BIG RIVER AND SALMON CREEK FORESTS

INTEGRATED RESOURCE MANAGEMENT PLAN

THE CONSERVATION FUND

in partnership with the California State Water Resources Control Board, California State Coastal Conservancy and the Wildlife Conservation Board

August 2019, updated from 2009

Cover photograph: Big River Forest by Matthew Gerhart

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ARBOC	Air Resources Board Offset Credit
Basin Plan	Water Quality Control Plan for the North Coast Region
BMP	Best Management Practice
BRSC	Big River and Salmon Creek
CAL FIRE	California Department of Forestry and Fire Protection
Cal-IPC	California Invasive Plant Council
CalVeg	California Vegetation
CAR	Climate Action Reserve
CARB	California Air Resources Board
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CE	conservation easement
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CHRIS	California Historic Resources Information System
CMZ	channel migration zone
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CWA	Clean Water Act
DBH	diameter at breast height
DO	dissolved oxygen
EHR	erosion hazard rating
ELZ	Equipment Limitation Zone
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FIP	Functionally Independent Population
FMU	Forest Management Unit
FPR	Forest Practices Rules
FPS	Forest Planning and Project System
FSC	Forest Stewardship Council
GIS	geographic information system
GLO	General Land Office
GPS	Global Positioning System
GRF	Garcia River Forest
GRI	Gualala Redwoods Inc.
GRSP	Gualala River Steelhead Project
GRWC	Gualala River Watershed Council
GuRF	Gualala River Forest
GWDR	General Waste Discharge Requirement
IFM	Improved Forest Management
IP	Intrinsic Potential
IPCC	Intergovernmental Panel on Climate Change
IRMP	Integrated Resource Management Plan
LiDAR	light detection and ranging

LWD	large woody debris
MBF	million board feet
MRC	Mendocino Redwood Company
MWAT	Maximum Weekly Average Temperature
MWMT	Maximum Weekly Maximum Temperature
NAD	North American Datum
NCRM	North Coast Resource Management
NCRWQCB	North Coast Regional Water Quality Control Board
NCWAP	North Coast Watershed Assessment Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	Nonpoint Source Program
NRCS	Natural Resource Conservation Service
NSO	northern spotted owl
NWIC	Northwest Information Center
PIA	Permitted Improvement Area
PRI	Program-Related Investment
PWS	Planning Watershed
QMD	quadratic mean diameter
RPF	Registered Professional Forester
SCAPOSD	Sonoma County Agricultural Preservation and Open Space District
SCC	State Coastal Conservancy
SCS	Scientific Certification Systems
SFI	Sustainable Forestry Initiative
SOD	Sudden Oak Death
SPWS	Super Planning Watershed
SRF	State Revolving Fund
Strategy	Strategy for Implementing State Revolving Fund for Expanding Use Projects
SWB	State Water Board
SWRCB	State Water Resources Control Board
the Fund	The Conservation Fund
THP	timber harvest plan
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCB	California Wildlife Conservation Board
WLPZ	Watercourse and Lake Protection Zone
WTL	watercourse transition line

1. Executive Summary

1.1 Project Description

The Big River and Salmon Creek (BRSC) forests were acquired in November 2006 by The Conservation Fund (the Fund) in partnership with the California State Water Resources Control Board, the California State Coastal Conservancy, the Wildlife Conservation Board, and the David and Lucile Packard Foundation. The project is part of the Fund's North Coast Forest Conservation Initiative, which seeks to demonstrate that large, understocked tracts of coastal forest can be returned to ecological and economic viability through patient, adaptive management by a nonprofit in partnership with private and public entities and community stakeholders.

As set forth in a memorandum of understanding (MOU) among the California State Water Resources Control Board (SWB), the California State Coastal Conservancy (SCC) and the Wildlife Conservation Board (WCB) attached as Appendix A, the "purposes for the acquisition and subsequent management of the [forests] are (a) to ensure the permanent protection of the [forests] from subdivision, residential and commercial development, mining … water diversion, and conversion to nonforest uses, and (b) protect, restore and enhance water quality and salmonid habitat, improve forest structure and increase natural diversity, provide a sustainable harvest of forest products, and, where appropriate, provide public access." The MOU further provides that the Fund will prepare a forest and water quality management and restoration plan. The plan is intended to fulfill the requirements of the MOU by describing integrated management activities that satisfy the purposes of the acquisition as set forth in the MOU. The Fund prepared this Integrated Resource Management Plan (IRMP) to document the sustainable management of the forest. It follows requirements established in the Sustainable Forestry Initiative® (SFI®) (2015-19 Standard) and the Forest Stewardship Council ® (FSC®) U.S. Forest Management Standard (version 1.0). The Conservation Fund's FSC Certification # SCS-COC-00102N.

The original IRMP was approved in 2009 with the intent to revise it every 10 years (see IRMP Section 3.2). The preparation of this revised version has been aided significantly by work done by the Fund and its partners to prepare subsequent IRMPs on Garcia River Forest (GRF), Gualala River Forest (GuRF) and Buckeye Forest (Buckeye) (2018, 2013 and 2016, respectively). While there are significant differences between the current conditions of these forests, including stocking levels and the financial obligations incurred in acquiring the various forests, there are also many commonalities with the ultimate management objectives. Consequently, many of the principles and strategies contained in the other North Coast Forest plans have been adapted for this revised IRMP.

1.2 Overview of Forest Characteristics and Conditions

The Big River Forest (approximately 11,770 acres) is in the middle portion of the Big River watershed and contains tributaries, including Little North Fork, Two Log Creek and Laguna Creek, as well as a central portion of the main stem of Big River. It adjoins the Big River State Park and Jackson Demonstration State Forest; together these properties make up the largest contiguous block of non-federal, protected land entirely within Mendocino County. Salmon Creek is a relatively small coastal watershed in Northern California, with the entire drainage area within 8 miles of the coast. Half of the watershed is within the Salmon Creek Forest (approximately 4,250 acres). On U.S. Geological Survey (USGS) maps the river is called Big Salmon Creek but is more commonly known at Salmon Creek. We will use Salmon Creek throughout this document. Please see the BRSC Property Maps and Adjacent Landowners Map.

Big River and Salmon Creek are high priority refugia watersheds identified in the 2004 "Recovery Strategy for California Coho Salmon." The forests combined include 37 miles of Class I watercourse, 50 miles of Class II watercourse, associated riparian habitats, four major sub-basins currently supporting coho salmon, and an array of additional sensitive species. The size and locations of the forests provide significant contributions to the integrity and ecological viability of their respective watersheds and the larger ecoregion.

