

**SOQUEL DEMONSTRATION
STATE FOREST
DRAFT
GENERAL FOREST
MANAGEMENT PLAN**

This final General Forest Management Plan is intended to set the goals and guide the development of programs and facilities on Soquel Demonstration State Forest (SDSF). It was approved by the SDSF Advisory Committee on xxx and by the Board of Forestry on xxx.

**CALIFORNIA DEPARTMENT OF FORESTRY
AND FIRE PROTECTION**

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EXECUTIVE SUMMARY

The Soquel Demonstration State Forest (SDSF) was established in 1990 by Assembly Bill 1965 (now Public Resources Code (PRC) Sections 4660-4664). The basic objective of the enabling legislation is to protect and preserve SDSF as an intensively managed, multifaceted research forest. The Public Resources Code Sections 4660-4664 state that SDSF will do all of the following:

- Provide watershed protection for local communities and base-line monitoring and studies of the hazards, risks, and benefits of forest operations and watersheds to urban areas.
- Provide public education and examples illustrating compatible rural land uses, including sustained yield timber production, as well as the historic development of timbering and forestry machinery, within the context of local community protection and nearby pressures.
- Provide a resource for the public, environmental groups, elected officials, environmental planners, the educational community, and the media as an open environment for the inspection and study of environmental education, forestry practices, and effects thereof.
- Protect old-growth redwood trees.

Soquel Demonstration State Forest is located near the center of Santa Cruz County, California, approximately eight miles northeast of the city of Santa Cruz. Positioned in the southern portion of the Santa Cruz Mountains, SDSF is eighteen air miles south of San Jose and within a two-hour drive of the San Francisco and Oakland metropolitan areas. This proximity to the large urban areas of San Francisco Bay, Monterey Bay, and San Jose provides prime opportunities for urban children to experience forestry education on a first-hand basis.

SDSF is bordered by both state and private properties. These include the Forest of Nisene Marks State Park, timberland managed by Redwood Empire, the Olive Springs Quarry, and private rural-residential parcels that range in size from 1 to 80 acres.

Public access is currently limited to a road access point off Highland Way or entry through The Forest of Nisene Marks State Park. The inability of the public to drive to the forest when county roads are closed and problems with trespass are challenges limiting accomplishment of SDSF's mission to provide for public education and access.

Between the late 1920's and early 1940's, SDSF was managed on an even-aged basis with clearcutting and natural regeneration. Currently, SDSF is managed on an uneven-aged basis as required by the Coast Forest District's southern sub-district rules of the State's Forest Practice Rules. SDSF harvests timber utilizing either single tree and/or small group selection harvest that ensures proper land stewardship, improves forest health, and protects and preserves SDSF as an intensively managed, multifaceted research forest, consistent with the legislative goals of PRC Sections 4660-4664. Watershed, soil, fisheries, and wildlife resources are monitored and protected before, during, and after all timber harvesting activity.

Existing old-growth redwood areas in the Forest have been excluded from timber harvesting, as mandated by SDSF's authorizing legislation. In addition, late-succession management areas are administered to promote the development of old-growth habitat. These areas make up 15 percent of the overall forest, and protect 300 feet on each side of the East Branch of Soquel Creek, Amaya, and Fern Creeks within SDSF boundaries.

The East Branch of Soquel Creek provides valuable steelhead trout spawning and rearing habitat, and is part of the domestic water supply for the local community. Late-succession management areas have been established along the East Branch of Soquel Creek, Amaya, and Fern Creeks to protect water quality and fisheries habitat.

CHAPTER ONE: INTRODUCTION

CALIFORNIA'S DEMONSTRATION STATE FOREST SYSTEM

The demonstration state forest system of the California Department of Forestry and Fire Protection (CAL FIRE) was established in the mid-1940's to meet local needs for research, demonstration, and education related to forest management. Currently, the demonstration state forest (DSF) system encompasses over 71,000 acres of land in the form of eight state forests. DSFs are healthy, living forests which demonstrate conservation and protection of wildlife, fisheries, vegetation, soil, and watershed resources as well as sustained-yield forest management activities.

The Soquel Demonstration State Forest (SDSF), when established in 1990, was the first addition to the DSF system in over 40 years. SDSF contains 2,681 acres; including mostly coast redwood and mixed evergreen forest types. Former Assemblyman Sam Farr authored SDSF's enabling legislation, Assembly Bill 1965 of 1987 (now Public Resources Code (PRC) Sections 4660-4664), which provided for the protection and preservation of the SDSF as an intensively managed educational and research forest. It also contained special provisions for the use of SDSF, including a limited amount of commercial timber operations on the property within the SDSF in order to provide funds for the maintenance and operation of SDSF, reasonable capital costs, and other expenses incurred in fulfilling the objectives of PRC Section 4660 on SDSF. AB 1965 is reprinted in Appendix A of this plan.

SDSF was formally transferred from its interim managers, The Nature Conservancy (TNC), to CAL FIRE on July 13, 1990. Former CAL FIRE Director Harold Walt, former Assemblyman Sam Farr, a representative of State Controller Gray Davis, and Steve Johnson of TNC dedicated the Forest, emphasizing the nature and purpose of this addition to the DSF system.

SDSF was the first of California's demonstration state forests to have an advisory committee formed to assist the Department in planning future management of the Forest. The Advisory Committee, also required by AB 1965, met monthly during the planning process to facilitate the creation of the original 1998 General Forest Management Plan. The Advisory Committee reconvened in 2011 and plays a vital role in reviewing the revisions to this updated version of the plan.

THE GENERAL FOREST MANAGEMENT PLAN

Following the acquisition of the SDSF property (see the Administration chapter), TNC created an interim management plan for what they called the Soquel Creek Forest. Recognized as a temporary plan, TNC's document provided direction for current and future management decisions involving SDSF. The 1998 General Forest Management Plan incorporated elements of the TNC plan and information from other sources. It was developed with input from the public and resource professionals. Public workshops were held to obtain feelings, opinions, and factual information about the management of SDSF's forest resources. Furthermore, individuals

representing many interests contributed data, publications, and personal knowledge for consideration through conversation with Forest staff. Public comments and concerns relating to various subjects are summarized in each chapter. A supplemental document, titled Public Input to the Soquel Demonstration State Forest General Management Plan, presents all input received during the development of the draft plan.

Local resource professionals contributed a significant amount to the 1998 plan. Knowledgeable individuals served on the Advisory Committee, provided factual information about various resources, and composed elements of the plan itself. Without their assistance and experience, this management plan could not have been written.

The environmental impacts of the 1998 management plan were thoroughly investigated by Jones and Stokes Associates, Inc. in a program environmental impact report (EIR) which was completed in compliance with the California Environmental Quality Act (CEQA). A primary objective of this program EIR was to identify mitigation measures to reduce or avoid adverse environmental impacts that could result from implementation of any SDSF projects. As required by CEQA, mitigation measures identified from this EIR have been incorporated into a Monitoring Plan located in Appendix C.

FUTURE PLANNING

The Board of Forestry and Fire Protection (the Board) approved the original General Forest Management Plan on May 18, 1998. In 2003, the Board reviewed and reauthorized the plan. No revisions were made at that time.

As indicated throughout this plan, SDSF staff continue to formulate more specific management guidelines and planned actions. This revision of the plan includes new studies and the results of monitoring and research regarding the management of components such as fisheries, wildlife, watershed, archeology, and timber.

This SDSF General Forest Management Plan will be in effect until it is either amended or a new plan is adopted in accordance with the procedures prescribed in PRC Section 4663. Working with the Advisory Committee, CAL FIRE will reexamine the General Forest Management Plan every five years and determine whether any changes are necessary or desirable. This plan embodies the legislative intent of PRC Sections 4660-4664, and any subsequent amendments of this plan or any new plan must be consistent with the interpretations the PRC except to the extent, if any, that subsequent legislation changes that intent. If changes are desired, the changes will be developed by CAL FIRE and presented to the Advisory Committee for consideration at one or more public meetings. The changes shall be approved by the Advisory Committee prior to adoption by the Board. Any changes will be subject to environmental review as provided by the California Environmental Quality Act.

CHAPTER TWO: MANAGEMENT GOALS

SDSF's management goals represent a combination of legislation, policy, and public input. PRC Sections 4660-4664, the enabling legislation for Soquel Demonstration State Forest, is the preeminent authority with regard to the management of the SDSF. Consistent with the objectives of that legislation to protect and preserve SDSF as an intensively managed, multifaceted research forest and to the extent not in conflict with that enabling legislation, the SDSF will be managed in accordance with the state forest system legislation (PRC Sections 4631-4658) and Board of Forestry policy.

Public Resources Code Section 4660 states that the intent of the Legislature in establishing the Soquel Demonstration State Forest is to provide an environment that will do all of the following:

- * Provide watershed protection for local communities and base-line monitoring and studies of the hazards, risks, and benefits of forest operations and watersheds to urban areas.
- * Provide public education and examples illustrating compatible rural land uses, including sustained yield timber production, as well as the historic development of timbering and forestry machinery, within the context of local community protection and nearby pressures.
- * Provide a resource for the public, environmental groups, elected officials, environmental planners, the educational community, and the media as an open environment for the inspection and study of environmental education, forestry practices, and effects thereof.
- * Protect old-growth redwood trees.

As is common in legislation, these objectives contain many potential conflicts and will require trade offs in implementation.

Section 4661 further states that CAL FIRE may permit a limited amount of commercial timber harvesting in order to provide the funds needed for the maintenance and operation expenses of SDSF, reasonable capital costs, and other expenses incurred in fulfilling the objectives of PRC Sections 4660-4664 on SDSF.

Below is a listing of SDSF's general management goals which elaborate on the legislative intent. Other subjects and greater detail relating to the topics listed here can be found throughout the following chapters of this General Forest Management Plan.

RESOURCE PROTECTION AND ENHANCEMENT

1. Protect, restore, and enhance the significant natural values of the Soquel Demonstration State Forest.
2. Provide watershed protection and conduct baseline studies and monitoring of hydrological resources.
3. Demonstrate fire protection using a coordinated fire prevention and control system which includes education and enforcement of fire prevention guidelines, Forest patrol, and vegetation management including prescribed fire, fuelbreak construction, pre-attack strategies, and suppression tactics.
4. Improve fisheries and wildlife habitat to foster healthy populations and promote biodiversity.
5. Monitor, study, and implement controls for various forest pests using Departmental and outside specialists.
6. Monitor, study, and implement controls for invasive plant species.
7. Study all significant archaeological and historical features and protect them during all management activities.
8. Conserve soil resources by reducing erosion resulting from flooding, earthquakes, logging activities, roads, and trails.

DEMONSTRATION AND EDUCATION

1. Conduct innovative demonstrations and education in forest management including silviculture, habitat diversity, logging methods, hydrology, resource protection, and recreation.
2. Provide forestry education opportunities for the public, forest landowners, the educational community, the media, natural resource professionals, and environmental groups.
3. Develop interpretive resources to help Forest visitors understand the various coast redwood forest communities and the basics of forest land management.
4. Establish a volunteer program to assist forest staff in providing forestry interpretation for visitors.
5. Provide suitable public access and parking.

6. Plan for a Forestry Education Center to serve as the Forest's focal point for demonstration and education activities.

RESEARCH

1. Conduct research in forestry and natural resource management, including the benefits and risks of forest operations in watersheds close to urban areas.
2. Serve as a laboratory for in-house projects and encourage research by other agencies, interest groups, and educational institutions.
3. Disseminate information obtained from the State Forest to appropriate individuals in an effective and timely manner.

TIMBER MANAGEMENT

1. Demonstrate sustained-yield with examples of timber harvesting at a level that is compatible with rural land use in Santa Cruz County and recreational use of SDSF and promotes forest health, watershed protection, wildlife, and fisheries values as well as aesthetic enjoyment.
2. Protect old-growth redwood and Douglas-fir trees and recruit additional late-successional forest stands.
3. Incorporate demonstration, research, and restoration objectives into timber management activities whenever possible.
4. Study hardwood stand management alternatives including modification to enhance wildlife habitat, utilization for various forest products, and conversion to softwood timber stands consistent with the legislative goals of PRC Sections 4660-4664.

RECREATION

1. Provide for recreational opportunities which are oriented toward foot, bicycle, and equestrian traffic and include trails, roads, and picnic areas. Limited camping may be permitted if consistent with Forest objectives.
2. Integrate recreation management, forestry education, resource protection and examples of timber harvesting so as to demonstrate how they can be compatible.
3. Prohibit unauthorized fishing, the use of motorized vehicles, shooting, and hunting to provide for public safety and forest protection.

*THE FOLLOWING PUBLIC COMMENTS WERE RECEIVED DURING REVIEW OF THE
1998 GENERAL FOREST MANAGEMENT PLAN*

Throughout the planning process, members of the public have indicated that adherence to SDSF's enabling legislation, AB 1965, is legally required. Neighbors and visitors of the Forest have communicated that management goals and actions should abide by the written legislation. CAL FIRE intends to abide by this plan and to act consistently with the intention of the enabling legislation as expressed in this plan.

CHAPTER THREE: PROPERTY DESCRIPTION

LOCATION AND BOUNDARIES

Soquel Demonstration State Forest is located near the center of Santa Cruz County, California, approximately eight miles northeast of the city of Santa Cruz (Figure 1). Positioned in the southern portion of the Santa Cruz Mountains, SDSF is eighteen air miles south of San Jose and within a two-hour drive of the San Francisco and Oakland metropolitan areas. Access to the property is via State Highway 1 or 17 and local county roads. The entrance to the Forest is from Highland Way, a county road in the Santa Cruz Mountains that connects State Highway 17 with Watsonville. Virtually all of the Forest's 2,681 acres are located within the East Branch of Soquel Creek watershed.

SDSF's boundaries were originally established by metes and bounds rather than the more familiar township and range system. Formerly part of the Soquel Augmentation Rancho (a Mexican land grant), this area has always been defined differently than the land which surrounds it. Some of the corners listed in the survey, prepared by George Dunbar of Dunbar Land Surveys, have been verified and are in place. The Santa Cruz County parcel numbers for the Forest are 098-101-04; 098-161-06; 098-351-01¹; and 099-181-02, 03, 04, 06.

ADJACENT OWNERSHIP

SDSF is bordered by both state and private property (Figure 2). The Forest of Nisene Marks State Park borders the State Forest for three and one-half miles along Santa Rosalia Ridge to the south. Approximately three-hundred-forty acres directly east of the Forest boundary are owned by Roger and Michelle Burch. This land is managed by Redwood Empire and includes the main entrance and parking area for the Forest off Highland Way. To the north and west, the adjacent ownerships are private rural-residential parcels, including the large holding of Spanish Ranch. Most of these parcels range in size from 1 to 80 acres. On the southwest border is the property containing the Olive Springs Quarry, owned by the CHY Company.

With the considerable amount of private property surrounding the Forest, public access is currently limited. The only undisputed public access points into the Forest are from Highland Way and The Forest of Nisene Marks State Park.

HISTORY OF OWNERSHIP

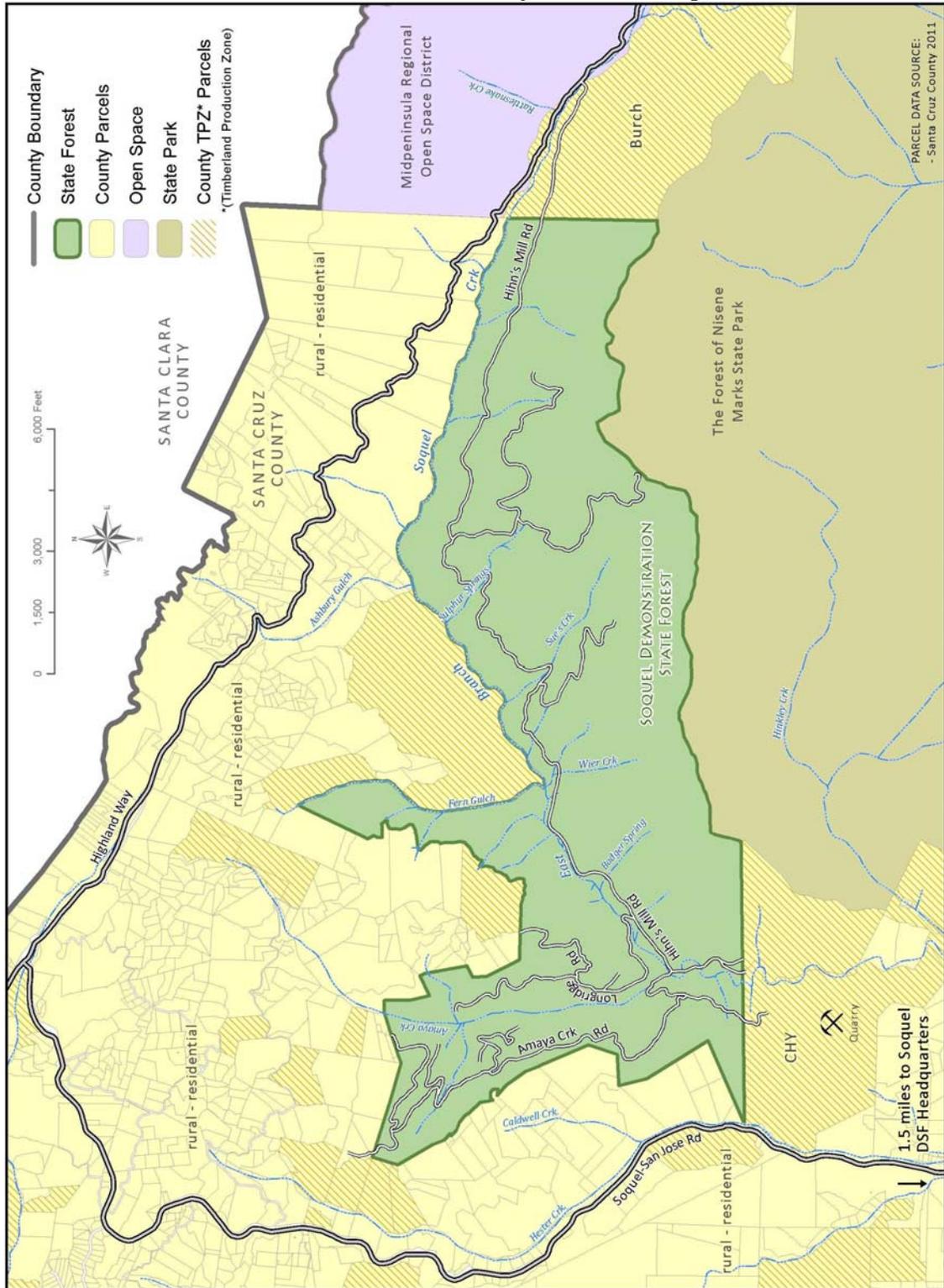
Prior to the arrival of Europeans, the Costanoan (also known as Ohlone) Indians inhabited the area. In the mid-1800's, the title to the 32,000-acre Soquel Augmentation Rancho was awarded to Martina Castro de Depeaux viuda de Lodge viuda de Cota, the daughter of a Spanish Colonial

¹ Note that historic parcel number 098-161-02 was changed to 098-351-01 by the Santa Cruz County Assessor in 1998.

