soil moisture and soil temperature regimes.

FACILITIES

The two primary buildings on the Forest are a warehouse/garage and main cabin. The cabin sleeps five, and the warehouse has limited maintenance equipment. Laboratory space is not available. A field office of the Pacific Southwest Research Station, with office and laboratory facilities, is located in Fresno, about 1 1/2 hours driving time away. Lodging is available at Dinkey Creek, approximately 40 minutes driving time distant.

CONTACT ADDRESS

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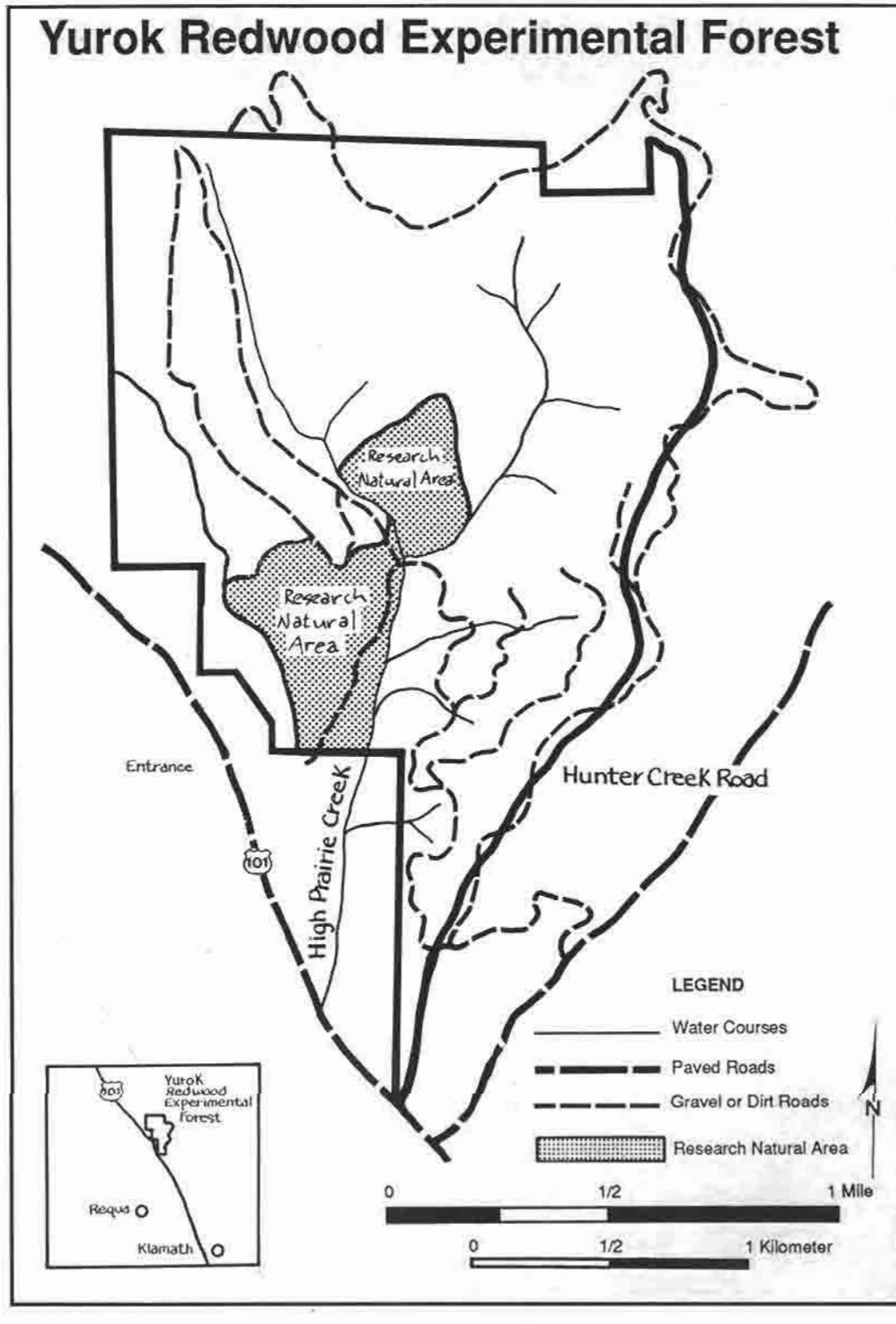
LOCATION

Teakettle Creek Experimental Forest is located in the north drainage of Kings River about 80 kilometers east of Fresno, California, on the Sierra National Forest and is 12 kilometers southwest of Wishon Reservoir (see map). Latitude is 37°58′ N., and longitude is 119°2′25″ W. Elevation ranges from 1980 to 2590 meters.