The forests are typical of the north coast of California, dominated by native conifers (primarily redwood and Douglas fir) and adapted to the steep slopes and heavy rainfall common to the region. They are richly productive and support significant wildlife, including such imperiled species as coho salmon, steelhead trout and northern spotted owls. Timber has been harvested at least twice in the majority of the forests since the arrival of European settlers around the turn of the 20th century. Initially logs were transported primarily by railroad, but as logging moved inland, splash dam logging was used to move the logs from the forest down to the wider river channels. Remnants of the railroads and splash dam logging are still visible today. Splash dam logging was responsible for some stream channel degradation in the Big River watershed. After World War II tractor logging was used extensively. Currently the forests are relatively well stocked, consisting of second- and third-growth timber, ranging from 30 to 100 years old.

1.3 Streams and Roads

Extensive logging and road building practices have contributed to erosion and subsequent stream sedimentation, producing a legacy of increased sediment loads that severely impact aquatic habitat in Big River and Salmon Creek and their tributaries. Large-scale tractor logging in the 1950s and early 1960s created a network of unstable truck and tractor roads. Logging practices at the time also removed overstory shade canopy from primary anadromous fish spawning grounds. Removal of the overstory in the riparian corridors has resulted in a lack of large trees necessary for woody debris recruitment and thus a lack of deep pools with shelter needed for salmon and steelhead summer rearing habitat (GRWC, 2013).

Like most large timberland tracts in the region, BRSC forests have been managed for industrial timber production for several decades. According to the *Nonpoint Source Program Strategy and Implementation Plan, 2014-2020* (NPS Implementation Plan), "[S]ilviculture contributes pollution to 17 percent of the polluted rivers … in California. Without adequate controls, forestry operations may degrade the characteristics of waters that receive drainage from forestlands. For example, (1) sediment concentrations can increase due to accelerated erosion, (2) water temperatures can increase due to removal of overstory riparian shade, (3) dissolved oxygen can be depleted due to accumulation of slash and other organic debris, and (4) concentrations of organic and inorganic chemicals can increase due to harvesting and the use of fertilizers and pesticides." The *Recovery Strategy for California Coho Salmon* (Coho Strategy), prepared by the California Department of Fish and Wildlife, says: "[H]istorical forestry practices and some current forestry practices have been shown to impact several freshwater habitat components important to anadromous salmonids in general, and coho salmon specifically. These impacts include increased maximum and average summer water temperatures, decreased winter water temperature, and increased daily temperature fluctuations; increased sedimentation; loss of [large woody debris]; decreased [dissolved oxygen] concentrations; increased instream organic matter; and decreased stream-bank stability."

The State Water Resources Control Board (SWRCB) lists the Big River watershed as having impaired water quality due to sediments and/or temperature in accordance with Section 303(d) of the federal Clean Water Act. In addition, both the Big River and Salmon Creek watersheds are designated as "Critical Coastal Areas," or specially designated land areas of the California coast where government agencies and other stakeholders have agreed to improve or protect exceptional coastal water quality from the impact or threat of nonpoint source pollution through the implementation of specific management measures.

While past forest management has been a significant contributing cause of impairment of North Coast water bodies (primarily because of poorly designed and maintained legacy roads), there is broad agreement that preventing fragmentation of large tracts of coastal forests and implementing management measures relating to sediment reduction through improved road maintenance and sustainable forest practices is the most feasible means of enhancing water quality in the region.

1.4 Forest Management

The specific management goals identified and described in this plan are to:

- Improve ecological conditions by protecting and enhancing water quality through high standards for road construction and maintenance.
- Improve ecological conditions by protecting and enhancing terrestrial and aquatic habitat, vegetative diversity, late-seral conditions and riparian forest, while significantly increasing the inventory of commercial timber volumes.
- Generate sufficient revenue to cover taxes, on-site maintenance, management and restoration projects.
- Develop, implement and maintain improved forest management greenhouse gas reduction projects under the California Air Resources Board (CARB) Compliance Offset Protocol, U.S. Forest Projects.
- Practice continual improvement through adaptive management, based on monitoring of water quality and forest health against specific objectives described in the plan.
- Support the local business community by utilizing local contractors and suppliers.
- Involve the local community by seeking input on management, including review of this plan as well as timber harvest methods implemented under the plan, while providing compatible public access, and educational and recreational opportunities where possible.

1.5 Community Use and Involvement: Public Access

The Fund will provide a range of opportunities for community use and involvement, while also protecting natural resources, engaging with long-term restoration and enhancement projects, and implementing active forest management practices. These opportunities for the public range from research, education and demonstration to participation in restoration projects, as well as unsupervised pedestrian access.

To foster community relationships, the Fund provides guided tours of road improvement and restoration projects, native plants and areas that are intended for timber harvest. Tours, tailored for youth education, are also organized by the Fund. In turn, these programs familiarize the public with sustainable management methods and objectives, while building transparent community partnerships. Through these cumulative community initiatives, the Fund emphasizes that not just the company, but also the public, has an active role as being a steward of the Forests.

Photo by Jenny Griffin

2. Project Introduction

2.1 Background

The redwood region of California's North Coast is one of the richest and rarest ecosystems in the world. It is home to keystone species such as the northern spotted owl, marbled murrelet, mountain lion, coho salmon and steelhead trout. For decades, timber harvesting has been the predominant land use in the region, and much of the coastal watersheds in Mendocino County continue to be held in large blocks of industrial timberland. Until recently, the economic value of these smaller parcels and alternative uses has not been competitive with the value of continued timber production, and they were largely ignored. But timber inventory depletion, the regulatory environment in California, and the increasing value of land for "higher and better uses" has led some forestland owners to sell or look to uses that yield greater financial return. As a result, rural residential and recreational use subdivisions and vineyard conversions are increasingly common on the North Coast.

The conversion and subdivision of coastal forests in Mendocino County presents a serious threat to the ecological integrity of these coastal watersheds and the aquatic and terrestrial habitat they provide for a rich suite of natural communities and sensitive species. The fragmentation of these large forest tracts also threatens the future viability of a sustainable timber economy in the region. According to the Mendocino County 2017 Crop Report, the county was fourth in California in timber volumes, behind Humboldt, Siskiyou and Shasta, and produced roughly 7.6 percent of the state's total timber harvest in 2017. Timber represents the second highest value commodity in Mendocino County, with a gross "at mill" value of $102 million in 2017. Approximately 52,200 workers, earning $3.3 billion annually, are employed in the forest industry in California, including primary and secondary wood and paper products, private sector forestry and logging, and forestry support activities (McIver et al., 2015).