FIGURE 1 – Locator map for SDSF



FIGURE 2 – SDSF and adjacent ownerships



soldier. SDSF was contained within the rancho, and Martina gave this portion to her daughter, Antonia Lodge de Peck. Frederick A. Hihn, a German-born entrepreneur, was able to acquire portions of the Soquel Augmentation through a discrepancy in legal title. He was particularly interested in Lodge de Peck's parcel and purchased it in 1863.

In the 1880's, Hihn established the Valencia-Hihn Company and began selectively logging the old-growth redwood on his lands to produce shingles, posts, and rails. Upon his death in 1913, Hihn's heirs assumed management of his lands and continued to harvest the area. In 1924, the Valencia-Hihn Company sold their land to the Monterey Bay Redwood Company (MBRC). The MBRC owned the State Forest property for 37 years and performed extensive harvest in the 1920's and '30's. They sold their property to the Glenco Forest Products Company of Sacramento in 1961, which later changed its name to the CHY Company. Eighteen years later, in 1979, CHY sold the State Forest portion of their land to the Pelican Timber Company. Additional details about the history of the Forest can be found in Archaeological and Historical Survey of Soquel Demonstration State Forest (Dillon, 1992).

In 1988, Pelican was involved in a debt-for-nature land swap with the State of California and the Bank of America (see the Administration chapter for more details). A result of this land swap was the creation of SDSF as authorized by former Assemblyman Sam Farr's Assembly Bill 1965. The Nature Conservancy acted as the interim managers of the Forest until its transfer to CAL FIRE in 1990.

CLIMATE

The climate of the Santa Cruz Mountains is Mediterranean, characterized by dry, warm summers and wet, cool winters. SDSF is usually cool and damp because of the dense canopy of forest vegetation and its location on a north-facing slope. The average minimum January temperature is 38 degrees Fahrenheit, and the average maximum July temperature is 76 degrees Fahrenheit.

Most of the precipitation in the area occurs from November through April. The average annual rainfall for the East Branch of Soquel Creek is 44 inches (Linsley et al., 1992). At elevations above 2,000, snowfall occurs about every other year and averages less than five inches total.

During the late spring and early summer months, Santa Cruz County often has foggy or cloudy skies. In the Forest, this is generally limited to early morning and late evening hours. Winds generally blow from the west or southwest (onshore) and are mild to moderate throughout the year. Strong winds, however, come in with winter storms and are strongest at higher elevations. Pressure gradients inland may occasionally cause strong northeasterly winds to occur.

SOILS AND GEOLOGY

SOIL TYPES

The parent material of soils found in SDSF is primarily sedimentary and consists of fine and coarse-grained sandstone, consolidated shale, weathered mudstone, and siltstone. Schist and

intrusions of granitic rock are also present. There are nine soil series which developed from these parent materials; see Table 1 and Figure 3 (US Department of Agriculture, 2004)). They are all deep and well-drained soils except for the Maymen Stony Loam which is a shallow, well-drained soil. According to the Natural Resources Conservation Service, most of the soils support watershed, recreation, and wildlife resources. Five of the soils (Ben Lomond, Felton, Lompico, Nisene, and Aptos) also support timber production, with the primary species being coast redwood and Douglas-fir.

GEOLOGIC ACTIVITY

In 1992, a detailed geologic study was completed by the California Geologic Survey (Manson and Sowma-Bawcom, 1992). This investigation resulted in a report which focuses on the process and degree of instability in both the State Forest and surrounding areas. The report, titled Geology, Slope Stability, and Earthquake Damage in Soquel Demonstration State Forest, includes maps of general geologic and geomorphic characteristics, landslide features (indicating the relative degree of stability), stream orders, roads to be considered for abandonment, and Alquist-Priolo Special Studies Zones².

SDSF is seismically very active. The San Andreas Fault runs through the northeastern boundary and along the East Branch of Soquel Creek to the mouth of Ashbury Gulch, where it turns north. The Zayante Fault, part of the San Andreas Rift Zone, runs through the southwest edge of the Forest. The epicenter of the 1989 Loma Prieta Earthquake was located approximately 2 miles south of SDSF, in The Forest of Nisene Marks State Park. Numerous cracks and fissures dating from the 1989 earthquake have been located in the State Forest.

Geologic activity, coupled with past fires and severe rain storms, has helped form the steep terrain found throughout the Forest. These events have also contributed to the many landslides present within the inner gorges of streams and along steep roadcuts. The numerous natural springs and sag ponds found throughout the Forest are also the result of past geologic activity.

The elevation of SDSF ranges from 500 feet at the East Branch of Soquel Creek to 2,500 feet at the southeast corner on Santa Rosalia Ridge. The higher elevations occur in the southeast portion of the Forest and decrease along the ridge going southwest.

WATER RESOURCES

The East Branch of Soquel Creek is a perennial stream that flows through the entire length of the Forest. It is fed by the perennial stream of Fern Gulch and Amaya Creeks from the north, and numerous unnamed intermittent and ephemeral streams. The total size of the East Branch watershed is approximately 19 square miles or 12,240 acres.

² Alquist-Priolo Special Studies Zones are areas along traces of the San Andreas Fault where geologic investigations are required prior to development.

FIGURE 3 – Locations of soil series in SDSF

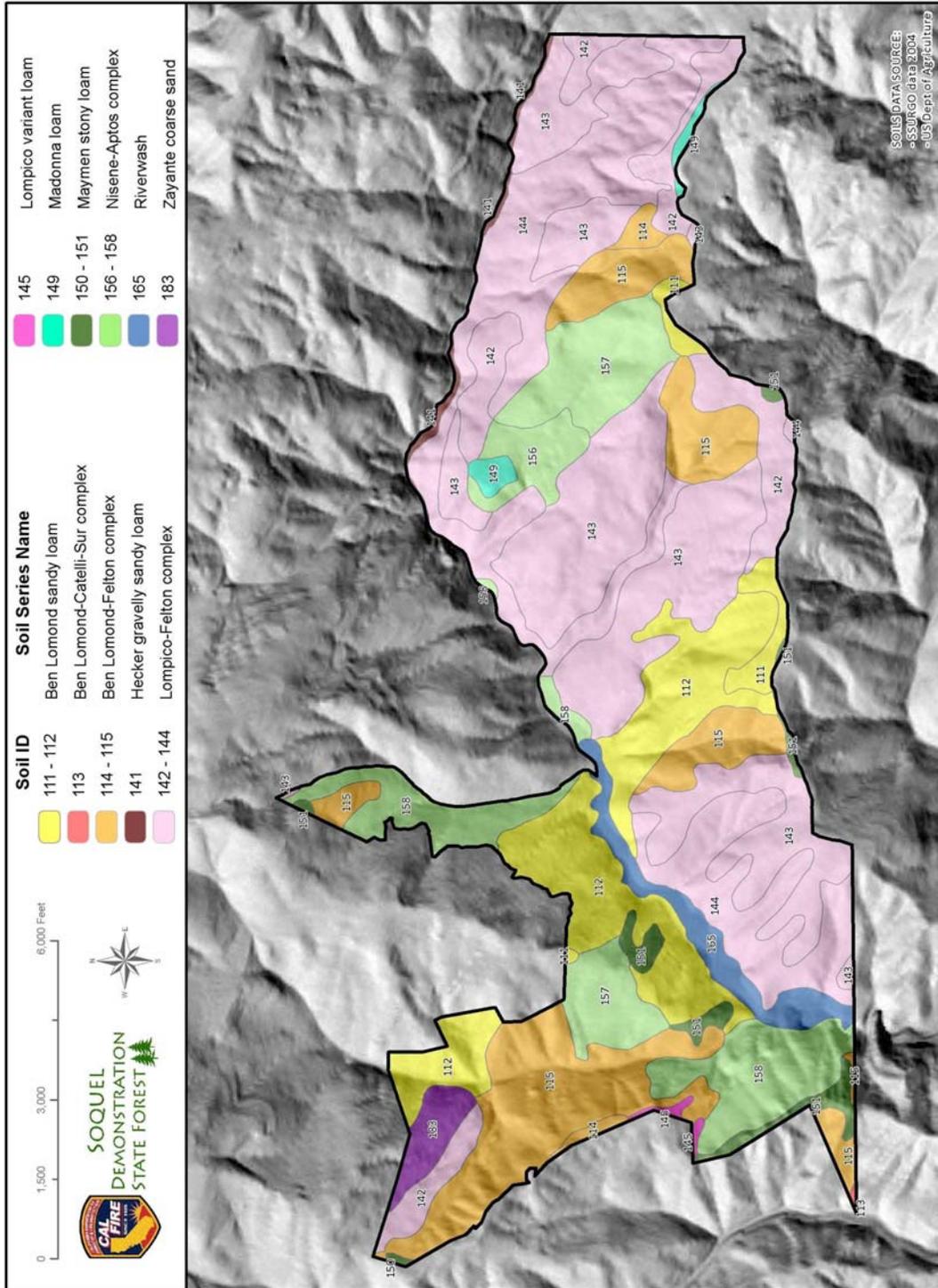


Table 1. Soil types and associated erosion hazard of SDSF*

SOIL TYPE	PERCENT SLOPE	PERCENT ACRES	EROSION HAZARD
Ben Lomond sandy loam	15-50	1.77	moderate to high
Ben Lomond sandy loam	50-75	11.61	very high
Ben Lomond-Felton Complex	30-50	0.66	High
Ben Lomond-Felton Complex	50-75	15.81	very high
Hecker gravelly loam	50-75	0.48	very high
Lompico-Felton Complex	5-30	7.44	moderate to high
Lompico-Felton Complex	30-50	23.95	high
Lompico-Felton Complex	50-75	14.71	very high
Madonna loam	15-30	0.88	high
Maymen stony loam	15-30	0.06	high
Maymen stony loam	30-75	1.97	high to very high
Nisene-Aptos Complex	15-30	1.90	moderate to high
Nisene-Aptos Complex	30-50	6.76	high
Nisene-Aptos Complex	50-75	7.62	very high
Riverwash	-	2.94	-
Zayante coarse sand	30-50	1.44	moderate to high

*From Soil Survey of Santa Cruz County, California (US Department of Agriculture, 2004)

As previously mentioned, natural springs and sag ponds can be found in the Forest. The two largest springs are Sulphur Springs, located on the Sulphur Springs Trails, and Badger Springs, located near the main picnic area. Badger Springs was at one time a developed water source as is evident by the remains of a spring box and steel pipes scattered around the area. A third spring, located east of Sulphur Springs along Hihn's Mill Road, was created by the 1989 earthquake. The natural springs of Sulphur and Badger, as well as other unnamed springs, are also special to SDSF. These springs, plus Amaya Pond, enhance particular biotic communities and offer various research opportunities.

Amaya Pond, a seasonal body of water, is located in the northwestern arm of the Forest. Approximately one-half acre in size, it is located on the east side of Amaya Road, approximately one-third of the way down from Comstock Mill Road. (See Preliminary Biological Assessment of Soquel Demonstration State Forest, Santa Cruz County, California, [Holland et al., 1992] for more details about Amaya Pond.)

The portion of the East Branch that runs through the Forest is well known for its steelhead rearing habitat. The California Department of Fish and Game prohibits angling in this part of the Soquel Creek watershed in order to protect this important resource. The Fisheries chapter of this report contains more information on the creek and its fisheries assets.

Soquel Creek, including the East Branch, is also part of the domestic water supply for the local community. The lower portion of Soquel Creek serves as part of the natural groundwater recharge system for residents' wells and supplies surface water to a number of intakes along the creek. Soquel Creek is within the Central Coast California (CCC) Coho Salmon Evolutionarily Significant Unit (ESU). (See the Fisheries and Watershed chapters for additional information on watershed condition, use, and management.)

ZONING AND GENERAL PLAN

The Santa Cruz County General Plan (1994) can be described as the county's "blueprint" for future development. It is a long-range policy document that looks at the future of the community and takes into account the types of development that will be allowed, the spatial relationships among land uses, and the general pattern of future development. The stated objective for timber production (Santa Cruz County General Plan, Chapter 5, and Objective 5.12) is to encourage the orderly economic production of forest products on a sustained yield basis under high environmental standards, to protect the scenic and ecological values of forested areas, and to allow orderly timber production consistent with the least possible environmental impacts.

Under the concept of zoning, various kinds of land uses are grouped into general categories or "zones". A zoning ordinance is the local law (refer to County Code) that spells out the immediate, allowable uses for each parcel within the County. Zoning regulates present development through specific standards such as lot size, building setbacks, and a list of allowable uses. Zoning must comply with the general plan. The purpose of zoning is to implement the policies of the general plan. The Santa Cruz County General Plan allows timber harvesting and associated operations, requiring approval of a Timber Harvesting Plan by the California

Department of Forestry and Fire Protection for the following zoning designations: Timber Production (TP), Parks, Recreation and Open Space (PR) (except in the coastal zone), Mineral Extraction Industrial (M-3), and the Commercial Agriculture (CA) (except in the coastal zone).

SDSF is entirely classified as Timber Production Zone (TPZ). This statewide zoning designation was created by the Forest Taxation Reform Act of 1976 and counties throughout the State were required to rezone parcels that met the definition of Timberland as defined in Government Code Section 51104(g) and consistent with Sections 51112 and 51113. TPZ land is devoted to and used for growing and harvesting timber and other compatible uses as defined in Section 51104(h). Compatible uses include but are not limited to watershed management, fish and wildlife habitat management, and outdoor education and recreation activities, and a residence or other structure as necessary for management of land zoned as timberland production. .

Any development must not only meet the specific requirements of the zoning ordinance, but also the broader policies set forth in the local general plan. For the purpose of determining the development potential of rural parcels, the Santa Cruz County General Plan designates the Forest land as Mountain Residential. Objectives of this designation are to provide for very low density residential development in areas which are unsuited to more intensive development due to the presence of physical hazards and development constraints, the lack of public services and facilities to support higher densities, the protection of natural resources, retention of rural character, and to maintain sustainable use of natural resources.

CHARACTERISTIC FEATURES

A distinctive feature of SDSF is its proximity to the large urban areas of San Francisco Bay, Monterey Bay, and San Jose. This provides prime opportunities for urban children to experience forestry education on a first-hand basis.

The presence of steelhead trout in the Soquel Creek watershed also contributes to the special characteristics of SDSF. Once abundant along the entire west coast, steelhead populations have declined due to habitat loss and several other factors. The East Branch of Soquel Creek, the portion of Soquel Creek that flows through the Forest, supports a steelhead population and its required habitat. A very limited number of coho salmon and their habitat are also present in the watershed.

As mentioned above, the San Andreas Fault and Rift Zone are directly associated with SDSF. The effects of both ancient and contemporary seismic activity are apparent throughout the Forest. The history and future of this very active system make for an interesting addition to SDSF's abundant natural features.

Finally, the Forest contains archaeological and historical sites discovered during on-going archaeological surveys (Dillon, 1992). The Archaeology Chapter of this plan describes the sites and their significance in detail. Both prehistoric and historic, these sites will enhance SDSF's demonstration and education programs.

CHAPTER FOUR: ADMINISTRATION

THE LEASE

On March 7, 1988, State Controller Gray Davis and the Bank of America settled a thirteen-year long lawsuit over unclaimed bank accounts. The settlement included \$35.7 million in cash and four undeveloped natural parcels in Tehama and Sonoma Counties. The property that is now SDSF was acquired during the settlement process and added to the package.

The settlement properties are held in a trust with the State as the beneficial owner and the Exchange Bank as trustee. The properties can be sold to pay unclaimed funds if they exceed the \$35.7 million in cash set aside for this purpose. It is doubtful, however, that this will ever happen.

At the time of the settlement, The Nature Conservancy (TNC) volunteered to act as steward for these properties. A 25-year lease was developed which stated that TNC would manage these properties and that past land use practices could continue. Any revenues generated from these activities were to pay for property taxes, operations and maintenance, natural resource enhancement, and access improvement projects.