Main access is along approximately 8 kilometers of graded road from the junction with a paved road at Tule Meadow.


Yurok Redwood Experimental Forest
Research Natural Area
Research Natural Area
Entrance
High Prairie Creek
Hunter Creek Road
101
LEGEND
Water Courses
Paved Roads
Gravel or Dirt Roads
Research Natural Area
N
0
1/2
1 Mile
0
1/2
1 Kilometer
Yurok Redwood Experimental Forest
101
Requa
Klamath

YUROK REDWOOD
Experimental Forest

The Yurok Redwood Experimental Forest was established in 1940 to study the silviculture of coast redwood *(Sequoia sempervirens)* and to develop techniques for regeneration and management. The Experimental Forest includes 379 hectares drained by High Prairie Creek. Redwood is the principal timber species on the forest with Douglas-fir *(Pseudotsuga menziesii)*, Sitka spruce *(Picea sitchensis)*, western hemlock *(Tsuga heterophylla)*, and Port Orford-cedar *(Chamaecyparis lawsoniana)* making up the remainder. About 59 percent of the timberland is classified as Site I; 35 percent is classified as Site II. Tree ages range up to 1200 years. Topography varies considerably over the forest. Slopes range from 0 percent to greater than 75 percent.

About 45 percent of the total area (226 ha out of 502 ha) was clearcut in harvest units ranging from 1.2 to 62.7 hectares between 1956 and 1985. About 1 percent (4 ha) was harvested in 1981 using the selection system. An additional 23 percent (87 ha) is available for approved manipulative research studies and 16 percent (61 ha) is preserved in an undisturbed old-growth redwood forest condition in the Yurok Research Natural Area, established in 1976. An ecological survey was conducted in 1982 for the Research Natural Area (Taylor 1982).

CLIMATE

The climate is typically mild and foggy in summer. The average July temperature is 12.6°C, with little precipitation other than fog drip. The average January temperature is 6.8°C. Annual rainfall averages 1933 millimeters and snowfall is uncommon. No climatic data are maintained at the Experimental Forest, but data are available from the town of Klamath, in a similar climatic environment 6.4 kilometers south, and from Crescent City, 27.2 kilometers north of the Forest. Precipitation is well in excess of potential evapotranspiration, except for about a month in midsummer.

SOILS

The entire region is underlain by Mesozoic rocks of the Franciscan Formation, a complex of raw to slightly metamorphic sedimentary rocks. This formation is generally soft and easily weathered, so that soil development is good, with unweathered regolith at depths of about 3 meters in most areas. Rock outcrops are few and, where they do occur, shallow soils and exposure combine to make such sites ecologically unique. The major soil series is Melbourne, with a small amount of Hugo Series along the ridge tops (about 6.5 ha) and Atwell Series at the lower elevations on the southern part of the Forest (about 2.0 ha). Unclassified alluvial soils are found along High Prairie Creek on a total of about 32.4 hectares.

MAIN COMMUNITIES

The Yurok Research Natural Area supports very dense stands of old-growth redwood averaging about 200 square meters per hectare. The two dominant vegetation types on the forest are *Sequoia sempervirens–Polystichum munitum* and *Alnus rubra–Rubus spectabilis*.

DATA BASES

Maps

Soil-vegetation maps are available for the general area.

Timber Data

Regeneration after cutting, young stand growth and yield, response to thinning, and redwood sprout development were recorded intermittently between 1956 and 1982. Post-harvest regeneration and effects of shelterwood removal were recorded between 1970 and 1985.

Wildlife Habitat Data

Data are available on species composition and abundance of vertebrate communities in response to changes in age, moisture, and structural features of forest stands from 1983 to 1985.

Fish Habitat Data

Stream reaches and distribution of fish species in High Prairie Creek were mapped from 1984 to 1987.

EXAMPLES OF RESEARCH

- Salmonid preference for obstacle-formed pools
- Stream structure and fish production
- Ecology of old-growth forest wildlife habitat community.

FACILITIES

Dormitory and office space, garage, storage areas, and several small houses are available on an administrative site. However, only some of these facilities are maintained on a regular basis. Commercial facilities are available in Crescent City and Klamath.