Several state resource agencies have recognized the importance of preventing fragmentation of large forest tracts in the region. The Coho Strategy specifically recommends "encouraging continued economically sustainable management of forest and agricultural lands in the range of coho salmon to reduce the potential for conversion to residential or commercial development." (CDFW, 2004). California Department of Forestry and Fire Protection (CAL

FIRE) has underscored the need to “recognize the continued importance of large scale, unfragmented ownerships in the working landscape … and examine if state policies can be improved to assure both private and public benefits of large unfragmented holdings.” (CAL FIRE, 2003). Finally, SWRCB’s Nonpoint Source Program Strategy and Implementation Plan, 1998–2013, identifies several management measures related to silvicultural and agricultural activities that can enhance water quality.

While the benefits of protecting large tracts of forestland are clear, the means of achieving their protection is less obvious. The traditional approach of public acquisition and preservation of forestlands cannot alone get the job done. There is not nearly enough public money to purchase or manage such large tracts of forestland. Further, local communities are increasingly resistant to the effects of such large public purchases on the local economy and tax base; intrusion of large government and wasteful spending are common themes in the current political and economic climate.

In response to this dilemma, the Fund launched its North Coast Forest Conservation Initiative in 2004 with the acquisition of the 23,780-acre GRF in Mendocino County. With this purchase, the Fund sought to test a unique hypothesis: Large tracts of depleted coastal forest can be protected from fragmentation and conversion, returned to sustainable timber production and ecological vitality through use of innovative financing and patient management by a nonprofit organization, in partnership with private and public agencies and community stakeholders. In November 2006, the Fund used innovative funding through a loan from the State Revolving Fund (SRF) to help purchase the Big River and Salmon Creek tracts, totaling roughly 16,097 acres, in partnership with SWRCB, SCC, WCB, and the David and Lucile Packard Foundation. In 2011, the Fund purchased GuRF to protect and restore an additional 13,913-acre contiguous commercial forest tract in the North Fork Gualala River watershed. This acquisition was made possible by partnering with the WCB, The Nature Conservancy (TNC), Keith Campbell Foundation and the Mellon Foundation. The Buckeye Forest was acquired in May 2013 by the Fund, in partnership with the SCC, Sonoma County Agricultural Preservation and Open Space District (SCAPOSD), the Gordon and Betty Moore Foundation, Packard Foundation, and the Sonoma Land Trust.

2.2 Principal Management Goals

The BRSC project seeks to balance the ecological needs of coastal forests with the economic imperatives of ownership, management and restoration.

This document is a presentation of our vision for what this balance looks like after more than 10 years of ownership and management, and how we will manage the property going forward.

This plan identifies and describes the following specific management goals:

- Improve ecological conditions by protecting and enhancing water quality through maintaining high standards for road construction and maintenance.
- Improve ecological conditions by protecting and enhancing terrestrial and aquatic habitat vegetative diversity, late-seral conditions and riparian forests, while significantly increasing the inventory of commercial timber volumes.
- Generate sufficient revenue to cover taxes, on-site maintenance, management and restoration projects.
- Continue to implement the improved forest management greenhouse gas reduction project first registered under the Climate Action Reserve (CAR) Forest Project Protocol version 2.1 and now transitioned to the CARB Compliance Offset Protocol, U.S. Forest Projects.

- Practice continual improvement through adaptive management based on monitoring of water quality and forest health against specific objectives described in the plan.
- Support the local business community by utilizing local contractors and suppliers.
- Involve the local community by seeking input on management of the forests, including review of this plan and timber harvest methods implemented under the plan, and providing compatible public access and educational and recreational opportunities.

Particular emphasis will be placed on achieving water quality enhancement and antidegradation objectives by: a) permanently protecting BRSC from subdivision, residential and commercial development, forestland conversion and agricultural intensification; and b) implementing remediation, protection and restoration measures to address sediment pollution problems and associated impacts resulting from historic and current forest management in the North Coast region, including measures identified in the:

- Strategy for Implementing State Revolving Fund for Expanding Use Projects (Strategy),
- Nonpoint Source Program Strategy and Implementation Plan, 1998 – 2013 (NPS Implementation Plan),
- *Big River Total Maximum Daily Load for Sediment* developed by the US EPA, Region IX in December 2001 (Big River TMDL), as adopted by the North Coast Water Board in *Resolution No. R1-2004-0087,*
- Total Maximum Daily Load Implementation Policy Statement for Sediment-Impaired Receiving Waters in the North Coast Region (TMDL Implementation Policy).

Successful implementation of these measures will also achieve important state objectives related to recovery of coho salmon and steelhead trout (CDFG, 2004).

2.3 Project Financing

Sustainable forest management allows the Fund to rebuild commercial timber inventories that support the local economy and, at the same time, help repay loans taken to acquire the forests, upgrade roads and restore stream conditions for rare and threatened species. The emergence of a robust market for greenhouse gas emission offsets associated with improved forest management has significantly improved the means and rate of attainment of our principal management objectives. The Fund continues to be a consistent supplier of forest carbon offsets from its North Coast properties.

The BRSC forests were acquired by the Fund in November 2006 with acquisition funding sources, and amounts are as follows:

State Revolving Fund (SRF) loan	$25,000,000
California State Coastal Conservancy grant	$7,250,000
Wildlife Conservation Board grant	$7,250,000
David and Lucile Packard Foundation loan	$5,000,000
The Conservation Fund equity	$4,000,000
Total:	$48,500,000

The State Revolving Fund (SRF) is a low-interest loan program established under the Clean Water Act and administered by the State Water Board to fund water quality projects. Capitalization for the SRF comes from periodic federal appropriations, 20 percent state matching funds and loan repayments that revolve back into the SRF. Interest rates are 50 percent of the state's general obligation bond rate, with loan repayments over periods as long as 20 years. Traditionally, the SRF has been used to fund construction of publicly owned wastewater treatment facilities and related infrastructure. However, SRF loan funds also can be used to address nonpoint source pollution issues, including those related to silviculture, such as increased sediment loading and water temperature, as is the case with this project. The low interest rate and relatively long loan maturity make the SRF an ideal financing mechanism for protecting and restoring depleted forestlands when used in combination with equity and grant funding.

The Fund covers the cost of the ongoing management of the BRSC forests, including restoration projects, road maintenance, staff time, consultants and property taxes, through revenue from timber harvests and carbon offset sales. These ongoing management expenses for BRSC have averaged $3 million annually.

BRSC has been enrolled as a carbon offset project since 2007. The forests participated in the early action, voluntary market with the CAR for seven years. During this time, BRSC generated a total of 2.4 million metric tons of verified emission reductions. In 2015, the project transitioned to CARB's Compliance Offset Protocol, U.S. Forest Projects, and is now a registered Improved Forest Management Project. As a CARB project, BRSC continues to update and store carbon dioxide and has generated approximately 60,000 Air Resource Board Offset Credits (ARBOCs) each year. Sale of these offsets has provided significant additional financial support for the forests, enabling us to accelerate restoration activities and defer harvests when log prices are low.