The Nature Conservancy transferred their lease of the Santa Cruz county property (now SDSF) to CAL FIRE on April 18, 1990. CAL FIRE assumed management at that time and a dedication ceremony for SDSF was held on July 13, 1990. In 2013, at the end of the 25-year lease, the property will be transferred permanently to the State, free and clear.

Under the terms of the lease, both the trustees and the Controller have certain rights and responsibilities. The trustee's primary responsibility is to monitor the lessee's performance as managers of the properties. The Controller is responsible for the sale of any or all the properties in the event that cash assets are insufficient to satisfy all claims. As previously mentioned, this is unlikely to ever happen.

CAL FIRE ADMINISTRATION

Authority to *administer and operate* state forests in California comes from the Legislature and is contained in the Public Resources Code (Sections 4631-4664 and 4701-4703). Rules and regulations governing *use* of state forests are contained in the California Code of Regulations (Title 14, Sections 1400-1439 and 1510-1521). The State Board of Forestry and Fire Protection gives policy direction to the Demonstration State Forest Program, which is administered by the Director of CAL FIRE.

CAL FIRE is administratively broken into two Regions, each with a Region Chief who reports to CAL FIRE's Director. Each region includes units, and state forests are administered by a local Unit Chief. SDSF is in the Northern California Region (with headquarters in Redding) and is within the San Mateo-Santa Cruz Unit (headquartered in Felton). The State Forest office is

located next to the CAL FIRE Soquel Forest Fire Station at 4750 Soquel-San Jose Road in Soquel, California. When fully staffed, SDSF has a staff of five: Forest Manager, Assistant Forest Manager, half-time Office Technician, and two seasonal Forestry Aides. The Forest Manager is supervised by the Unit Chief.

The Forest staff is responsible for the on-site operation of the Forest as provided for by the Public Resources Codes, California Code of Regulations, and the State Board of Forestry and Fire Protection. Forest regulations, policy, and other issues prescribed by the Director of CAL FIRE are used to develop plans and procedures to govern development and perform maintenance of the Forest. The General Forest Management Plan will be reviewed and approved by SDSF'S Advisory Committee (described below) and ultimately approved by the Board of Forestry and Fire Protection.

SDSF is an important resource for CAL FIRE training as well as for other agencies and affiliated organizations. CAL FIRE specifically uses SDSF for training of state personnel in chain saw operations, off highway driving for fire apparatus, wilderness first aid, search and rescue operations, swift water rescue, Forest Practice Regulations, Resource Management training for Joint Apprenticeship Committee requirements, Archaeology, and erosion control practices.

FUNDING AND TAXES

The Demonstration State Forest Program, including SDSF, is funded through the regular annual state Budget Act. AB 1965 did not establish a separate fund for SDSF and it is not listed as a line item in the state budget. Revenues from all state forests are deposited in a special fund called the Forest Resources Improvement Fund (FRIF), providing money for the annual budgets of state forests.

Expenditures for all state forests are included in a single budget line item in the Department's annual budget. Soquel State Forest was added to the Department's state forest budget in the 1990-91 fiscal year with a minimum of staffing and operating expense. The Budget Change Proposal recognized that there would be little revenue from SDSF for the first few years and that FRIF would need to contribute over one million dollars in operating expense before the Forest could produce revenue. It was also recognized that many years would pass before revenues would equal expenses.

The Department may permit a limited amount of commercial timber operations on SDSF in order to provide funds on a cumulative basis as necessary for the maintenance and operation expenses of SDSF, reasonable capital costs, and other expenses incurred in fulfilling the objectives of PRC Sections 4660-4664 on SDSF. The enabling legislation requires a minimum level of timber harvesting, or "floor", to provide income for all costs of operation and for research and educational purposes of SDSF. The legislation authorizes a higher level of harvesting, or "ceiling", which shall not exceed long-term sustained yield (LTSY) and on a cumulative basis shall not exceed the level of timber harvesting necessary to provide the funds needed for the maintenance and operation expenses, reasonable capital costs, and other expenses incurred in

fulfilling all the objectives identified in PRC Sections 4660-4664 on SDSF. These additional objectives include watershed protection and monitoring, demonstrations of compatible rural land uses, and historic development of timbering and forestry machinery.

As a practical matter, the various objectives overlap and cannot be completely separated. For example, demonstration or experimental timber harvesting could qualify as research and public education as well as being an example of compatible rural land uses. The protection of old-growth redwood trees will occur under normal operations of SDSF and does not need to be identified as a separate purpose with separate funding.

Funding for SDSF needs to be increased over time in order to fulfill the objectives of PRC 4660-4664. In order to adhere to the administrative and budgeting processes currently in place while simultaneously assuring compliance with the limitations placed on the Department by the enabling legislation, the Department will publish accurate annual reports which will compile revenues and expenses itemized by program. The Department will post the Annual Report on the CAL FIRE website. Large capital expenses (e.g., for additional properties to provide proper access to SDSF or for construction of a Forestry Education Center and administrative facility) will be funded through the FRIF fund or any fund source approved by the Legislature. Amortization of these capital outlays may be included in the computation of cumulative expenses in the annual reports.

The State pays property taxes to the County of Santa Cruz on land values within SDSF. Additionally, purchasers of state forest timber are liable for payment of timber yield taxes according to Public Resources Code, Section 4654. SDSF's timber sale purchasers are required to file quarterly tax returns with the California Board of Equalization.

ADVISORY COMMITTEE

The legislation which created SDSF (AB 1965) called for the establishment of an advisory committee to assist with the development of SDSF's General Forest Management Plan. A main function of the committee is to act as a critical link between CAL FIRE and the community in the planning effort. This allows SDSF to learn what the community expects and how they feel about certain issues.

The original Advisory Committee had nine members appointed by the Director of CAL FIRE in August of 1991. Five positions were specified by the legislation and four were added by the Director. The original committee consisted of one representative from each of the following:

- * State Board of Forestry and Fire Protection
- * Santa Cruz County Board of Supervisors
- * California Department of Parks and Recreation
- * California Department of Fish and Game
- * The Forest of Nisene Marks State Park Citizens Advisory Committee
- * The Nature Conservancy

- * Soquel Creek Water District
- * Neighborhood Representative
- * Local Registered Professional Forester

The Committee held monthly meetings during the development of the 1998 General Forest Management Plan. The Advisory Committee became inactive following the approval of the 1998 Plan. The Advisory Committee reconvened in 2011 to provide input on updating the Plan. Most of the groups listed above continue to be represented on the Committee. However, the Soquel Creek Water District removed itself from the Committee and the State Park Citizens Advisory Committee has been disbanded. The latter groups have been replaced with representatives from the Stewards of Soquel Forest and from the Resource Conservation District of Santa Cruz County. Each member serves a three-year term or until the General Forest Management Plan updating process is completed (whichever is longer). Once these conditions have been met, one third of the members' terms shall expire on the last day of each year. Following the approval of the updated Plan, the group will meet twice a year or as needed to review progress on plan implementation and contribute to on-going planning activities.

SAFETY

The remote and rustic character of SDSF makes safety an important management consideration. Forest visitors need to be informed of safety issues and hazards inherent to the Forest. Roads, trails, and facilities are maintained in safe condition. The staff coordinates with local CAL FIRE Emergency Command Center, the Loma Prieta Volunteer Fire and Rescue, the county sheriff's office, and other agencies and groups for emergency medical response. Forest personnel, including volunteers, are trained in first-aid; permanent Forest personnel maintain certification as Emergency Medical Responders. Additionally, search and rescue organizations are allowed to train in the Forest so as to develop their skills and better acquaint themselves with the terrain.

The following safety protocols are currently in place:

- * Restriction and regulation signs are posted at Forest entrances. Hazards, safety issues, and the primitive nature of the area are stated on signboards and in the SDSF brochure.
- * The staff works with the California Department of Parks and Recreation to provide trail maintenance, safety, and coordinated emergency response along the common boundary.
- * All trails, roads, and emergency helicopter landings are regularly inspected and maintained. Fallen trees and other hazards are removed as needed to maintain safe conditions.
- * Motorized vehicles are prohibited beyond designated parking areas. Exceptions are made through special permission and for management, patrol, and emergency purposes.

- * Coordination with CAL FIRE's Emergency Command Center in Felton and the county sheriff's office ensures effective emergency response in the Forest. All responses for emergency assistance will be recorded and compiled, including calls for police, fire, medical, or search and rescue services. (Refer to Appendix C, Monitoring Plan.)
- * Volunteers from the Stewards of Soquel Forest and the SDSF chapter of the International Mountain Bike Association provide trail maintenance and patrols, assistance to forest visitors, and support for emergency response.

LAW ENFORCEMENT

Forest regulations and policies are posted on signs and enforced through patrol and apprehension of violators (also see the Resource Protection chapter). CAL FIRE peace officers, authorized under the California Penal Code, will be used to detain violators, with local law enforcement agencies providing backup when necessary. The Department of Fish And Game wardens will enforce fishing, hunting, and trapping laws. Apprehension and prosecution of violators shall be actively pursued. Violators will generally be cited and expected to appear in court, but may be taken into custody if warranted. Methods to prevent illegal activities and alternatives which curtail unwanted behavior will be explored and developed to reduce law enforcement problems.

State Forest trespass violators will normally be cited under sections of the California Code of Regulation (Title 14). Illegal trespass includes removal of trees without a permit and parking, camping/campers, or building in the Forest.

Marijuana cultivation in the Forest has been relatively minor. Since the dedication of the Forest, the remnants of nine old gardens have been found and four active gardens have been eradicated. The general inactivity of marijuana cultivation is due in part to the majority of the Forest being south of the East Branch of Soquel Creek with a northern exposure. Furthermore, SDSF is inaccessible by vehicles and, therefore, is not readily available for use.

Detection of marijuana gardens will occur during normal patrol activities or as leads are developed. Most detection efforts will depend on flights by the Santa Cruz County Sheriff's Marijuana Eradication Program. Information about gardens found in SDSF will be referred to the sheriff's office.

ACCESS NEEDS

As stated in the Soquel Demonstration State Forest Recreation Study Final Report (McNally and Hester, 1993) and the Recreation chapter, Forest access is a significant problem and complex issue. The inability of the public to drive to the forest when county roads are closed and trespass across private property to and from the Forest are challenges.

The SDSF property came into state management with two verified legal access routes (see the

Roads and Other Improvements chapter for more details). The first is an administrative and public right-of-way through the Burch property off Highland Way. The second is across CHY Company property, through the Olive Springs Quarry, which includes a right-of-way for administrative use only.

Many visitors come in via Ridge Trail from The Forest of Nisene Marks State Park. Some recreationists, particularly equestrians, have permission to pass through private property to enter the Forest. The public's use of Comstock Mill Road is prohibited due to neighbors' opposition.

There is an obvious need to develop better access into the State Forest, particularly along the south and west ends where most trespassing occurs. It is important to provide Forest visitors with additional safe and legal access in order to reduce trespass onto private property. Furthermore, alternative access points are necessary when landslides close Highland Way and/or Eureka Canyon Road.

LAND ACQUISITION PRIORITIES

Land acquisition to improve access to SDSF is a top priority. This has been actively pursued since the dedication of the Forest. Negotiations with various neighboring property owners regarding appropriation and/or easements have been ongoing. Parcels formerly owned by the Noren family were purchased in 2005. These parcels make up about 9.5 acres are shown on the Acquisition Map below (Figure 4). The State acquired the properties for the express purpose of providing an improved access to SDSF in anticipation that successful negotiations with the CHY Company would eventually add the other key piece needed for this access. This parcel is adjacent to the Noren properties and would provide a suitable road alignment into the SDSF ownership, as well as a site for the Forestry Education Center and other facilities (see the Demonstration and Education chapter for more information).

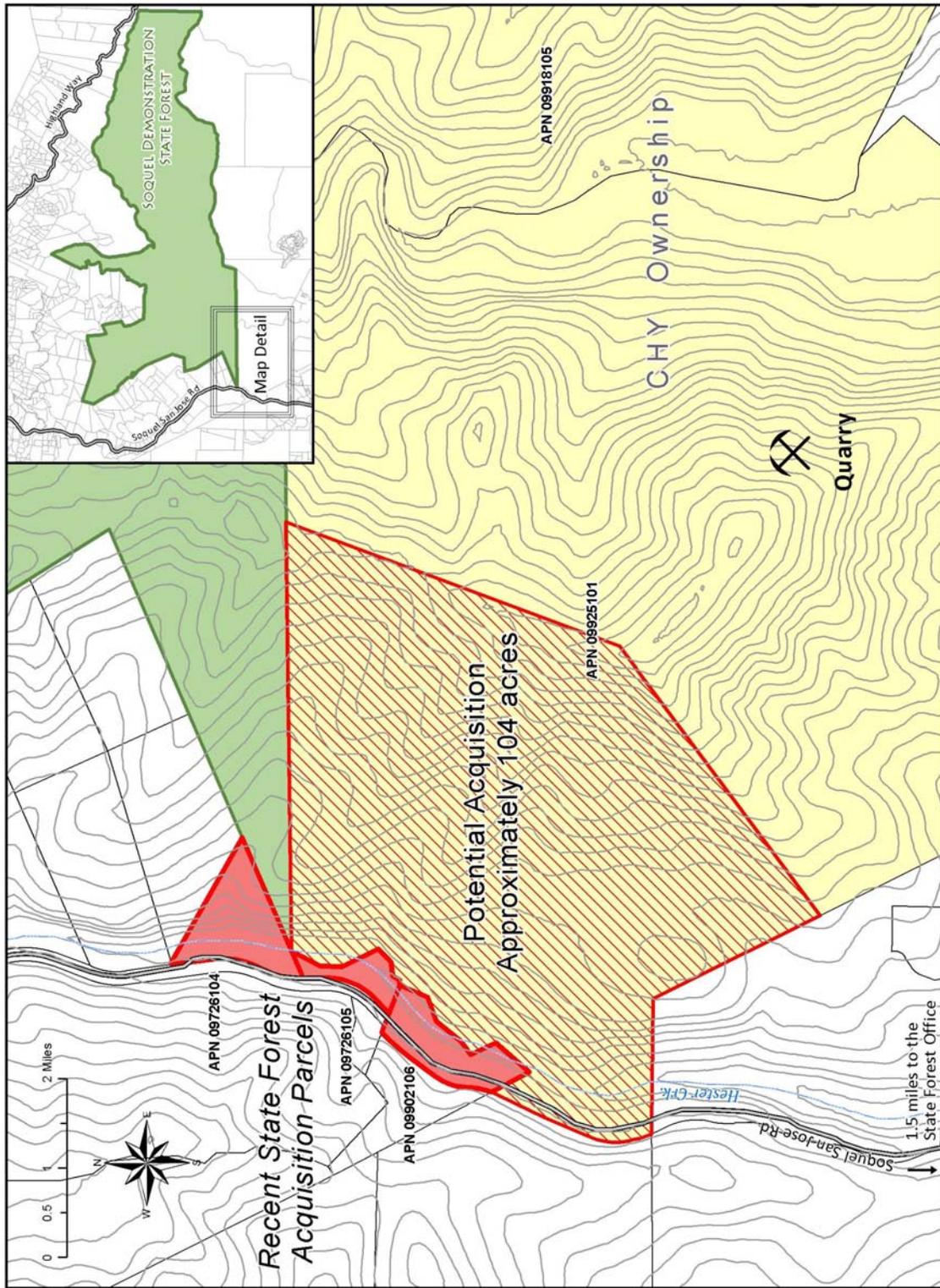
Another potential acquisition parcel is the Burch property which contains the entrance to the Forest (see Figure 2 in the Property Description chapter). The benefits of this procurement would include access control, additional areas for resource management and recreational visitor use, and a location for an informational kiosk and restroom. There would also be clear authority and responsibility for maintenance of and improvements to the bridge, roads, and parking area.

Other options for improving public access aside from direct land purchases will be considered. These could include purchase or trade of rights of way or easements. Any land acquisitions funded by timber harvest revenues from SDSF shall be limited to those which improve access to SDSF or otherwise directly enhance SDSF. All acquisitions for SDSF will comply with CEQA.

COOPERATION WITH ADJACENT LANDOWNERS

As the previous CAL FIRE Director, Harold Walt, indicated at SDSF's dedication ceremony in 1990, it is important for SDSF to cooperate with their neighbors. Forest staff will continually work with the community regarding local issues. These issues include but are not limited to fire prevention, trespass, watershed impacts, fisheries restoration in the East Branch of Soquel Creek,

FIGURE 4 – Acquisition Map for SDSF



mitigation of recreational and timber harvest impacts, emergency response and invasive species management. SDSF staff work with local schools in forestry education and also coordinates fire prevention programs with the local CAL FIRE Unit.

COOPERATION WITH OTHER AGENCIES AND INSTITUTIONS

SDSF cooperates with other agencies in resource protection, fire prevention and suppression, law enforcement, and safety. Cooperation is also encouraged for demonstration, forestry education, and university research projects. Other agencies that work with SDSF include the California Department of Parks and Recreation, California Department of Fish and Game, California Geological Survey, National Oceanic and Atmospheric Administration Fisheries, US Fish and Wildlife Service, US Geological Service, the County of Santa Cruz, and the Resource Conservation District of Santa Cruz County. Cooperative institutions of learning and research include UC Santa Cruz, Cabrillo College, California Polytechnic State University at San Luis Obispo, San Jose State University, UC Berkeley, UC Cooperative Extension, University of Washington, and local public schools.