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LOCATION

The Yurok Redwood Experimental Forest is located on the coastal front of the North Coast Ranges in northern California, about 2.4 kilometers inland from the Pacific Ocean and near the mouth of the Klamath River, approximately at latitude 41°35′ N. and longitude 124°05′ W. (see map). Elevation ranges from 457 to 3658 meters

The Experimental Forest is readily accessible from U.S. Highway 101, 27.2 kilometers south of Crescent City and 6.4 kilometers from Klamath.

REFERENCES

Dunn, Paul H.; Barro, Susan C.; Wells, Wade G., II; Poth, Mark A.; Wohlgemuth, Peter M.; Colver, Charles G. 1988. **The San Dimas Experimental Forest: 50 years of research**. Gen. Tech. Rep. PSW-104. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture. 49 p.

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

Griffin, James R. 1975. **Ecological survey of Teakettle Creek candidate Research Natural Area**. Teakettle Creek Experimental Forest, Sierra National Forest. Unpublished manuscript on file, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA. 50 p.

Hallin, William E. 1954. **Unit area control—its development and application**. Misc. Paper 16. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 10 p.

Herbert, Fred W., Jr.; Begg, Eugene L. 1969. **Soils of the Yuba area, California**. Davis: Department of Soils and Plant Nutrition, University of California; 170 p., 41 maps.

Kuchler, A. W. 1977. **The map of the natural vegetation of California**. In: Barbour, M. G., Major, J., eds. Terrestrial vegetation of California. New York: Wiley; 909-915.

Meyer, Walter H. 1938. **Yield of even-aged stands of ponderosa pine**. Tech. Bull. 630. Washington, DC: U.S. Department of Agriculture; 59 p.

Paysen, Timothy E.; Derby, Jeanne A.; Black, Hugh, Jr.; Bleich, Vernon C.; Mincks, John W. 1980. **A vegetation classification system applied to southern California**. Gen. Tech. Rep. PSW-45. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 33 p.

Powers, Robert F.; Oliver, William W. 1978. **Site classification of ponderosa pine stands under stocking control in California**. Res. Paper PSW-128. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 9 p.

Salman, K. A.; Bongberg, J. W. 1942. **Logging high risk trees to control insects in the pine stands of northeastern California**. Journal of Forestry 40(7): 533-539.

Talley, Steven N. 1977. **An ecological survey of the Onion Creek candidate Research Natural Area on the Tahoe National Forest, California**. Unpublished manuscript on file, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA; 65 p.

Taylor, D. W. 1982. **Ecological survey of the vegetation of the Yurok Research Natural Area, California**. Report to: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, Berkeley, CA. Contract 40-9A062-793.

U.S. Department of Agriculture, Forest Service, 1985. **Forest Service Manual 4062, Experimental Forests and Ranges**.

U.S. Department of Agriculture, Forest Service. 1987. **Region 5 Suppl. 5 and PSW Suppl. 14 to Forest Service Manual 4062**.

APPENDIX—METRIC CONVERSION TABLE

Metric Unit	British Equivalent
kilometer (km)	0.622 mi
millimeter (mm)	0.039 inch
centimeter (cm)	0.394 inch
meter (m)	3.281 ft
grams per square meter ($g/m^2/yr$)	4.885×10^{-3} $lb/ft^2/y$ per year
hectare (ha)	2.471 acres
square kilometer (km^2)	0.386 square miles
cubic meters per year (m^3/yr)	1.129×10^{-6} ft^3/s
	8.107×10^{-4} acre-ft/yr
liters per second (l/s)	0.0369 ft^3/s
degree Celsius (°C)	(°F- 32) x 0.556
kilogram (kg)	0.454 lb
cubic meters per hectare (m^3/ha)	71.457 bd ft/acre

The Forest Service, U. S. Department of Agriculture, is responsible for Federal leadership in forestry. It carries out this role through four main activities:

- Protection and management of resources on 191 million acres of National Forest System lands
- Cooperation with State and local governments, forest industries, and private landowners to help protect and manage non-Federal forest and associated range and watershed lands
- Participation with other agencies in human resource and community assistance programs to improve living conditions in rural areas
- Research on all aspects of forestry, rangeland management, and forest resources utilization.

The Pacific Southwest Research Station

- Represents the research branch of the Forest Service in California, Hawaii, American Samoa and the western Pacific.