2.4 Plan Requirements

As set forth in the MOU, the SCC and WCB approval requires the Fund to "prepare a forest management and restoration plan, plan sustainable harvests which eventually will fund the repayment of loans taken to purchase and/or manage the [forests, and] the implementation of forest management and restoration plan, and provide public access." The State Water Board approval requires that the Fund "develop a water quality management and restoration plan…. This plan will explain the measures the [Fund] will implement to correct and prevent deterioration of the watersheds due to past, current and proposed future management practices, and how performance and benefits of the project will be measured." The MOU contemplates that the Fund may fulfill these requirements by preparing a single plan that conforms to the respective conditions and requirements of the approvals. This plan fulfills in a single document the foregoing conditions and requirements as specified in the MOU.

Photo by Matthew Gerhart

3. Purpose of Plan

3.1 Plan Requirements

The plan follows requirements established in the FSC U.S. Forest Management Standard (version 1.0) and as further specified during the Fund's 2012 FSC audit. For continuity, the BRSC plan follows the same format as plans prepared for all the North Coast forests.

From FSC Principle 7: Management Plan: "This principle is intended to ensure that management of the [Forest Management Unit] FMU is described in a comprehensive management plan. The plan should be developed with expertise and public input appropriate to the scale of the operation. The management plan, and the process of its development, should embody and consider all of the principles and criteria in this standard.… The management plan may consist of a variety of documents or an umbrella document that describes how a collection of management documents relate to an integrated strategy for managing the forest. This may include a combination of ownership level plans, unit plans, site level plans (e.g., harvest plans), [Geographic Information Systems] GIS, published guidelines (e.g., regional silviculture or [Best Management Practice] BMP guides), landowner policies and other information.… Guidance on scale and intensity of operations: All management plans regardless of the scale and intensity of operations must address the Indicators of Criterion 7.1 unless otherwise noted in the guidance below."

The intent of Criterion 7.1 is to "ensure that a written management plan, as described in the principle-level intent and guidance above, exists for the property within the scope of the certificate. The actions and objectives detailed in the plan are specific, achievable, measurable and adaptive. They are also sufficient to meet the requirements of this standard.… Whenever the term "management plan" is used, it refers to any combination of documents and systems that meet the intent of the indicator." Per Criterion 7.1, the following indicators must be included in the plan:

a) Management objectives;
b) Description of the forest resources to be managed, environmental limitations, land use and ownership status, socioeconomic conditions, and a profile of adjacent lands;
c) Description of silvicultural and/or other management systems, based on the ecology of the forest in question and information gathered through resource inventories;
d) Rationale for rate of annual harvest and species selection;
e) Provisions for monitoring of forest growth and dynamics;
f) Environmental safeguards based on environmental assessments;
g) Plans for the identification and protection of rare, threatened and endangered species;
h) Maps describing the forest resource base including protected areas, planned management activities and land ownership; and
i) Description and justification of harvesting techniques and equipment to be used.

3.2 Plan Revisions

Consistent with the criteria of SFI and FSC certification and the principles of an adaptive management approach, the plan will be updated every 10 years to reflect the condition of the forests as they change over time and as management activities are implemented. Local experts, advisors, agency staff and community members will be included in the revision process. Revisions and/or amendments will be provided to the WCB, SWB and SCC for review prior to adoption.

3.3 Adaptive Management

Adaptive management is the process of continually adjusting management in response to new information, knowledge or technologies (Walters and Holling, 1990). Adaptive management recognizes that unknowns and uncertainty exist in the course of achieving any natural resource management goals.

The complexity and interconnectedness of ecological systems, combined with technological and financial limitations, make a complete understanding of all the components and linkages virtually impossible. In addition, the systems themselves are constantly changing through both natural and human-caused mechanisms, making the effort to comprehend ecosystem dynamics and foretell their trajectories even more challenging (Gunderson et al, 1995).

Uncertainty will always be a part of the management of ecosystems, and adaptive management provides a mechanism by which uncertainty can become "the currency of decision-making instead of a barrier to it" (Walters, 1986). Sound implementation and the ultimate attainment of the project will depend in part on the commitment made to adaptive management, where research and monitoring are given a high priority, and new information is gathered to feed back into the basic data management system and future plans.

This plan identifies two information streams for adaptive management: 1) monitoring of implementation benchmarks established for Streams and Roads, Forest Management and Community Involvement described in this plan; and 2) monitoring the effectiveness of achieving the implementation benchmarks on selected ecological conditions (principally water quality and forest inventory and structure). Each of the proposed indicators for monitoring viability of conservation and restoration effectiveness will need to be evaluated by the following criteria:

- Cost efficiency—getting the most information for the least cost;
- Quality control—data collection and compilation has accepted quality control standards and can be applied consistently and effectively across all data collection points and efforts;
- Scientific defensibility and credibility—designs for data collection, quality control efforts, and data analysis techniques meet standards commonly used by the relevant regulatory agencies; and
- Timely yield of information—the monitoring program must yield information for management in a timely manner.

Photo by Matthew Gerhart

4. Property Setting and Current Conditions

4.1 Property Orientation

4.1.1 Property Location

The Big River and Salmon Creek forests are in the coastal mountain range of southwestern Mendocino County, roughly centered between the Highway 1 and Highway 101 corridors. The Big River Forest (approximately 11,770 acres) adjoins Big River State Park and Jackson State Demonstration Forest and is located within the middle portion of the Big River watershed; its tributaries include Little North Fork, Two Log Creek and Laguna Creek, as well as a portion of the main stem of Big River. The property is accessed by Highway 20 on the north and Comptche-Ukiah Road on the south.

Salmon Creek is a relatively small coastal watershed in Northern California, with the entire drainage area lying within 8 miles of the coast (see SC Property Map). The Salmon Creek Forest (approximately 4,250 acres) covers 51 percent of the watershed and is situated between and accessed by Albion Ridge and Navarro Ridge roads.

4.1.2 Neighbors and Adjacent Lands

The Big River Forest is adjacent to Big River State Park (which contains the 8.3-mile estuary), Mendocino Woodlands State Park, and Jackson State Demonstration Forest. Together, Mendocino Redwood Co., Jackson State Demonstration Forest, Big River State Park, Mendocino Woodlands State Park, Coastal Ridges, The Conservation Fund, and Weger Holdings own 82 percent of the watershed. Thirty-one property owners—with plots ranging from 160 acres to 2,052 acres—own 9 percent of the land, and the rest is in scattered private residences (NCRWQCB, 2005). Other than the town of Mendocino at the mouth of Big River, there are few people living in the watershed. Scattered ranches and residences can be found primarily in the upper or east end of the basin, which are dominated by annual grasslands and therefore more suitable for ranching.