THE FOLLOWING PUBLIC COMMENTS WERE RECEIVED DURING REVIEW OF THE 1998 GENERAL FOREST MANAGEMENT PLAN

Public comments and concerns involving the administration of SDSF have largely been focused on the issue of safe and legal access but have also touched upon the FRIF program and Advisory Committee composition.

Suitable public access into SDSF is a major concern for neighbors, users, and Forest staff. As previously stated, there is an obvious need to develop adequate entry and exit points and to stop illegal trespass. Several individuals have made specific requests regarding the location of access points, usually focusing on the area from Olive Springs Quarry to Comstock Mill Road. However, neither end is owned or controlled by the state, and only administrative access is allowed. SDSF will continue working with its neighbors and on potential access acquisitions to alleviate this complex and pressing issue.

During the process of establishing SDSF and creating the General Forest Management Plan, questions regarding the purpose and use of FRIF monies have been raised. As required by the Public Resources Code, all revenues from SDSF's timber sales must go into FRIF to be managed and allocated. As part of a state agency, SDSF will adhere to the requirements of FRIF as outlined by law.

Finally, neighbors of the State Forest have expressed that they would like greater representation on SDSF's Advisory Committee. Letters were written to former CAL FIRE Director Richard Wilson by both neighbors and the committee chairman requesting a review of the public's concerns. After a careful and lengthy evaluation, the Director determined that the committee composition was adequate due to strong current local representation.

CHAPTER FIVE: BIOTA

INTRODUCTION

Biota is defined as the flora (vegetation) and fauna (wildlife) which inhabit a particular area. When people envision forests, such as SDSF, biotic elements are what generally come to mind. Biota, however, are only one element of an ecosystem, small pieces of the larger puzzle.

An ecosystem has been defined as "the interacting populations of plants, animals, and microorganisms occupying an area, plus their physical environment." (Hunter, 1990). The physical environment consists of abiotic factors such as soil, water, space, and climate. The presence and actions of humans make up a yet another component of ecosystems. Though humans often consider themselves to be separate entities, at a basic level they are part of the biota and are intricately connected to everything in an ecosystem. When biotic, abiotic, and human components of a forest ecosystem are working together in dynamic balance, diverse biota and healthy forests are attained. (Dynamic balance refers to the continual interaction of ecosystem components which leads to a balanced yet constant state of change.) In real life, there are rarely clear boundaries between adjacent habitat communities or even ecosystems. Ecosystems and habitats blend and overlap but can be given a label based on general wildlife, vegetation, and location features. Management planning for ecosystems or habitat communities which looks at landscape patterns caused by this overlap can benefit all inhabitants, whether they be stationary (e.g., plants) or mobile (e.g., animals).

In this chapter, the biota is described for each habitat type, or community, found in the Forest. Only the most common plants and animals found in these communities are mentioned, but complete flora and fauna lists are located in Appendix B. For a detailed account of the biota of SDSF, refer to Preliminary Biological Assessment of Soquel Demonstration Forest, Santa Cruz County, California (Holland et al., 1992). For specific information about trees (size, abundance, etc.), see the Timber Management chapter. Fisheries resources are described in a separate chapter.

HABITAT COMMUNITIES

Communities consist of the living organisms collectively found in an ecosystem (Hunter, 1990). Even though considerable overlap often occurs, communities are individually labeled and classified for research, inventory, and education purposes. They are generally named for the dominant plant species within each community. The dominant plant species is dependent on specific environmental conditions (e.g., soil, climate, water) that further characterize the community. Because communities overlap, plants indicative of one habitat type may be found in others. Poison oak, for example, can be found growing in virtually all of the communities of SDSF but is most abundant in drier habitat types. Also, some fauna considered to be permanent residents of a particular community actually travel through several communities. These animals, including large mammals (deer, bobcat, gray fox, mountain lion), can be found throughout SDSF

as they search for food, water, and shelter.

In 2006 an inventory was completed which gathered tree data on plots located on a grid layout. This data was analyzed along with digital image segmentation and aerial imagery to classify the vegetation using the California Wildlife Habitat Relationship (CWHR) habitat classification system. Using this protocol six CWHR habitats were classified on SDSF. These are by order of abundance; Redwood, Montane Hardwood-Conifer, Coastal Oak Woodland, Douglas-fir, Mixed Chaparral and Annual Grassland. The CWHR system further classifies each type by the amount of canopy closure. The amount and extent of tree canopies are used in the CWHR system to help predict which wildlife species may be supported by these ecosystems. On SDSF there is Moderate density (40% to 59% canopy closure) and Dense (60% to 100% canopy close). The CWHR system then further categorizes by the average tree size classes. On SDSF the size classes correspond to 3 (pole size, 6 to 11 inches diameter at breast height), 4 (small tree size, 11 to 24 inches diameter breast height) and 5 (medium/large tree size, greater than 24 inches diameter breast height). Figure 5, showing these types with their corresponding locations and acreages, appears below.

COAST REDWOOD FOREST COMMUNITY

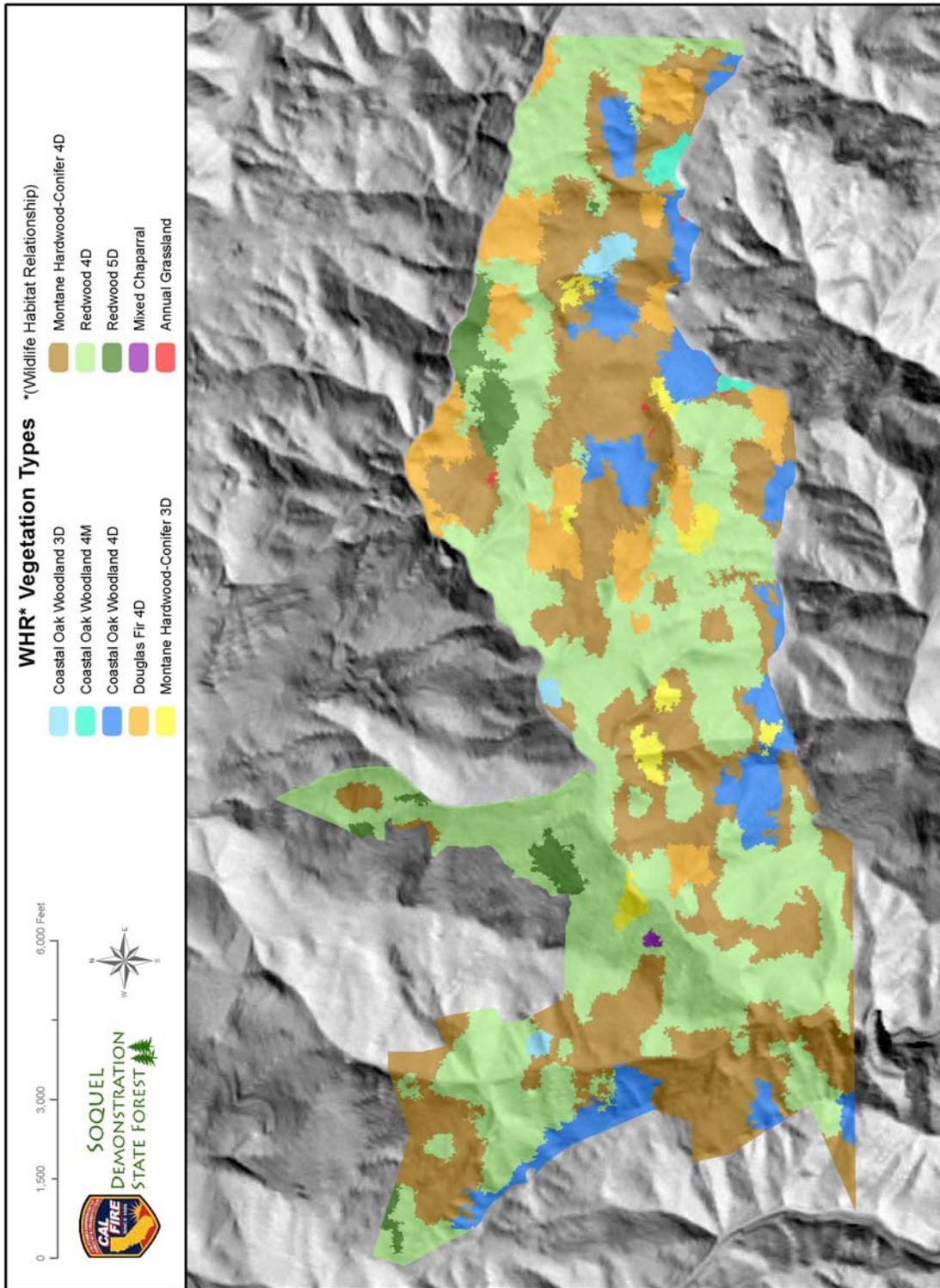
The coast redwood forest is dependent on areas of high moisture. In its northern range, large continuous stands of redwood are formed. Southern redwood forests are restricted to moist canyon slopes and riparian zones since more moisture is available in these areas. As its name suggests, the dominant tree of this community is coast redwood, the majority of which in the State Forest are second growth (regrowth after original clearcutting). Small groves of old-growth redwoods occur at Badger and Sulphur Springs, and individual old-growth redwood trees are scattered throughout the Forest. Other common trees of this community are tanoak, Douglas-fir, and madrone. Understory species found in the redwood community of SDSF are redwood sorrel, California hazel, wild ginger, and western sword fern. Common wildlife residents include pygmy nuthatch, Steller's jay, and Trowbridge's shrew. The redwood community provides nesting habitat, cover, and food for birds and a variety of small mammals. Redwood forests have comparatively little forage value for deer and other large mammals, however, limiting use of this habitat type.

MONTANE HARDWOODS-CONIFER COMMUNITY

This forest community is dominated by both conifers and hardwoods, often in a closed canopy. About 978 acres of the Forest are categorized as Montane Hardwoods-Conifer. Primary tree species include Douglas-fir Shreve oak, and redwood; and to a lesser extent madrone, California bay, black oak, and big leaf maple (Holland et al., 1992). Montane Hardwoods-Conifer forests are on the drier slopes above the redwood community, though the two overlap considerably. Also included in this community are stands with significantly more Douglas-fir which are classified at CWHR Douglas-fir and compose about 213 acres.

Common understory species include poison oak, California blackberry, vetch, toyon, and yerba

Figure 5 – Vegetation Type Map for SDSF



buena. Familiar wildlife residents are Merriam's chipmunk, dusky-footed woodrat, western gray squirrel, California slender salamander, acorn woodpecker, sharp-shinned hawk, and screech owl. Evidence of feral pig activity is also found throughout the community. Oak trees located in these areas have very high value for wildlife, providing both nesting and roosting substrates and a food source through acorn production.

Some stands in this community historically supported a more significant conifer component than exists today. These stands failed to regain the original species distribution following intensive harvesting during the 1930's and 40's. These stands are dominated by tanoak and Shreve oak. Understory vegetation is typically minimal except for occasional conifers where canopy openings permit (See Timber Management Chapter for additional hardwood management discussion).

COASTAL OAK WOODLAND COMMUNITY

The coastal oak woodland community is composed primarily of hardwoods and covers about 254 acres. These hardwood stands appear to be long dominated by a combination of coast live oak, Shreve oak, and tanoak. They occupy sites less favorable to conifers. As with the coast redwood and montane hardwoods-conifer communities, other hardwoods such as madrone, bay (laurel) and black oak are also present. These stands include large senescent oaks with unique structural features beneficial to wildlife. Acorn production is important to many species, especially as winter range. Understory species are similar to the Montane Hardwoods-Conifer community. Any management activities conducted in these stand types will be conducted solely for long term maintenance.

RIPARIAN COMMUNITY

Riparian communities are named for the intermittent or continual presence of fresh water rather than the vegetation of such areas. Riparian communities are located along the edges and floodplains of streams or surrounding lakes. In SDSF, an abundant riparian community exists along the floodplain of the East Branch of Soquel Creek and to a lesser degree along Amaya Creek. This community is dominated by deciduous hardwoods such as white alder, bigleaf maple, black cottonwood, and California sycamore. Along with these trees, red and yellow willows grow in dense clumps along the banks of the East Branch. Horsetails and hedge nettles are common ground cover along the edges. Wildlife residents include vireos, warblers, Pacific-slope flycatcher, long-tailed weasel, and raccoon. Pacific newts, brown-colored salamanders with bright orange bellies, are abundant in the riparian community and a great delight to young forest visitors. The Pacific tree frog, thought to be common, is only found in a few locations (Holland et al., 1992). Additionally, large colonies of ladybug beetles gather along creeks to overwinter and breed.

Riparian communities are the most productive terrestrial habitat type for wildlife because of structural diversity and the presence of water. Many migratory songbirds are dependent on riparian habitat for breeding and foraging. Large mammals use the riparian zone as a water supply, and incorporate it into their home ranges. The riparian community is probably the most

significant habitat type in the Forest due to its high value to wildlife and limited regional occurrence.

OTHER COMMUNITIES AND ADDITIONAL SPECIES

There are a few other limited communities present in SDSF. Freshwater marshes are areas where the soil stays wet the majority of the year, supporting characteristic vegetation. These marshes usually occur along the perimeter of ponds, at springs, near shallow pools of streams, or in areas of high water tables. The freshwater marsh community in SDSF is scattered, including only Amaya Pond and a few natural springs (Sulphur, Badger, and a couple of small, unnamed springs caused by or increased from the Loma Prieta earthquake). Wildlife residents include migratory waterfowl, great blue heron, black phoebe, belted kingfisher, and garter snakes.

Less than five acres of SDSF are comprised of grassland and mixed chaparral communities. Some of the grassland areas are natural, due to soil conditions conducive to permanent grassland establishment. Other grassland areas are the result of past disturbance. SDSF's grasslands primarily contain wild oats and annual fescue grasses. Most grasslands are being encroached upon by coyote brush, lupine, poison oak, and Douglas-fir. Common wildlife residents of the grasslands are the gopher snake and Botta pocket gopher.

There is one significant chaparral stand located in the Longridge Road area on the south facing slope above Soquel Creek. Chaparral species are also found mixed in the Montane Hardwood-Conifer and Coastal Oak Woodland vegetation types along the exposed ridge tops and on south-facing slopes at higher elevations. These dry locations support the fire-adapted woody shrubs of manzanita, buck brush, coyote brush, and chamise. Common wildlife residents are Bewick's wren, California towhee, scrub jay, western fence lizard, and brush rabbit.

FUNGAL RESOURCES

A local mycological organization has identified a wide variety of mushrooms in the Forest (refer to Appendix B). Fungi are broken into three categories based on their relationship to the immediate environment: mycorrhizal, saprophytic, and parasitic. Saprophytic fungi occur on wood that is already dead whereas parasitic fungi attack and can kill live trees. The most common fungi found in SDSF are mycorrhizal.

Mycorrhizal species form a symbiotic relationship with the trees they grow under. These organisms grow around the rootlets and collect water and trace nutrients for use by trees. The trees in turn provide carbohydrates to the fungi. Trees and mycorrhizae, therefore, depend on one another for optimum health. According to a representative of the Fungus Federation, SDSF is a reasonably healthy forest because of the wide occurrence of mycorrhizal fungi (Nathan Wilson, personal communication, 1993).

In general, mycological research of California's wildlands has been minimal, particularly regarding conditions conducive to fungi growth. SDSF provides ample opportunities for

mycological research including fungi population analysis and succession of fungal species in the Forest. To protect the fungal resources of SDSF, a permit system for mushroom collection is maintained that prohibits any collection for commercial purposes.

FERAL PIGS

Since the establishment of SDSF, feral pigs (*Sus scrofa*) have been observed throughout the Forest. Feral pigs are an introduced species and are present throughout the Santa Cruz Mountains. Their populations shift from year to year based on weather patterns and forage availability, and seem to be transient between the Forest and the surrounding areas. The pigs are a problematic species because they can cause damage and/or alter the Forest's native communities. They frequently wallow in soft soil and wet, marshy areas which can contribute to sediment in watercourses and disturb flora and fauna that use these habitats. Their rooting/foraging behavior often damages roads and encourages invasive plant species. Feral pigs also aggressively defend themselves and under certain conditions may pose a threat to Forest users. In the past, the Forest has received complaints about damage done to neighboring properties because of the belief that the feral pigs reside in SDSF. Requests were made for increased monitoring and management of the feral pig population.

The population is managed through the Department of Fish & Game's Wild Pig Depredation permitting process. When increased pig activity is noted during patrols (rooting along roads, tree damage, wallowing at sumps and ponds), depredation permits are issued.

CORVIDS

Corvids are birds from the genus *Corvus*, and in the Santa Cruz Mountains include common species such as crows, ravens and jays. Unlike many other bird families, corvids fitness and reproduction, increases with human development. Corvids are especially significant in the Santa Cruz Mountains because they are major predators on eggs and chicks of the endangered marbled murrelets. Large populations of corvids are frequently associated with campgrounds in forests where unnatural foodstuffs are found. Big Basin State Park, a nesting site for murrelets, works specifically to contain trash and food at campgrounds as well as inform the recreating public about the sensitivity of nesting murrelets. Corvid populations are unlikely to be higher for SDSF than for the surrounding privately managed timberlands. Camping is not allowed on a regular basis at SDSF and visitors are expected to pack out all trash. Marbled murrelets have never been detected at SDSF, although the old-growth stand near Badger Springs is considered suitable habitat for the species.