The Salmon Creek Forest covers 50 percent of the Salmon Creek watershed (4,306 of 8,596 acres). Fifty-three percent of the watershed is under active forest management, 8 percent is under agricultural use, and small private ownerships make up the remainder (Green Info Network, 2006). Mendocino Redwood Co. lands border a majority of the north and east boundaries of the Salmon Creek Forest (included in MRC's "Albion Inventory Block"). Most of the smaller parcels and residences are concentrated on the coastal terrace ridges to the south and north of Salmon Creek.

4.1.3 Physiographic Setting

4.1.3.1 Description of Watershed

The Big River watershed is 116,000 acres (181 square miles) located in the northern California Coast Range in western Mendocino County, entering the Pacific Ocean at the town of Mendocino, about 10 miles south of Fort Bragg. The Big River Basin extends 24 miles to the east, to within 3 miles of Willits and Highway 101. It drains primarily from east to west, sharing ridges with the Noyo River and Caspar Creek basins to the north, the Eel River watershed to the east, and the Little, Albion and Navarro rivers watersheds to the south.

Elevations within the Big River Basin range from sea level at the mouth to 2,836 feet at Irene Peak, 5 miles south of Willits. The basin's topography is diverse along its length, varying from flat estuarine environments and uplifted marine terraces to rugged mountains with high relief in the eastern portion.

Big River Property Map

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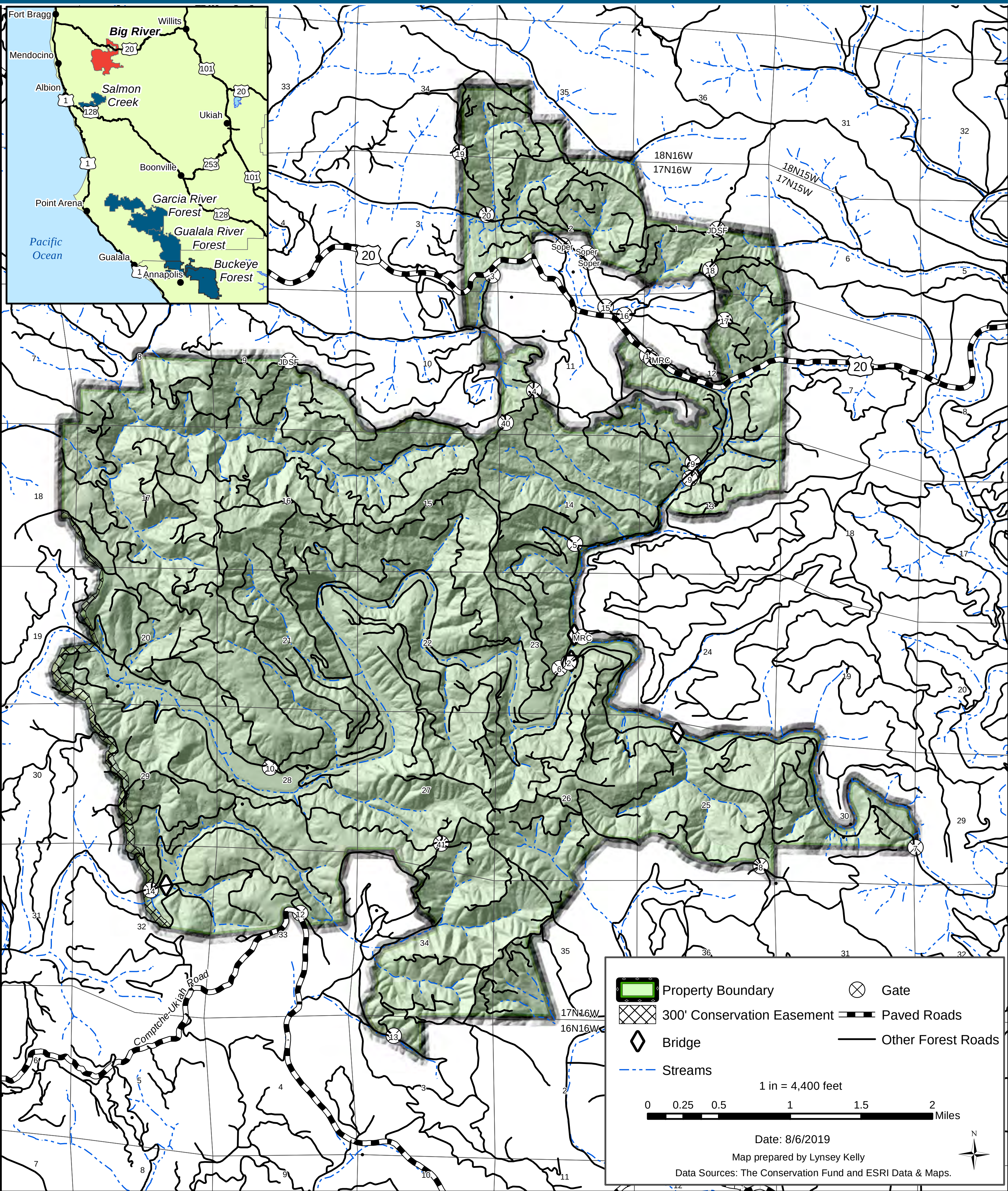
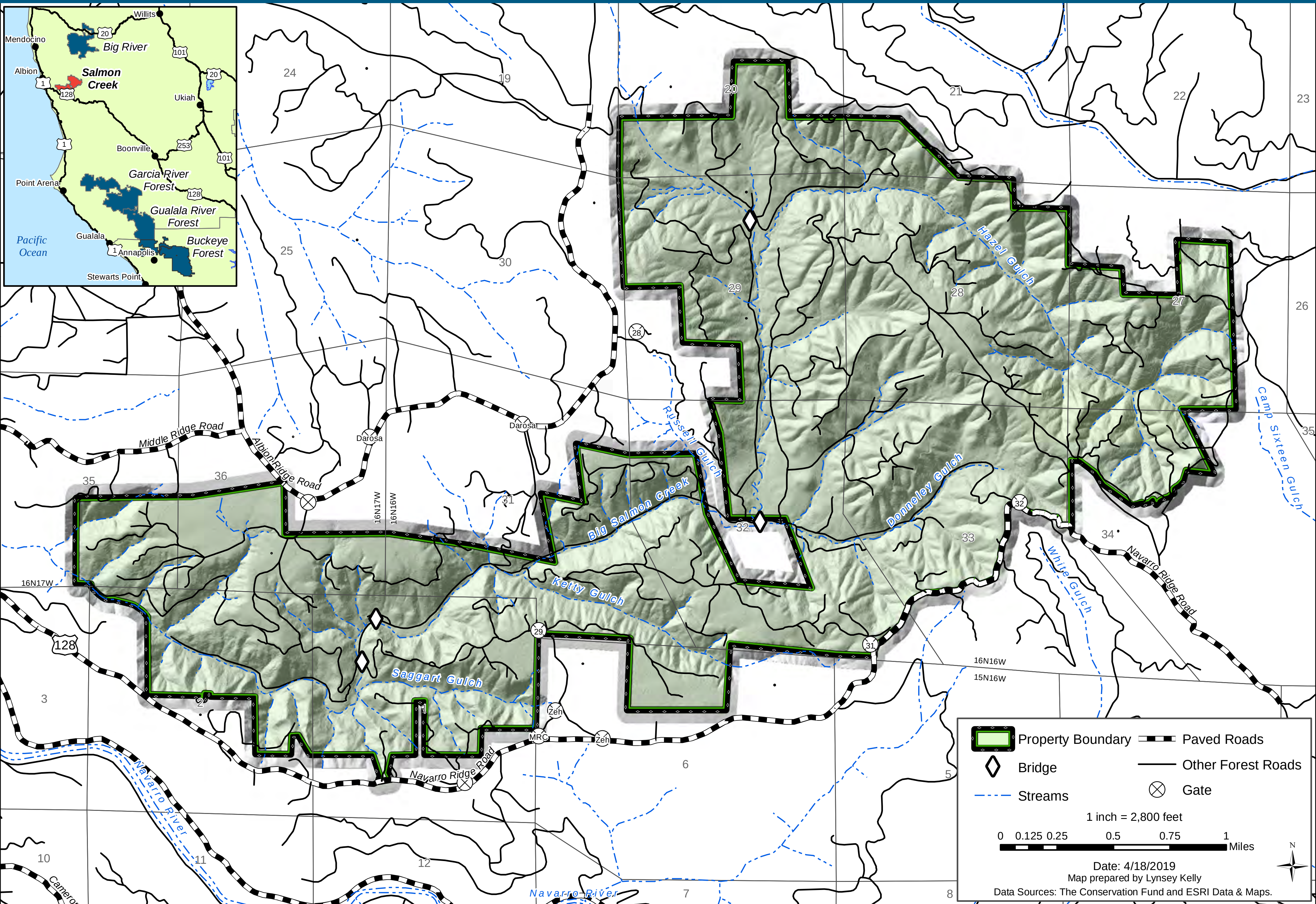


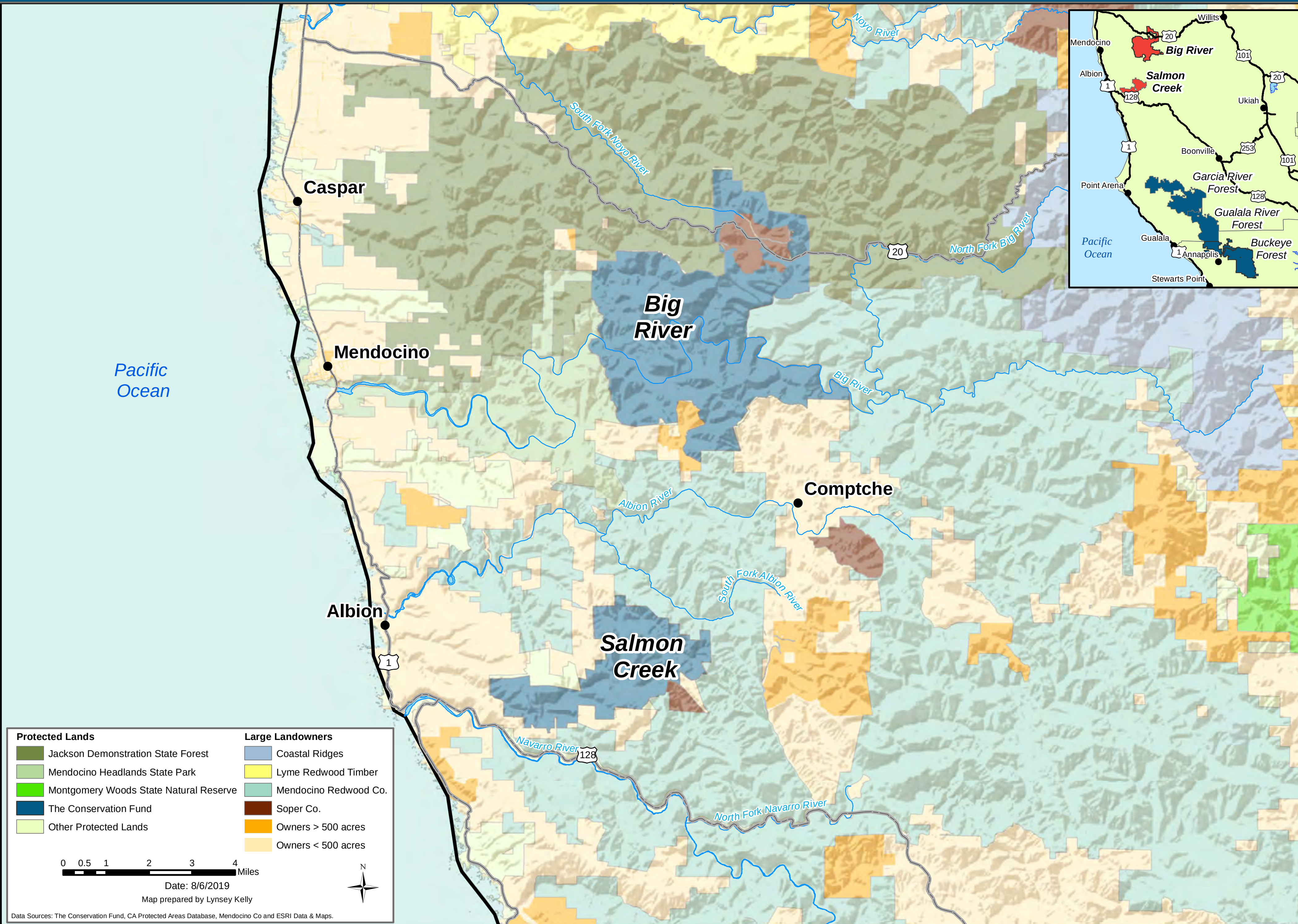
Salmon Creek Property Map

THE CONSERVATION FUND



Big River and Salmon Creek Adjacent Landowners

The Conservation Fund



The Salmon Creek watershed drains an approximately 8,600-acre watershed (over 13 square miles) located in the northern California Coast Range in western Mendocino County, grading into the Pacific Ocean through coastal plains half a mile south of the village of Albion and the Albion River and approximately 16 miles south of the city of Fort Bragg. The Salmon Creek Basin drains east to west and extends approximately 8.5 miles to the east, sharing ridges to the north with the Albion River Watershed and to the south with the Navarro River Watershed.