INVASIVE SPECIES

Invasive species control is an ongoing process at SDSF. Forest staff along with Ben Lomond Crews and volunteers log hundreds of person hours each year to reduce and control French broom. The primary method to reduce invasive species (predominantly French broom and jubata grass) has been a continuous mechanical removal approach by pulling plants and roots or cutting stems. Other control methods such as herbicide applications and flaming have not been

employed, although it is clear that a more efficient and cost effective approach needs to be considered. Efforts will be made to control existing invasive plant populations, reduce opportunities for further spread of existing species, and prevent the introduction of other species not currently present on SDSF. During the preparation of the Fern Gulch THP a botanical survey was conducted where twenty-four non-native species were identified which are representative of species found throughout SDSF (Table 2). Approximately half of the species identified are considered a high priority for control.

Many non-native plant seeds prefer bare mineral soil to germinate. Preventing the establishment of new or expansion of established populations is emphasized through THP mitigations that minimize soil disturbance and the amount of exposed mineral soil following operations. Additional project mitigations include avoiding the introduction of weedy grasses into project areas, avoiding the use of grass seed for erosion control, and using only certified weed-free straw (preferably rice straw) for mulching to prevent erosion.

PLANT SPECIES OF CONCERN

The Natural Diversity Data Base (NDDDB) was queried on May 10, 2010 to collect information on listed species and species of concern known to occur in the Laurel Quadrangle that contains the Soquel Demonstration State Forest. A total of eight plant species are state and/or federally listed as threatened or endangered. In addition six plant species are categorized as CNPS (California Native Plant Society) List 1B. The plants of List 1B are rare throughout their range with the majority of them endemic to California. Most of the plants of List 1B have declined significantly over the last century. List 1B plants constitute the majority of the plants in CNPS' Inventory with more than 1,000 plants assigned to this category.

All of the plants constituting List 1B meet the definitions of Sec. 1901, Chapter 10 (Native Plant Protection Act) or Sec. 2062 and 2067 (California Endangered Species Act) of the California Department of Fish and Game Code, and are eligible for state listing. These species must be fully considered during preparation of environmental documents.

A nine quad search of processed CNDDDB data, centered on the Laurel quadrangle identified 48 plant species. One plant species is CNPS List 1A, 32 CNPS List 1B, and 15 are federal and/or state listed as threatened or endangered. Although there is no suitable habitat for most of these taxa on Soquel Demonstration State Forest, the number of species listed provides a rough indicator of the extent of plant species of concern in the general vicinity of the State Forest.

SPECIAL-STATUS WILDLIFE SPECIES

Although the biological assessment of the Forest conducted in 1991-92 found no threatened or endangered plant or wildlife species, this is not the case today. The Central California Coast (CCC) coho salmon Evolutionarily Significant Unit (ESU) were federally listed as threatened in 2006. The California red-legged frog has also been found on the Forest and is now federally listed as threatened. Additionally, a few wildlife species of special concern to the State of

Table 2 Invasive exotic plant species occurring at Soquel Demonstration State Forest

Common Name	Scientific Name
*French Broom	<i>Genista monspessulana</i>
*Periwinkle	<i>Vinca major</i>
*Poison hemlock	<i>Conium maculatum</i>
*Jubata Grass	<i>Cortaderia jubata</i>
*English Ivy	<i>Hedera helix</i>
*Eupatory	<i>Ageratina adenophora</i>
*Subterranean clover	<i>Triflorium subterraneum</i>
*Italian thistle	<i>Carduus pycnocephalus</i>
*Italian ryegrass	<i>Lolium multiflorum</i>
*Forget me not	<i>Myosotis latiflora</i>
*Bermuda buttercup	<i>Oxalis pes-capre</i>
*Orchard grass	<i>Dactylis glomerata</i>
Bull thistle	<i>Cirsium vulgare</i>
Cutleaf geranium	<i>Geranium dissectum</i>
Rough cat's-ear	<i>Hypochaeris radicata</i>
Common chickweed	<i>Stellaria media</i>
Field bindweed	<i>Convolvulus arvensis</i>
Broadleaf fleabane	<i>Conyza sumatrensis</i>
Spiny sowthistle	<i>Sonchus asper</i>
Soft chess	<i>Bromus hordeaceus</i>
Bur-Chevril	<i>Anthriscus caucalis</i>
Sticky chickweed	<i>Cerastium viscosum</i>
Fiddle dock	<i>Rumex pulcher</i>
Olive	<i>Olea europaea</i>

* The survey botanist recommended these species have the highest priority for control.

California have been seen in SDSF (Holland et al., 1992 and CAL FIRE, 1994). Those species observed were the foothill yellow-legged frog, western pond turtle, sharp-shinned hawk, Cooper's hawk, and golden eagle. The long-eared owl and yellow warbler may also occur in the Forest, but they have not been observed (Table 3). Suitable breeding, nesting, or foraging habitats exist in the Forest for all species observed except the golden eagle.

The Laurel Quadrangle CNDDDB query for animal species indicates the occurrence of two federally listed endangered insects and two federal or state listed threatened and endangered fish species. In addition, one amphibian is federally listed as threatened and one amphibian, one reptile, and one mammal species are presently California Department of Fish and Game Species of Special Concern. See Table 3 for further information.

Table 3. Special-status vertebrate fish and wildlife species occurring or with potential to occur at Soquel Demonstration State Forest

SPECIES	LEGAL STATUS a FEDERAL/STATE	HABITAT	OCCURRENCE IN SDSF b
American peregrine falcon	/FP	Nests in cliffs, forages in a variety of habitats	4
Merlin	/WL	Wintering only, frequents open habitats	2
Marbled murrelet	T/E	Nests in old-growth conifer forest; forages in pelagic habitats	4
Golden eagle	BCC/FP	Nests in cliffs and trees in forests and woodlands; forages in grasslands, shrublands, and chaparral	2
Osprey	--/WL	Nests in snags and spike-top trees;forages in open water	2
Cooper's hawk	--/WL	Nests and forages in woodlands and forests; also forages in open habitats	2
Sharp-shinned hawk	--/WL	Nests and forages in conifer forest habitats	1
Long-eared owl	--/CSC	Nests and forages in riparian and woodland habitats	2
Olive-sided flycatcher	--/CSC	Tall conifers used for nesting,perching; Forages over open/low vegetation	2
Purple martin	--/CSC	Nests and forages in woodland and forest habitats in tree cavities	4
Vaux's swift	--/CSC	Nests in large tree cavities with a Preference for redwood and Douglas-fire habita	2
Black swift	--/CSC	Nests on cliffs,steep rocky outcrops, Canyons near water	2
Yellow warbler	--/CSC	Nests and forages in riparian habitats	2
Foothill yellow-legged frog	--/CSC	Occurs in streams with rocky substrate	2
California red-legged frog	T/CSC	Occurs in slow-moving streams, pools and ponds	2
Western pond turtle	T/CSC	Occurs in pools, ponds, and lakes	2
Steelhead (Central CA Coast ESU)	T/CSC	East Branch Soquel Creek	4
Coho salmon(Central CA Coast ESU)	E/E	East Branch Soquel Creek	3
Pallid Bat	--/CSC	Buildings, rock outcrops	3
San Francisco dusky-footed woodrat	--/CSC	Forested habitats of moderate canopy and Moderate to dense understory	2

a Status codes:

Federal: T = threatened; E = endangered; P = proposed for listing as threatened or endangered; BCC = bird of conservation concern, USFWS

State: CSC = species of special concern; T = threatened; E = endangered; WL = Watch List

b 1 = confirmed nesting/reproduction; 2 = observed; 3 = not observed; 4 = unlikely to occur.

Sources: Jones and Stokes Associates, Inc., 1996
California Department of Fish and Game Special Animals List, July 2009
California Department of Fish and Game State and Federally Listed Endangered & Threatened Animals of California, January 2010
California Department of Fish and Game, California Natural Diversity Database, Laurel Quadrangle, May 10, 2010

THE FOLLOWING PUBLIC COMMENTS WERE RECEIVED DURING REVIEW OF THE 1998 GENERAL FOREST MANAGEMENT PLAN

A major focus for the management of SDSF's biota involves species evaluation and monitoring, particularly for special status species. Comments have largely focused on fauna though concern about edge vegetation and introduced plant species has been expressed. As stated in the Management Guidelines and Planned Actions below, SDSF plans to monitor selected biotic elements of the Forest and evaluate effects of forest management activities on the condition of those resources.

Another primary concern is the restoration of degraded habitats and maintenance of exceptional resource values in SDSF. Emphasizing this concern are comments regarding management of habitats individually (e.g., manage riparian habitats separately from mixed evergreen habitats) and management activities which allow interior forest species to thrive. Many commenters feel that development and management of SDSF should be performed in such a way that biotic resources are preserved or improved. The Management Guidelines and Planned Actions deal with these issues as well.

Finally, input has been received regarding the desire for details on exactly how SDSF will manage and maintain its biotic resources. Since this management plan is intended to be general, specific information on the what, how, why, and when of SDSF management activities will be outlined in other formats. More specific management strategies will be developed for different areas and habitats based on anticipated management endeavors and research and monitoring results.

MANAGEMENT GUIDELINES

1. Ongoing monitoring will be performed to detect listed and special status species. Monitoring will include keeping current with state and federal lists as well as conducting periodic floral and faunal surveys. Inventories will emphasize special-status species expected to be present but not yet observed in SDSF. New findings will be added to current species lists. Every consideration will be given to protecting these species and their habitat as required by law and determined by a qualified biologist.
2. Old-growth trees will be protected as outlined in SDSF's authorizing legislation, AB 1965. Areas of old-growth redwood have been located and protection will be provided in

all phases of forest management. Additionally, areas have been designated to promote late-succession stands of trees (see the Timber Management chapter for more details).

3. Restore, maintain, or enhance resource values of native habitat communities to promote natural diversity and stability. Measures to achieve this include:
 - * snag recruitment and retention
 - * preservation of appropriate logs and other woody debris
 - * maintenance of natural ponds and springs
 - * protection of riparian zones for use as movement corridors for wildlife
4. Achieve mutual benefit with timber harvesting, demonstration and education, and recreation programs while respecting native biotic elements. Wildlife habitat improvements, such as those mentioned in Management Guideline 3 above, will be considered during the planning and implementation of timber sales, demonstration and education activities, and recreational facilities. Conversely, possible impacts of present or future wildlife and vegetation management projects on other management objectives will be studied prior to project approval and implementation.
5. Control and/or eradication of exotic invasive plant species utilizing Integrated Pest management techniques will be incorporated into management activities, as appropriate. Ben Lomond Conservation Camp crews are utilized for hand pulling and cutting. Forest volunteers also help with the removal of invasive plants. Additional efforts including herbicides or flaming where and when appropriate will be employed.
6. Control mushroom collection by issuing permits for scientific, educational, and personal use. Mushroom gathering for commercial purposes is prohibited.

PLANNED ACTIONS

1. Encourage researchers to study wildlife habitats, populations and unique characteristics at SDSF. Continue to support the UC Santa Cruz Puma Project and the newly developed herpafauna survey efforts described further in the Research chapter.
2. Examine the California Natural Diversity Database (CNDDDB) reports during project planning and incorporate measures into all project development and monitoring processes for all known species as well as special status species that may be present. Submit CNDDDB Field Survey forms to DFG for any sightings of listed, rare or special status species.
3. Conduct preharvest and post-project surveys to identify active nest sites of all special-status bird species that may occur in the Forest. Those species that may occur in SDSF are Cooper's hawk, sharp-shinned hawk, long-eared owl, and yellow warbler. In addition, preharvest surveys will be conducted for California red-legged frog, foothill

yellow-legged frog, and southwestern pond turtle.

4. Continue to evaluate the feral pig situation, and develop management strategies and actions to diminish existing problems.
5. Continue to build the inventory of old-growth trees across SDSF (further described in the Old Growth section of the Timber Management chapter).
6. Continue to use mechanical methods for controlling invasive species with Ben Lomond crews and volunteers each year. Use additional follow up treatments to improve effectiveness, such as herbicide application or flaming, where and when appropriate.
7. Biological Assessments will be conducted incrementally in new project areas. These will include results of CNDDDB reports, botanical surveys, and other site specific assessments.

CHAPTER SIX: FISHERIES

INTRODUCTION

Approximately 7.5 miles of fish-bearing streams flow through SDSF, including the East Branch of Soquel Creek (5 miles), Amaya Creek (2 miles), and Fern Gulch Creek (0.5 miles). The East Branch provides valuable steelhead trout spawning and rearing habitat. This, along with their legally-protected status and cultural values, makes the fisheries of SDSF an important resource.

STEELHEAD TROUT AND COHO SALMON

The fishery resources of greatest concern in SDSF are the steelhead trout and coho salmon. Anadromous fish such as steelhead and coho spawn (mate and lay eggs) in freshwater creeks or rivers but spend most of their adult lives in the ocean.

The cycle begins with the development of eggs into young fish in streams where the adults spawned. Once the eggs hatch, young fish develop in the watercourse and gradually make their way to the ocean. Steelhead trout in this area typically spend two years in fresh water although a few may spend additional years inland before migrating. The length of time spent in streams depends on environmental and genetic factors, and some individuals never migrate (Barnhart, 1986). Coho salmon spend one year in freshwater before going to the ocean. Due to the abundance of food, anadromous fish species experience most of their growth once they have reached the ocean. Steelhead and coho along the California coast usually spend two years in salt water, attaining sexual maturity and storing fat for their journey back up streams. As with all anadromous fish, steelhead trout and coho salmon usually return to the stream from which they hatched to mate and lay eggs. Coho die following spawning, but steelhead swim back to the ocean. Steelhead may repeat the cycle and spawn up to four times, but most repeat spawners do so only twice.

Historically, coho salmon spawned in coastal streams from the Bering Sea of the Arctic and the coast of Japan to the Monterey Bay in California. The steelhead's range extended further to the north coast of Baja California. Steelhead and coho populations have been declining throughout their entire range, both in fresh and salt water, for decades due to a number of factors including habitat loss. In California, numbers decrease from north to south, with the southernmost population of steelhead in the Ventura River (Barnhart, 1986), and coho in Soquel Creek. While the Soquel Creek watershed is within the steelhead and coho's range as discussed below, there has been a considerable decline in numbers for both species.

LOCAL FISH POPULATIONS

Anadromous fish populations in Soquel Creek and along most of the Central Coast have declined significantly since the late 1960s. Large numbers of coho salmon were historically present in Soquel Creek, and reports estimate that runs may have included from one to two hundred fish (Runs are groups of fish that swim upstream around the same time of year to spawn.) According to Dave Hope, resource planner for the County of Santa Cruz, past steelhead runs in Soquel

Creek may have had up to 1,000 fish. Coho salmon were planted into the East Branch of Soquel Creek in the 1930s originating from the Brookdale, Big Creek, Prairie Creek and Fort Seward hatcheries (Anderson, 1995).

In 1995, the California Fish and Game Commission listed coho salmon south of San Francisco Bay as endangered. That listing designation was extended from San Francisco Bay to Punta Gorda, Humboldt County in 2005. Coho salmon along the Central California Coast were also listed under the federal Endangered Species Act as endangered in August of 2005 (NMFS, 2010).

No production/mitigation hatcheries (hatcheries that produce fish with the goal of increasing recreational and commercial harvest or for mitigation purposes) for Central California Coast coho salmon currently exist. The two hatchery operations in the Central California Coast Evolutionarily Significant Unit are captive broodstock facilities operated expressly for conservation and recovery purposes with significant oversight by the California Department of Fish and Game and the National Marine Fisheries Service. Coho salmon reared at these two facilities are listed under the Endangered Species Act. In Santa Cruz County the goals of the captive broodstock program include increasing population size, maintaining genetic diversity, and producing sufficient numbers of fish to promote straying into neighboring streams (Sturm, 2009). Coho salmon were thought to be extinct in Soquel Creek in the 1990s and most of the first decade of this century, until a small population of young of the year fish was observed in 2008 near the entrance of Hinckley Creek below SDSF.

Central California Coast steelhead occurs in Soquel Creek in greater numbers. In February, 2006 this species was listed under the federal Endangered Species Act as threatened for coastal basins from the Russian River, south to and including Soquel Creek (CDFG, 2009) and for naturally spawning populations (e.g., not a product of hatchery operations). The listing excludes the Sacramento-San Joaquin River Basin, as well as two artificial propagation programs: the Don Clausen Fish Hatchery, and Kingfisher Flat Hatchery/ Scott Creek (Monterey Bay Salmon and Trout Project) steelhead hatchery programs. Principal hatchery production for the Central California Coast steelhead originates from the Warm Springs Hatchery on the Russian River and the Monterey Bay Salmon and Trout Project on a tributary of Scott Creek. The most recent planting of hatchery-raised steelhead in SDSF (i.e., the East Branch of Soquel Creek) occurred in the 1930s. Steelhead trout from the Brookdale and Big Creek hatcheries were released in the East Branch of Soquel Creek (M. McCaslin pers. comm.). The Monterey Bay Salmon and Trout Project stocked steelhead annually in the main stem of Soquel Creek (downstream of the SDSF) until recently, and in the early 1980s, released fish near the quarry (just south of the SDSF) (M. McCaslin pers. comm.) Estimated run size for the Central California Coast steelhead in Soquel Creek was 500-800 fish in 1982, but declined to less than 100 fish in 1991 (Reavis, 1991) and 50-100 fish in 1994 (Shuman, 1994). The basis for the estimates put forward by Shuman (1994) is, however, considered questionable by Good et al (2005).

Other species of fish within the boundaries of SDSF include the Pacific lamprey and a small resident rainbow trout population above Ashbury Gulch. According to biologist Jerry Smith, additional species likely to be found in the East Branch include prickly sculpin, coast range

sculpin, California roach, Sacramento sucker, and northern threespined stickleback.