Elevations within the Salmon Creek Basin range from sea level at the mouth to 1,000 feet at Albion Ridge to the north. The basin's topography varies from its flat estuarine environment to uplifted marine terraces to moderate to steep slopes in eastern portions.

4.1.3.2 Climate

Big River and Salmon Creek are forested watersheds with a coastal-influenced climate in the lower half of the drainage. Located within the Oregonian Biotic Province, the watersheds have a Mediterranean climate, characterized by a pattern of low-intensity rainfall in the winter and cool, dry summers with coastal fog. Mean annual precipitation is 40 inches at Fort Bragg near the western margin of the watershed and 51 inches at Willits to the east. Most of the precipitation (roughly 90 percent) occurs between October and April, with the highest average rainfall during the month of January (NCRM, 2011).

4.1.3.3 Geology

The regional geologic landscape of the BRSC forests were shaped by the tectonic collision of the Farallon and North American plates during the Mesozoic and early to middle Tertiary periods (Steinbuck, 2008). Tectonic forces mixed these sediments with other less common rock types as subduction continued; subsequent metamorphism and accretion to the western margin of North America resulted in what geologists collectively refer to as the Franciscan Complex (Blake and Jones, 1981). Geologic mapping conducted in the region indicates that the Big River and Salmon Creek forests are solely underlain by the coastal belt Franciscan Complex (Kilbourne, 1983a). The coastal belt Franciscan consists of arkosic sandstone and andesitic greywacke sandstone that underwent low-grade metamorphism as a result of subduction. Shear strength of the exposed bedrock is highly variable and dependent upon the local structure, bedding and lithology.

Landslides, both natural and related to past management, occur within the Big River and Salmon Creek forests and are widespread within the Franciscan Complex across the Coast Range Mountains. Large deep-seated landslides (e.g. translational-rotational landslides) have occurred on both the Big River and Salmon Creek properties and are generally characterized by a very slow-moving slide mass and deep slide plane extending well into bedrock. A majority of the shallow landslides (e.g. debris slides and flows) occur on slopes over 65 percent and are concentrated on steep streamside slopes along the outside of meander bends along the mainstems of Big River and Salmon Creek and their larger tributaries. Recent unconsolidated channel deposits composed primarily of sand, silt and gravel are exposed along the active channels on both the Big River and Salmon Creek properties.

4.1.3.4 Soils

The soils formed from the Franciscan Complex are generally well-drained loams and sandy clay loams. Due to the high annual precipitation, soil fertility is high and well suited to growing timber. Formed from the weathering of sedimentary rock, colluvial soils blanket a majority of the hillslopes across the Coast Range Mountains. The Natural

Resource Conservation Service *Soil Survey of Mendocino County* depicts the following 13 distinct soil complexes in the Big River and Salmon Creek properties:

- Irmulco-Tramway complex
- Dehaven-Hotel complex
- Vandamme loam
- Vandamme-Irmulco complex
- Ornbaun-Zeni complex
- Glenblair gravelly loam
- Threechop-Ornbaun complex
- Boontling loam
- Bigriver loamy sand
- Carlain loam
- Quinliven-Ferncreek complex
- Ferncreek sandy loam
- Shinglemill-Gibney complex

Thickness of the overlying colluvial soil can be highly variable. Generally, colluvium is thin along ridges and upper side slopes (typically one to two feet), and thick (as much as five to 10 feet) within deep swales and local depressions. For more information on soils see Appendix B, Geology and Soils.

Big River Soil Survey (SSURGO)