In order to help protect remaining steelhead trout populations in Soquel Creek, the California Department of Fish and Game prohibits angling in the East Branch of Soquel Creek (Fish and Game South Central District Regulation, Title 14, Section 7.00 [e] [4]). This regulation was adopted by the California Fish and Game Commission in December of 1981 and became effective in March, 1982. In spite of this regulation, poaching of adult steelhead during winter spawning is prevalent and continues to affect fish populations. To avoid adverse impacts of public use on fish in SDSF, forest staff and the California Department of Fish and Game will conduct ongoing patrols to enforce prohibitions on fishing and fish harassment.

HABITAT AND RESOURCE CONSIDERATIONS

HABITAT ATTRIBUTES

The basic stream attributes for steelhead and coho spawning, rearing, and migration include cool water temperature, high concentrations of dissolved oxygen, adequate water depth, sufficient pool space, and low sediment levels (Barnhart, 1986 and Anderson, 1995). In addition, suitable hiding cover, food supplies, and access to spawning areas can influence the survival of steelhead and coho. All of these habitat conditions need to be considered when working to restore, maintain, or enhance anadromous populations.

Riparian zones are strips of water-loving vegetation and associated organisms that follow the path of watercourses. Essential to healthy aquatic ecosystems, these zones help maintain favorable water quality and provide important food and habitat conditions. Trees along the water's edge shade the water, maintaining cool temperatures for anadromous fish spawning and rearing, as well as maintaining a favorable microclimate for amphibians. Riparian vegetation also stabilizes streambanks and intercepts eroded materials from upslope, minimizing the amount of sediment that enters the stream. Additionally, vegetation adds food and nutrients to the water for use by aquatic invertebrates. Large woody debris falling into the water provides cover for fish, collects and controls the movement of sediment, and creates pools. Consistent with the Anadromous Salmonid Protection Forest Practice Rules approved in 2009, conifers will be planted in riparian zones, in areas where none exist, to promote long-term recruitment of large instream woody debris. Small intertwined pieces of debris, such as branches and twigs, act as collectors of leaf litter and provide more food for invertebrates.

HABITAT LOSS AND DEGRADATION

The loss of habitat, particularly for rearing, has had a significant impact on the anadromous fish populations of the Soquel Creek drainage. Habitat has declined due to diversion and overdrafting of water by residents, past logging practices, flood control measures, increased development along the creek (including vegetation removal), pollution, and naturally unstable hillslopes. These elements have increased water temperature, added sediment to the creek, altered natural flow patterns, and decreased water levels during the critical summer months and

periods of drought. (See the Watershed Assessment chapter for details on SDSF's watercourse conditions.)

Over the years, the combination of increased sediment and lowered water levels has resulted in a considerable loss of pool space throughout the Soquel Creek watershed. This loss of pool space, along with general fresh and saltwater habitat degradation, may have contributed to the nearly complete disappearance of the coho salmon. Coho population densities along the central coast are extremely low and will need vast assistance and human cooperation to become viable again (NMFS, 2010).

An additional habitat problem in the East Branch involves access to spawning areas. A few log jams within SDSF may not be passable by fish. During periods of high water, fish may be able to overcome these barriers, but conclusive evidence of this does not exist. Careful study and evaluation of the steelhead population and barriers may reveal ways to improve steelhead access. Log jams and other barriers will not be removed unless it is evident that such removal will do more good than harm. Furthermore, removal of log jams would be reviewed and approved by the California Department of Fish and Game.

The diversion and overdrafting of water are significant problems in the Soquel Creek drainage, especially along its lower reaches. Near the town of Soquel, a portion of the creek has dried up on various occasions, including the summers of 1991, 1992, and 1994. Some residents along the creek use the water for agricultural as well as domestic needs. The Soquel Creek Stream System was formally adjudicated by Decree No. 57081, Superior Court for Santa Cruz County. The Decree was entered March 14, 1977 in Book 2731, page 581 of Official Records. There are water allotment requirements, but the requirements of fish were not considered when maximum amounts for residences and businesses were allocated. Because young steelhead move downstream as upper portions of streams dry out in the summer, additional drying downstream limits available space and foraging areas for the entire population.

Greater public awareness and response regarding the aquatic resources of the Soquel drainage are essential for maintaining a healthy anadromous population. Residents need to conserve water, allow the creek to flow in its natural channel, preserve riparian corridors, and prevent accelerated erosion. While improving the anadromous fish resource within SDSF is a start, it is not enough: Soquel Creek's fisheries require good habitat conditions along every reach of the watercourse and throughout the watershed. All creek users and neighbors should consider the consequences of their actions and how they can help improve the resource.

MONITORING AND ENHANCEMENT

Fish habitat at SDSF will be enhanced through monitoring of fish populations and their habitat, and implementation of habitat enhancement projects in conjunction with ongoing timber operations. A fisheries resources assessment was completed and used to develop a draft Fisheries Management Plan in 1995 (Berlekamp and Sutfin, 1995). The assessment inventoried the condition of the fisheries population as well as habitat status within SDSF. The management plan includes prioritized improvements, monitoring systems, research opportunities, and funding

sources. (Refer to Appendix C, Monitoring Plan.) Subsequent fisheries assessments in the watershed have been completed by the Santa Cruz County Resource Conservation District (Alley, D.W. and Associates, 2003) and by the National Marine Fisheries Service (NMFS, 2010).

Fish population inventories began in 1993 and are conducted annually in cooperation with NMFS. This work is conducted by electrofishing at 5 sites: four on the East Branch of Soquel Creek and one on Amaya Creek. The surveys assist with monitoring the fish populations in fish bearing creeks that run through SDSF and also support research performed by NMFS to monitor steelhead growth and migration. The graph below (Figure 6) shows a summary of data for the past 18 years³.

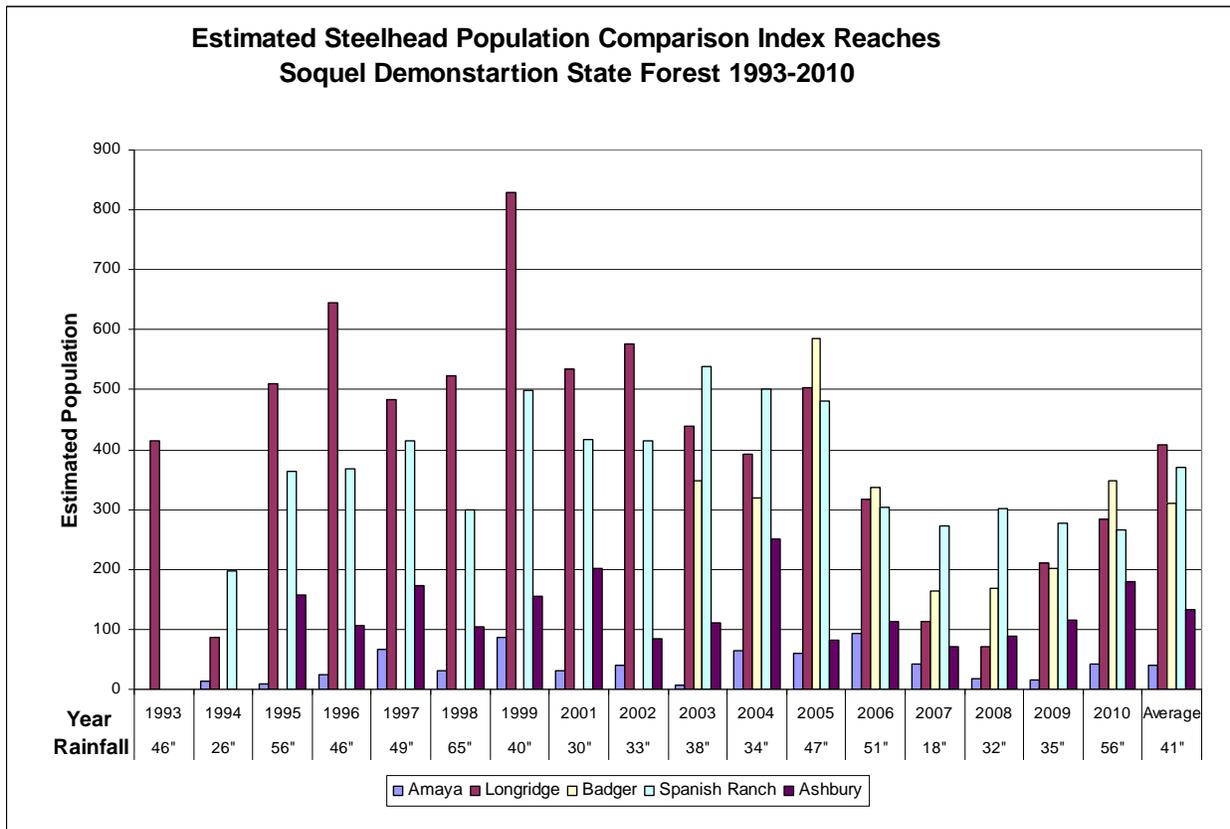


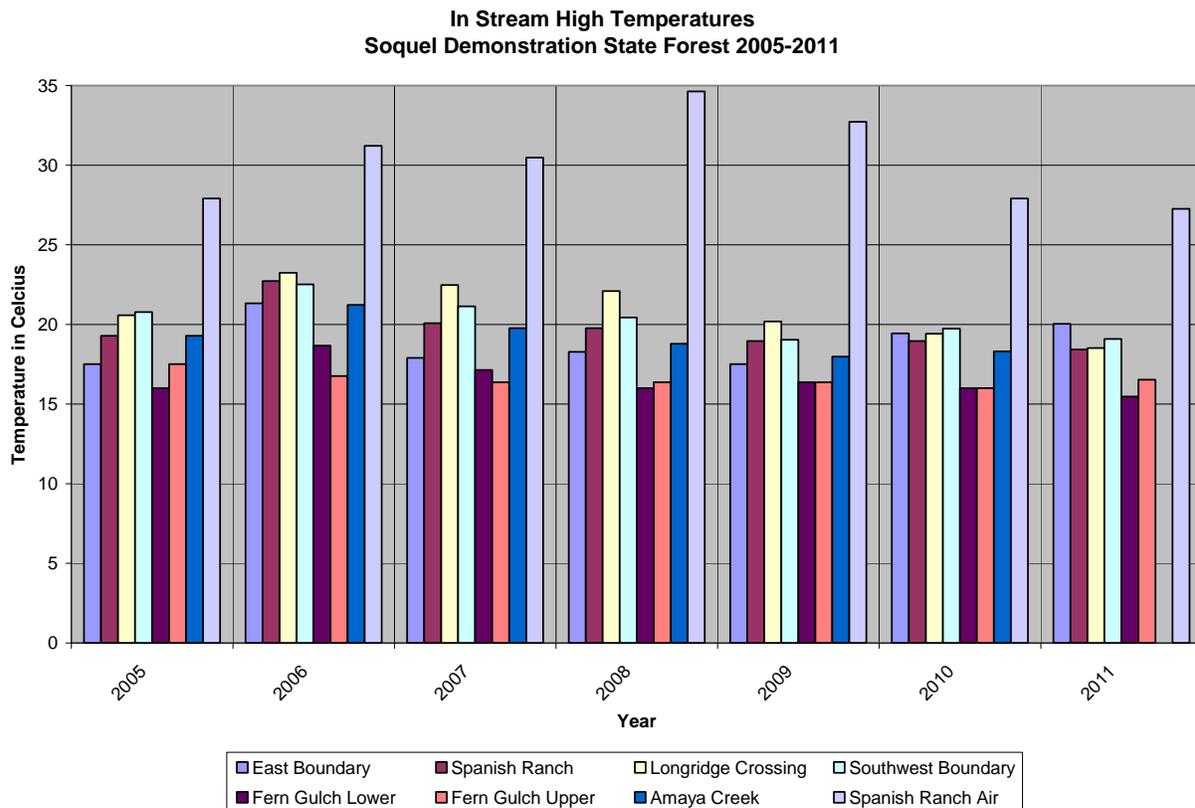
FIGURE 6

In stream temperature loggers are installed at various locations in SDSF to measure and record stream water temperatures throughout the dry season. An additional temperature logger is also installed at one site to measure and record air temperature during the same time period. In 2006, the California Regional Water Quality Control Board for the Central Coast Region released a set of protocols for continuous water temperature monitoring for their timber harvesting water quality waiver program. SDSF's methods are consistent with these protocols. Water

³ No data was collected in 2000.

temperatures above 21.1°C make it difficult for coho salmon and steelhead trout to extract oxygen from the water. Optimal rearing temperatures for juveniles are 7.22-14.4°C for steelhead and 11.67-14.4°C for coho (Reisner and Bjornn, 1979). An analysis of the number of days with temperature readings exceeding 21.1°C and 14.4°C provides valuable information for fisheries management in SDSF. No temperatures greater than 21.1 °C were recorded in 2009 - 2011. However, in 2008 Longridge Crossing had 2 days over 21.1°C. Temperatures over 21.1°C were recorded on 11 days in 2007. Detailed reports and temperature data analysis are compiled annually. The graph below (Figure 7) is a summary of the high temperatures recorded from 2005 to 2011. In 2011 the Amaya Creek logger was defective.

FIGURE 7



The NMFS 2010 Draft Recovery Plan for Central California Coast Coho Salmon (Recovery Plan) recommends increasing the quantity of large wood in the channel as one of the highest priorities for Soquel Creek. In response, a Large Woody Debris (LWD) and Habitat Complexity Project has been designed for the East Branch of Soquel Creek. The proposed project is also part of the Integrated Watershed Restoration Program for Santa Cruz County and designed collaboratively with NMFS, CDFG, CAL FIRE, the California Geological Survey, NOAA’s Southwest Fisheries Science Center (SWFSC), Alnus Ecological, and the Resource Conservation District of Santa Cruz County. The project entails placing LWD along a 0.7 mile section of the

creek in four, 200-foot reaches. Each reach will contain three LWD elements, and each element will include one to four pieces of LWD. The majority of the LWD pieces will be imported from the Fern Gulch timber sale. A fifth site for this LWD project is a stream bank repair site just east of Hihn's bridge where a fish-friendly revetment system will be installed. Implementation of the Large Woody Debris and Habitat Complexity Project is dependent on the Fern Gulch timber sale and the installation is expected to be done in 2012. A long term monitoring plan has been developed by NMFS and is expected to be grant funded through the SWFSC.

AQUATIC INVERTEBRATES

Aquatic invertebrates are organisms with external skeletons that live in water. They include insects (e.g., mayflies), crustaceans (e.g., crayfish), mollusks (e.g., snails), and freshwater earthworms. An important component of aquatic ecosystems, aquatic invertebrates are an essential part of the food web. They typically act as indicator species of fishery habitat quality and water pollution.

When tree litter falls into the water, microorganisms such as bacteria colonize and decompose the material, creating a slime substance. This substance becomes food for invertebrates, which in turn become food for fish. In this way, aquatic invertebrates provide a link in the food chain between microorganisms and fish, a connection crucial to fish survival.

In fresh water such as the East Branch, juvenile steelhead feed primarily on immature, aquatic stages of insects but will also feed on adult terrestrial insects (Barnhart, 1986). Steelhead prefer the larvae of mayflies, true flies (e.g., gnats), and caddisflies. They are often opportunistic, however, and may feed on any available insect. Adult steelhead typically do not eat during migration and spawning, instead utilizing energy from fat accumulated while living in the ocean.

Because they function as food, aquatic invertebrates, particularly insects, are key indicators of good fish habitat. In most cases, large amounts and diverse species of aquatic invertebrates signify an adequate food supply, increasing the ability of the stream to support larger and healthier populations of fish. Similarly, invertebrates need adequate amounts of leaf litter falling into the stream (therefore, adequate riparian vegetation) and appropriate conditions to support the microorganisms which convert the litter to a usable form. Because of their specific roles and narrow habitat requirements, invertebrates are useful indicators of stream conditions and changes. Through inventory and monitoring the composition of aquatic invertebrate communities, the health of aquatic ecosystems can be carefully evaluated. Regular inventory and monitoring has not occurred at SDSF. Some aquatic invertebrate data has been collected through various Department of Fish and Game studies, but the data has not been made available. Future plans for studies of aquatic invertebrates are included in the monitoring plan by the NMFS for the Large Woody Debris and Habitat Complexity Project. This work would monitor the habitat, including aquatic invertebrates, for the restored sites, as well as control sites, along the East Branch Soquel Creek.

THE FOLLOWING PUBLIC COMMENTS WERE RECEIVED DURING REVIEW OF THE 1998 GENERAL FOREST MANAGEMENT PLAN

Comments and concerns regarding the aquatic resources of Soquel Creek were numerous and often fervid. Given the condition of California's CCC coho salmon and steelhead resource and the significance of the Soquel Creek watershed, one would expect a great concern for its future. The comments, concerns, and suggestions received as a result of this concern are represented by two major categories.

The first and probably most important concern involves the maintenance and enhancement of fisheries and other aquatic resources within SDSF. Individuals have stated that, at the very least, SDSF should maintain the resources as they currently exist. Additionally, suggestions for improving the habitat and, therefore, the steelhead fishery touched on in-stream improvements and careful logging methods. SDSF will assuredly work to enhance all wildlife resources and habitats, including those of steelhead.

The second category of concern is really an extension of the first. Comments related that, in order to maintain and enhance SDSF's aquatic resources, inventories and monitoring of these resources must be performed. Specifically, commentators expressed that biologists familiar with the Soquel Creek watershed should set up and maintain a monitoring system which tracks the effects of SDSF's management activities on the resource. Strategies to ensure maintenance and enhancement of aquatic organisms could in turn be developed from the results of inventory and monitoring activities. SDSF plans to conduct the activities mentioned above as well as research and habitat improvement projects in order to satisfy these concerns (see Planned Actions below).

MANAGEMENT GUIDELINES

1. Protect stream channels, streambanks, and riparian zones during all management activities. Late-succession management areas (see the Timber Management chapter) have been established along all fish-bearing streams and receive specialized management designed to enhance the riparian zone. This will ensure protection of stream integrity, including the channel, bank, and vegetation as well as fisheries resources.
2. Increase the fisheries potential by improving the spawning and rearing conditions of the East Branch of Soquel Creek within SDSF by implementing projects to reduce sediment, remove fish migration barriers, and create pools.
3. Demonstrate that other forest management activities are compatible with the maintenance of healthy fisheries populations and habitats through educational programs and tours of harvested areas and stream enhancement projects.
4. Help residents of the East Branch watershed learn about the components of a healthy watershed and the importance of its maintenance. Educational programs, either formal or informal, will focus on stream health, riparian zones, and the impacts of human use. Once established, the Forestry Education Center (refer to the Demonstration and

Education chapter) will likely be the setting for these programs, allowing residents and other interested individuals to learn about the significance of aquatic ecosystems.

PLANNED ACTIONS

1. Implement mitigations through the timber harvest plan process that benefit anadromous fish.
2. Implement the Large Woody Debris and Habitat Complexity Project in cooperation with the California Department of Fish and Game, National Marine Fisheries Service, California Geological Survey, Resource Conservation District of Santa Cruz County, SWFSC and local qualified biologists.
3. Continue to support aquatic ecosystem research opportunities in the East Branch and its tributaries.
4. Coordinate with the County of Santa Cruz, the Resource Conservation District of Santa Cruz County, National Marine Fisheries Service, California Department of Fish and Game, and other groups to complete habitat restoration and maintenance projects, including installing large wood in Soquel Creek and control of invasive plants. Private groups such as the Monterey Bay Salmon and Trout Project or crews from the Ben Lomond Conservation Camp may help with projects such as channel stabilization, hiding cover retention, riparian vegetation maintenance, pool creation, and barrier removal.

Restoration and enhancement projects for the Forest will be prioritized based on recommendations in the Soquel Creek Watershed Assessment and Enhancement Project Plan (DW Alley, et al, 2003) and the National Marine Fisheries Service (NMFS) in their draft Recovery Plan for the Evolutionarily Significant Unit of Central California Coast Coho Salmon (NMFS, 2010) will be implemented over time as funding, equipment, and/or personnel become available.

5. Continue fish sampling in Amaya Creek and the East Branch of Soquel Creek in cooperation with NMFS. Electrofishing will be the primary method but other procedures such as underwater observation may be incorporated. Fish will be evaluated for species, size, health, and location. (Refer to Appendix C, Monitoring Plan.)
6. Continue to monitor in stream temperatures in the East Branch of Soquel Creek and Amaya Creek at the seven sites that have been established.
7. Monitor projects that are implemented in accordance with the California Department of Fish and Game methodologies. (Refer to Appendix C, Monitoring Plan.)
8. Conduct ongoing patrols with the assistance of the California Department of Fish and Game to enforce prohibitions on fish poaching and harassment. Incidents will be

recorded, compiled, and evaluated annually to determine significant adverse effects on SDSF fisheries. (Refer to Appendix C, Monitoring Plan.)

CHAPTER SEVEN: WATERSHED ASSESSMENT

PHYSIOGRAPHY OF THE WATERSHED

SDSF is located almost entirely within the drainage of the East Branch of Soquel Creek, its landbase covering approximately 21 percent of the basin. For the most part, the Forest is underlain by fine grained sedimentary rocks that are highly weathered and easily eroded. The headwater channel of the East Branch follows the San Andreas Fault Rift Zone and is heavily disturbed from landslides triggered by earthquake activity. Hillslopes throughout the Forest are commonly steep and prone to large, deep-seated landslides. Even greater instability occurs in active inner gorge zones near stream channels. When compared to mass erosion events (e.g., large landslides), surface erosion of the loamy soils is of minor significance.

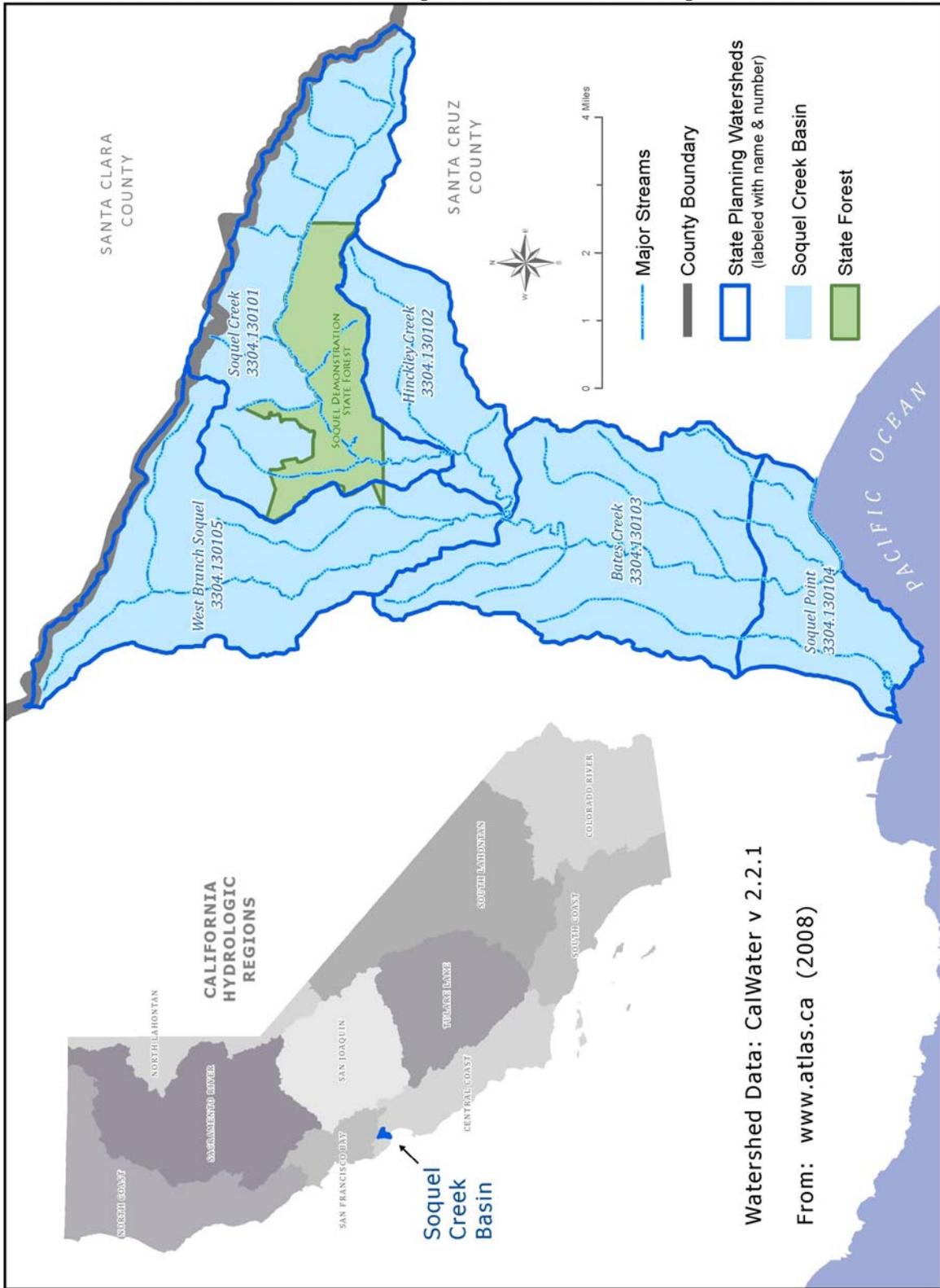
As stated in the Property Description chapter, the Soquel Creek watershed (see Figure 8 below) has a Mediterranean climate with cool, wet winters and warm, dry summers. Mean annual precipitation in the East Branch watershed varies from 30 to 46 inches and takes place primarily between November and April. Discharge records from the USGS stream gauging station located immediately upstream from the bridge in the town of Soquel show that the average discharge is 1.05 cubic feet per second per square mile. High intensity, long duration winter storms, however, produce extreme levels of runoff. Major floods occurred during December, 1955 and January, 1982, producing log jams and flooding in the town of Soquel (Lassette and Kondolf, 2003; see Figure 9). Singer and Swanson (1983) state that Soquel has a chance of being flooded once every seven to ten years.

Since 1996 streamflow has been measured at a gauge on the East Branch of Soquel Creek just below the Olive Springs quarry. This gauge and the data is maintained by the Soquel Creek Water District. The watershed area above the gauge represents a 13.9 square miles and essentially the entire SDSF area (a very small percentage of SDSF drains to Hester Creek). Data from this gauge has been coupled with data from a permanent rainfall gauge located just outside the Forest on Longridge Road and is represented on Figure 10 below.

BENEFICIAL USES

The two main beneficial uses of the East Branch of Soquel Creek are cold water fisheries and water supplies for various purposes. The East Branch supports spawning and summer rearing habitat for steelhead trout and coho salmon, but the number of returning fish has declined significantly in the past 40 years (refer to the Fisheries chapter). For example, in 1982 steelhead populations were only one-third to one-quarter of what they were thought to have been in the 1960s (Singer and Swanson, 1983). Coho salmon were thought to be extirpated from the Soquel Creek basin since 1968 (SCCRCD 2003, NMFS 2010), but 170 young-of-the-year fish were documented during surveys conducted in a stream reach below SDSF in August 2008. The major factors limiting anadromous fish populations are believed to be low summer flows, and limited rearing habitat due to siltation of pools and removal of woody debris. Large wood loading, floodplain connectivity, and estuary function were listed as poor for the Soquel Creek watershed

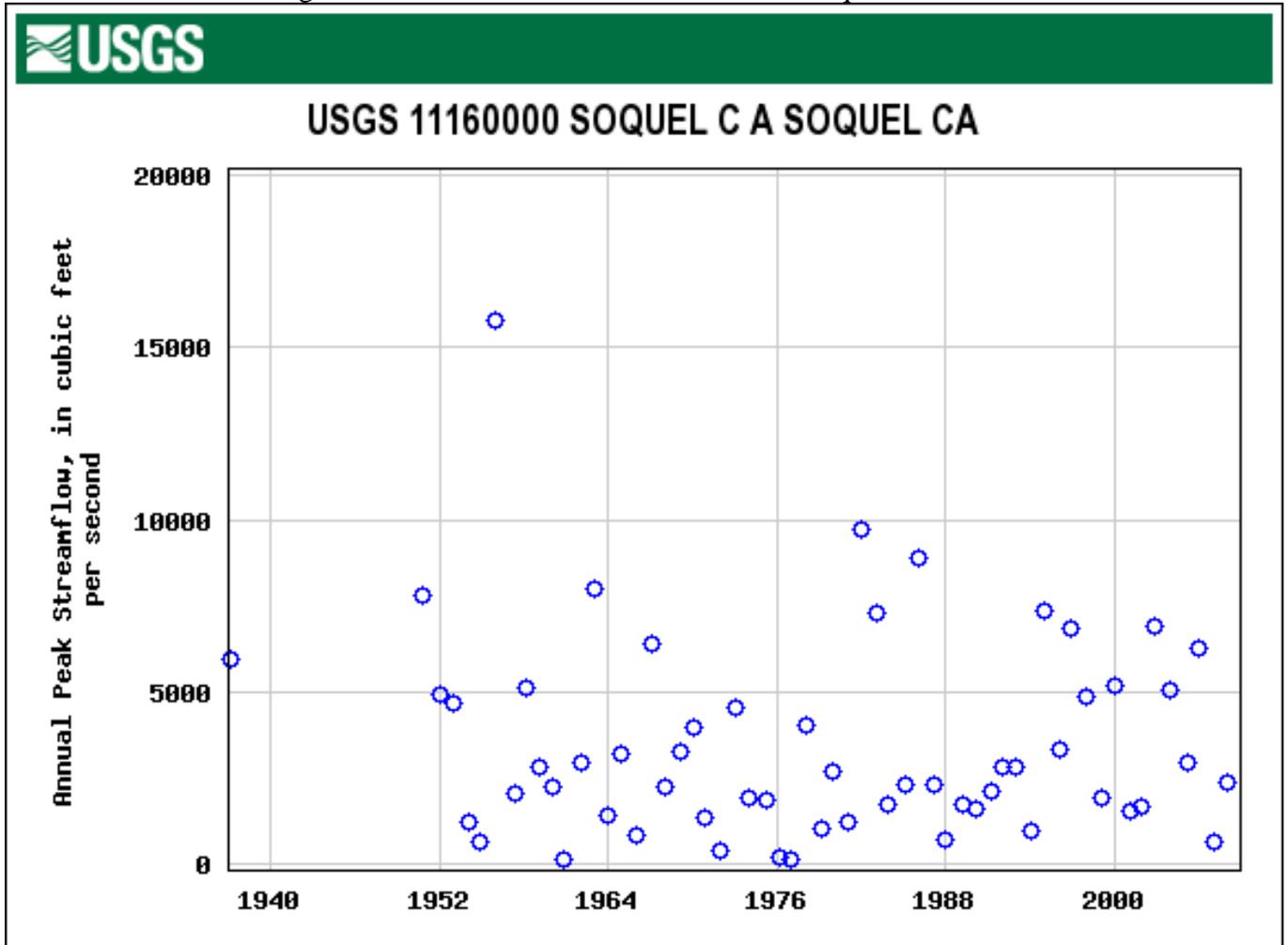
FIGURE 8 – Soquel Creek Watershed Map



Watershed Data: CalWater v 2.2.1

From: www.atlas.ca (2008)

Figure 9. Annual Peak Streamflow for Soquel Creek.



in the draft Central California Coast (CCC) coho salmon recovery plan (NMFS 2010). The East Branch of Soquel Creek is considered to be the southern most extent of coho salmon in California.

The other primary beneficial use in the main stem of Soquel Creek is water supply. There are eight dams in the Soquel Creek watershed that impede or block anadromous salmonid migration (NMFS 2010). Additionally, numerous small diversions exist that provide water for domestic, agricultural, and industrial purposes. Two permitted domestic water supply systems exist in the main Soquel Creek watershed that utilize surface flow, but there are no permitted systems utilizing surface water in the East Branch basin. The East Branch Soquel Creek watershed assessment conducted in 1993 reported that there were six surface water diversions in the East Branch basin (Cafferata and Poole 1993). The largest diversion in the East Branch is operated by the Olive Springs Quarry.

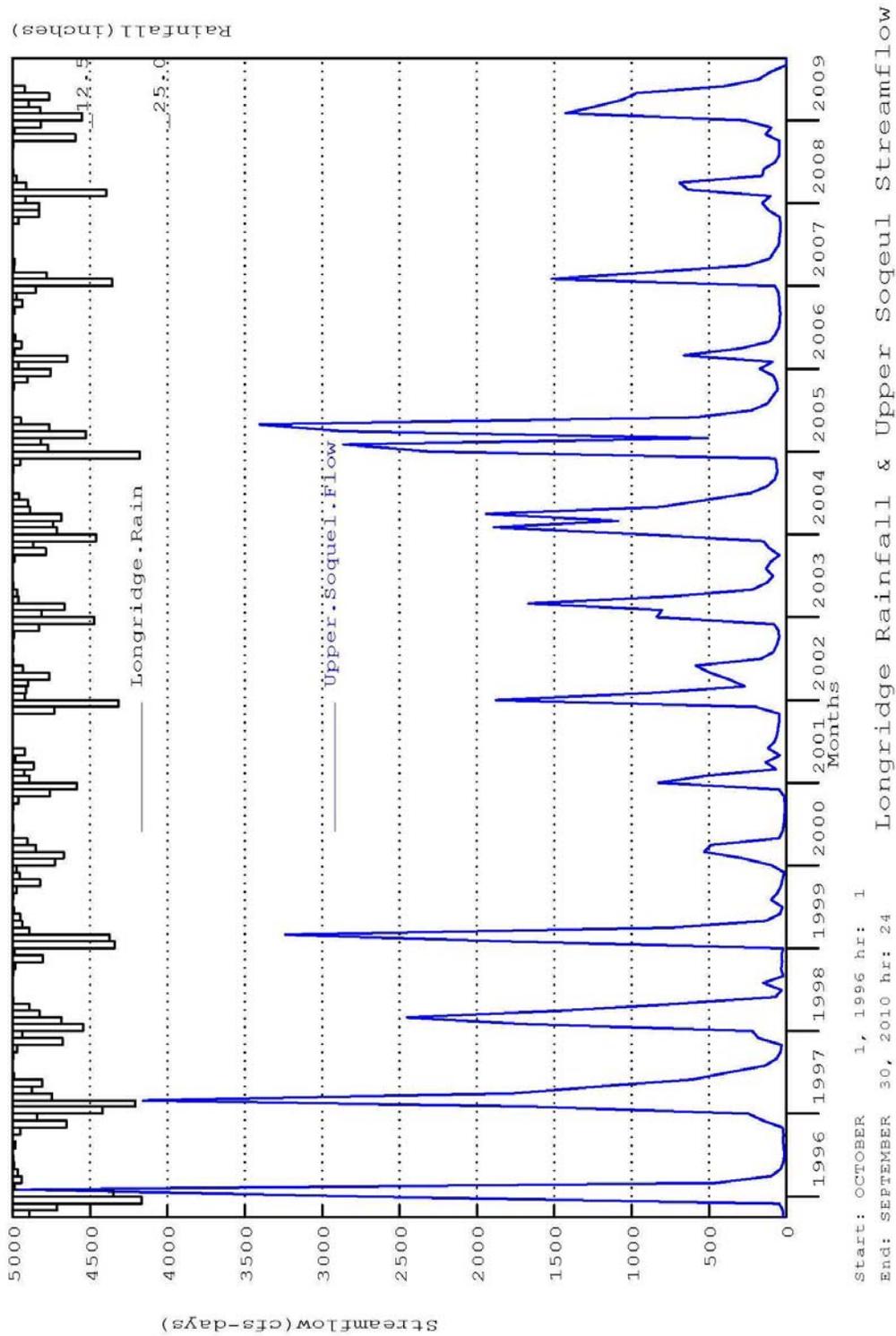


Figure 10 – Rainfall and Streamflow for East Branch of Soquel Creek

Diversions and overdrafting of groundwater in low discharge summer months have dewatered portions of the East Branch stream channel during drought years. This is likely to be a critical limiting factor for the fisheries resource in the lower part of the basin. Soquel Creek is a fully adjudicated stream under Decree No. 57081. After complaints by the city of Capitola in 1988, the State Water Resources Control Board concluded that a watermaster was needed to effectively regulate water use under low flow conditions, particularly during drought years, due to the complicated interrelationships of the water rights on Soquel Creek (Cafferata and Poole, 1993). To date, however, no watermaster has been appointed (Alley and Associates, 2004).

LAND USE HISTORY

The major types of land use in the East Branch watershed are timber management, recreation on public land, ranching, and residential development. The East Branch watershed's long history of timber harvesting began with clearcutting in the 1870's and continued into the 1940's. Timber was originally removed by oxen (1870-1895), then by steam donkey (1895-1930), and finally by crawler tractor. Following World War II, selective harvesting replaced clearcutting, continuing to the present day. Currently, nearly all of the old-growth timber has been harvested except for minor reserved groves and widely scattered suppressed trees. Second-growth harvesting has taken place on approximately 881 acres over the past 10 years. In recent years, cable yarding has been used along with tractor logging to selectively harvest timber in the basin. Approximately 20 percent of the Soquel Basin has never been harvested as it is in chaparral.

Recreation in the form of hiking and mountain biking takes place primarily in The Forest of Nisene Marks State Park and SDSF (SDSF also allows horseback riding). Additionally, adjacent property owners often allow friends and neighbors to utilize their lands as an access route to the park or SDSF. The Olive Springs Quarry, located near the East Branch channel, has produced sand and gravel from granitic rock exposed along the Zayante Fault since about 1960. Residential development has occurred in the chaparral communities and has steadily expanded over the past 40 years. Over the whole Soquel Creek watershed, housing development is rated as moderate to high, with approximately 7,000 housing units present in the basin. Residential and commercial development is considered a very high threat to coho salmon (NMFS 2010).

CUMULATIVE WATERSHED EFFECTS ASSESSMENT

Cumulative watershed effects (CWE) can be defined as the physical and biological impacts that result from multiple land use disturbances over space and time. These impacts occur within and away from the locations of actual land use and are transmitted through the fluvial system. When considering CWE, it is appropriate to estimate how current and future projects, when combined with impacts from past activities, will influence beneficial uses present in the basin under review. Techniques to determine whether CWE are significantly adversely impacting beneficial uses have been developed, but are generally considered to be inadequate for varying reasons. Existing CWE assessment approaches mostly range from checklists or indices that are subjective but

inexpensive and simple, to complex physically based models that have large data needs and are difficult to apply (Litschert 2009).

Watershed analyses and assessments are often used to evaluate cumulative watershed effects. For example, Berg et al. (1996) found that watershed analysis was the most suitable approach for assessing cumulative watershed effects in the Sierra Nevada. While a formal watershed analysis has yet to be completed for the Soquel Creek watershed, several watershed assessments and studies have been completed over the past 30 years that contribute a considerable amount of information regarding cumulative watershed effects. These studies include: Singer and Swanson (1983), Cafferata and Poole (1993), Santa Cruz County Resource Conservation District (2003), Alley and Associates (2003, 2004), Balance Hydrologics (2003), Greening Associates (2003), Pacific Watershed Associates (2003), and Lassetre and Kondolf (2003).

Cafferata and Poole's rapid landscape-level watershed assessment for the East Branch of Soquel Creek was conducted in 1992 and 1993. It is described below in considerable detail. Since specific harvest units had not been defined, the entire Forest served as the project area for this assessment. CWE assessment guidelines suggest that assessment areas must be large enough to detect past impacts and small enough to determine what the impacts of the proposed projects will be on the area. This assessment completed for the East Branch watershed evaluated the current condition of stream channels in the basin and determined how they would likely be altered with future timber operations.

The watershed assessment for SDSF was broken down into two main tasks: a stream channel inventory and a hillslope erosion/sedimentation evaluation. The stream channel inventory was completed in 1992 and illustrated the current condition of the channel network within the assessment area. Channel stability was rated with the U.S. Forest Service's Pfankuch Method, while channel condition was evaluated with CDF's Guidelines for Assessment of Cumulative Impacts (CDF, 1994). Due to limited personnel and time constraints, stream channels within SDSF were analyzed in greater detail than channels located in other areas of the basin (Poole, 1992).

The hillslope component of the CWE evaluation was completed in the summer of 1993. Quantitative estimates of erosion risk and erosion volumes associated with anticipated activities (e.g., timber harvesting and road building) were made based on the results of the Critical Sites Erosion Study (CSES; Lewis and Rice, 1989; Rice and Lewis, 1991). A selected number of random sample locations were installed on existing, planned, and abandoned roads, as well as past harvest areas. The resulting data was input into equations to estimate the risk of generating critical, or large, erosion sites (i.e., a large erosion event producing more than 100 cubic yards per acre). These equations are based on measurements made for slope, amount of hillslope or road curvature, soil color, and rock hardness.

On-site measurements were made to assess other sources of erosion not addressed by the CSES. Estimates were then made of the amount of sediment that could result from the approximated erosion. The significance of the estimated sedimentation was studied by comparing it with expectations of sediment yield for Soquel Creek. Since long-term sediment data from the Soquel Creek basin was not available, information from the San Lorenzo River, a similar, neighboring

basin, was used. The methodology utilized for the hillslope erosion and sedimentation analysis was designed by Rice (1993) and was used in several parts of the state in the 1990's.

Locations in the East Branch assessment area that were found to have poor stability and channel conditions were Amaya Creek, Hinckley Creek, and the East Branch between Ashbury Gulch and the upper SDSF boundary. The reaches with the best ratings for stability (high-fair) and channel conditions were the upper part of the East Branch above SDSF and the main stem of Soquel Creek below the junction with the West Branch. The reaches of the East Branch between Ashbury Gulch and the junction with the West Branch were reported as having intermediate stability and channel conditions.

Summarizing the results for the 10 miles of the East Branch surveyed, fair channel stability was the most frequent finding (10% good, 67% fair, and 23% poor). This compares reasonably well to the fair/poor relative overall rating for sediment and log contribution assigned to the East Branch by Singer and Swanson (1983). The exception was the highly impacted reach along the San Andreas Rift Zone. Additionally, the major tributaries were severely degraded by heavy landsliding activity. Very large quantities of sediment are stored in these headwater tributaries, as well as in wide, vegetated terraces along the lower reaches of the East Branch. Observation of the East Branch channel revealed that riffle stretches generally had cobble and gravel sized particles protecting the stream bottom surface. Inspection of stable pools below Ashbury Gulch, however, showed that this habitat type contained significant percentages of fine sediment.

Large woody debris was not found to be blocking anadromous fish passage in the East Branch, but was limiting habitat use in the major tributaries. Large wood was generally lacking along most of the East Branch of Soquel Creek below Ashbury Falls, except where it had accumulated in a few fairly stable locations. Large woody debris is valuable because of the pool habitat for young salmonids that forms around it in gravel dominated stream systems.

Results of the hillslope evaluation indicate that the risk of generating critical erosion sites is not significantly different from the average for the rain-dominated portions of the northern Coast Ranges in California (Cafferata and Poole, 1993). Very large amounts of existing erosion were measured on a few of the plots, however, and existing erosion was found to be considerably higher than the amount estimated from the critical site equations. For example, one of the road plots had a culvert that had carved an exceptionally large gully below its outlet, while another had large amounts of cut and fill slope erosion 50 feet from a Class II stream. Therefore, the potential for producing large erosion events is clearly evident in this terrain, even though the critical site equations did not generate exceptionally large estimates.

The terrain slope and distance to a Class II stream were used as an index of the proportion of erosion which would become sediment. The average sediment delivery was found to be much higher than is commonly assumed in forested watersheds. This is due to very high delivery from relatively few plots with extensive amounts of existing erosion. Long-term sediment data does not exist for Soquel Creek at the USGS gaging station; the nearest station with long-term discharge records and a reasonable sediment record is found on the San Lorenzo River at Big Trees State Park. A statistical analysis indicated that peak storm discharges on Soquel Creek

were significantly related to those of the San Lorenzo River. The peak storm discharge/annual sediment yield relationship generated for the San Lorenzo River was then used to estimate the annual sediment yield at Soquel Creek.

Extreme natural variability in sediment yield for Soquel Creek was found for 1952 to 1990, with the range spanning several orders of magnitude. The estimate of mean annual sediment yield based on the stream discharge record for Soquel Creek (~1,500 yd³/mi²/yr) was somewhat higher than that calculated based on hillslope erosion plot measurements. Due to the assumptions involved in making these estimates, however, it is unlikely that these estimated sediment yields are significantly different. Both estimates of sediment discharge for Soquel Creek are high for forested areas and illustrate the erosive nature of the basin. Cafferata and Poole (1993) concluded that it was unlikely, however, that the limited timber harvesting and rebuilding of abandoned roads planned for SDSF would significantly elevate the erosion rate and have a significant adverse impact on the aquatic system. The anticipated sediment production from SDSF's timber production was found to be small compared to the range of variability in sediment flux observed in this basin.

More recent watershed assessment work in the Soquel Creek watershed can be compared to the results of the Cafferata and Poole (1993) rapid assessment. For example, Lassette and Kondolf's (2003) much more detailed large wood study included the lower part of East Branch of Soquel Creek. They reported an average large wood loading for this reach of 0.005 m³/m², which they stated lies at the low end of the range of observed values for North American streams (e.g., approximately 36 times lower than for old growth coast redwood forests in Humboldt County). Similarly, Alley and Associates (2003) reported that large wood was extremely scarce in Soquel Creek compared to other coastal streams recently surveyed.

Large wood loading in the East Branch of Soquel Creek is low due to extensive log removal efforts by Santa Cruz County from the 1950's to the 1990's. The Santa Cruz County RCD watershed assessment (SCCRCD 2003) concluded that the scarcity of large wood limits juvenile salmonid production throughout the Soquel Creek watershed. Similar to other studies, their assessment states that large wood is scarce in the middle part of the East Branch and recruitment is low for this channel reach.

Balance Hydrologics (2003) reported that Soquel Creek has experienced prolonged periods (up to 25 to 30 years) of disturbed watershed conditions over the past 150 years. These conditions, they found, were caused by both natural processes and anthropogenic activities with the later likely resulting in an increase in the natural, base rate of sediment production in the watershed, although small relative to natural rates.

The Santa Cruz County Resource Conservation District (2003) watershed assessment project concluded that overall lateral channel stability of Soquel Creek was relatively high during the past 54 years with minor adjustment at several points of meander along the East Branch and mainstem. Major sediment production from natural sources was found to occur in both the East and West Branches and is most pronounced following earthquakes, large magnitude floods or forest fires, and is usually related to landsliding.

The SCCRCD (2003) assessment states that several factors appear to limit distribution and abundance of steelhead. These factors include passage impediments, poor spawning habitat quality (high proportion of fine sediment, number of constricting, steep riffles below spawning glides), low spring and summer baseflows, limited amount of escape cover (provided by instream wood, undercut banks, unembedded boulders, water depth itself), elevated water temperature, and limited water depth. Throughout the watershed, low baseflows and sedimentation limit the amount and quality of rearing habitat.

PWA (2003) inventoried the SDSF road network (18.2 miles) and found 82 sites with significant sediment delivery potential. Fifty seven of these sites were at stream crossings. Three crossing sites were identified as having a high treatment immediacy, with a potential sediment delivery of approximately 1,631 yds³. Sites requiring significant analysis, design and heavy equipment investment are upgraded and mitigated as CEQA projects are planned and implemented across SDSF. For example, one high priority culvert replacement as well as three other identified sites, were mitigated through implementation of the Rim THP and accompanying DFG streambed alteration permit in 2011. Additional rocking of the main roads in SDSF has also been implemented annually. Additional upgrades and mitigations along Longridge Road and Hihn's Mill Road are planned as part of the Fern Gulch timber sale.

CONCLUSIONS

In summary, it can be stated that the East Branch of Soquel Creek watershed is a highly sensitive basin. This is due to its inherent natural hillslope instability related to seismic forces, steep slopes, weak bedrock, and frequent high intensity rainfall. Impacts from past management activities, prior to modern California Forest Practice Rules, have contributed greatly to degraded conditions in the basin, as has residential development. In spite of these problems, the East Branch below Ashbury Gulch has not been overwhelmed with sediment, and it is clear from abundant observations of steelhead redds (gravel beds where female fish lay eggs) and young fish that spawning and rearing habitat remains.

The East Branch system is stressed by fine sediment moving downstream from tributaries, partially due to its close proximity to the San Andreas Fault Zone. This material is filling pools required for rearing habitat for listed anadromous salmonids. Lack of sufficient volumes of large wood and overdrafting of water in low flow summer months compounds this problem. As a result, the aquatic environment is sensitive to further degradation and timber operations must be carried out with extra caution.

Due to the sensitivity of the hillslopes and current channel conditions, special considerations are needed when planning forest management activities in the East Branch. Appropriate mitigations must continue to be utilized and remedial improvements implemented to repair existing problem areas, such as those suggested in the PWA (2003) report. If these considerations are employed, future timber sales can occur without significant adverse impacts to the beneficial uses of the basin.

MONITORING AND ENHANCEMENT

Ongoing management of SDSF will involve maintaining proper drainage along roads and trails by repairing culverts, water bars, and other drainage structures to reduce or prevent soil erosion and stream sedimentation. An active watershed remediation program will continue to be used that includes monitoring watershed conditions and implementing enhancement projects. Monitoring has included a forestwide inventory of stored sediments and active landslides, and mapping mass wasting hazards and surface erosion potential. Sediment risk-reduction projects have been rated for cost-effectiveness (PWA, 2003) and will be implemented in conjunction with timber operations according to their priority as available funding permits.

THE FOLLOWING PUBLIC COMMENTS WERE RECEIVED DURING REVIEW OF THE 1998 GENERAL FOREST MANAGEMENT PLAN

Public comments regarding the East Branch watershed have focused on its distinction and sensitivity. Individuals are concerned that forest management activities will result in general watershed degradation, including sedimentation of streams and excessive hillslope erosion. This is particularly important to them in regard to steelhead numbers and habitat, and possible impacts upon their land during high intensity rainfall. As stated in this and other chapters, careful pre-project evaluation and measures to ensure the maintenance of watershed integrity are a priority for SDSF. The CWE assessment work discussed above and other studies assist the Forest staff to understand and manage for the sensitive nature of the basin.

MANAGEMENT GUIDELINES

1. Design streamside management zones that properly address the inherently unstable nature of the East Branch watershed in SDSF. This includes extending zone widths beyond the standards set by the California Forest Practice Rules, for Class I fish-bearing watercourses, as is appropriate in sensitive areas. These zones must provide for the long-term recruitment of large wood, protection of the stream channels and banks, stream shading, sediment filtration, nutrient input, microclimate control, floodplain function, and prevention of significant ground disturbance.
2. Place heavy emphasis on road design and maintenance, since roads generally produce the largest percentage of management-related sediment in forested watersheds. New seasonal and temporary roads should be outsloped to avoid concentrating water that could trigger landslides or transport sediment directly into flowing streams. Of foremost concern for new road construction is the avoidance of localized unstable areas. For mainline roads, road drainage structures and watercourse crossings must be adequately sized to ensure that the risk of failure is minimized. Roads no longer needed must be properly abandoned. Wet weather use for roads impacting flowing streams should not occur and an active winter maintenance program is needed to ensure that drainage structures are adequately functioning. (Refer to the Roads and Other Improvements chapter for more information.)

3. No tractor operations will be permitted on slopes which average more than 35 percent without site-specific evaluations of slope stability and erosion potential. This will depend on the ability to mitigate such operations to levels of insignificance.

PLANNED ACTIONS

1. Continue to record data on all timber harvesting operations done in the Forest that could influence soil and water resources. Link THP road mitigation sites, information on road construction and harvesting, and monitoring results through our GIS database.
2. Continue to implement the treatment priorities for high and moderate risk inventoried sediment sources in the Soquel Demonstration State Forest watershed assessment area developed by PWA (2003).
3. Evaluate the performance of each previously-implemented remediation project to determine the success in reducing the risk of large-scale sedimentation. Redesign and modify any project not meeting its intended objective. (Refer to Appendix C, Monitoring Plan.)