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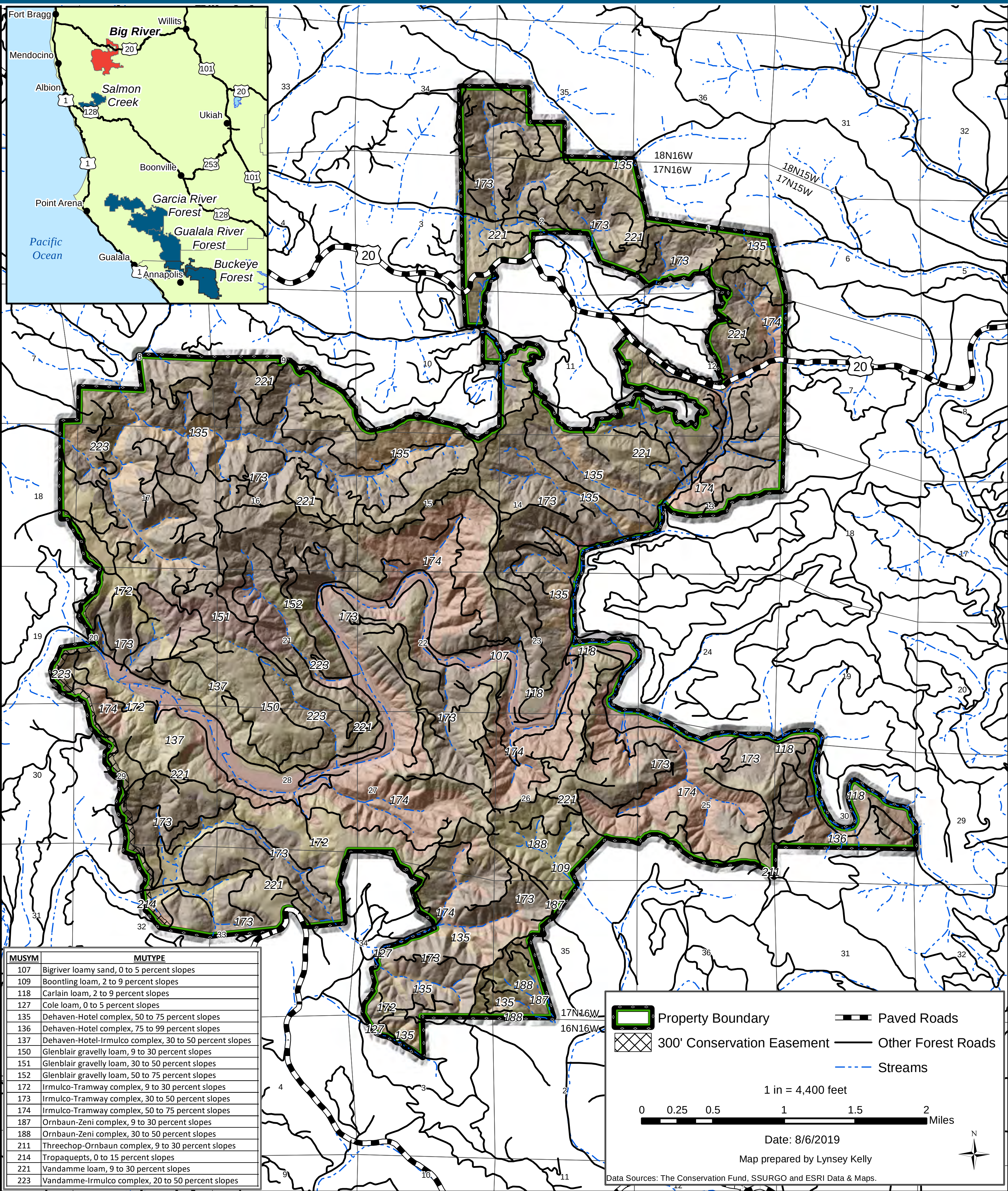
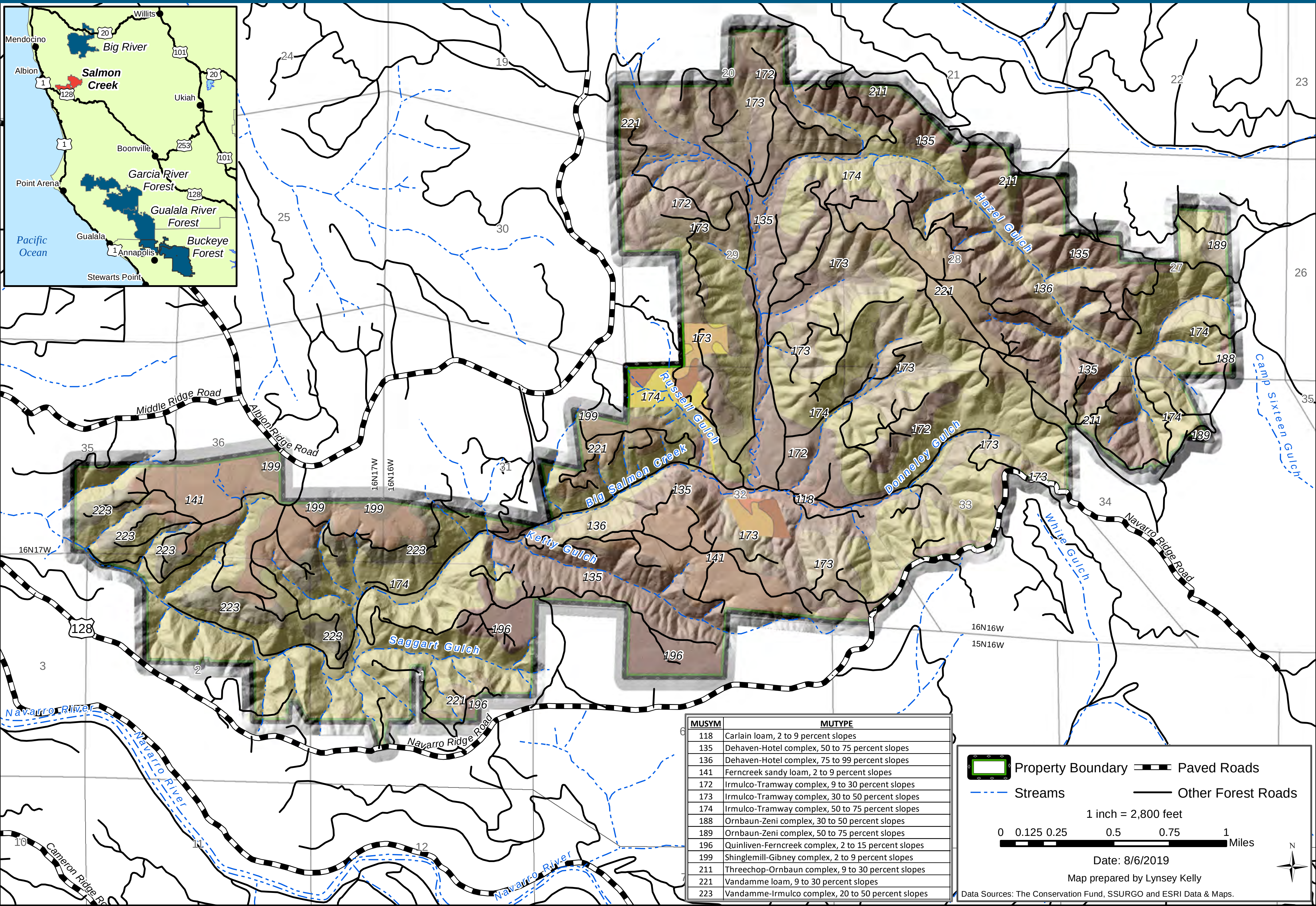


MUSYM	MUTYPE
107	Bigriver loamy sand, 0 to 5 percent slopes
109	Boontling loam, 2 to 9 percent slopes
118	Carlain loam, 2 to 9 percent slopes
127	Cole loam, 0 to 5 percent slopes
135	Dehaven-Hotel complex, 50 to 75 percent slopes
136	Dehaven-Hotel complex, 75 to 99 percent slopes
137	Dehaven-Hotel-Irmulco complex, 30 to 50 percent slopes
150	Glenblair gravelly loam, 9 to 30 percent slopes
151	Glenblair gravelly loam, 30 to 50 percent slopes
152	Glenblair gravelly loam, 50 to 75 percent slopes
172	Irmulco-Tramway complex, 9 to 30 percent slopes
173	Irmulco-Tramway complex, 30 to 50 percent slopes
174	Irmulco-Tramway complex, 50 to 75 percent slopes
187	Ornbaun-Zeni complex, 9 to 30 percent slopes
188	Ornbaun-Zeni complex, 30 to 50 percent slopes
211	Threechop-Ornbaun complex, 9 to 30 percent slopes
214	Tropaquepts, 0 to 15 percent slopes
221	Vandamme loam, 9 to 30 percent slopes
223	Vandamme-Irmulco complex, 20 to 50 percent slopes

Salmon Creek Soil Survey (SSURGO)

THE CONSERVATION FUND



MUSYM	MUTYPE
118	Carlain loam, 2 to 9 percent slopes
135	Dehaven-Hotel complex, 50 to 75 percent slopes
136	Dehaven-Hotel complex, 75 to 99 percent slopes
141	Ferncreek sandy loam, 2 to 9 percent slopes
172	Irmulco-Tramway complex, 9 to 30 percent slopes
173	Irmulco-Tramway complex, 30 to 50 percent slopes
174	Irmulco-Tramway complex, 50 to 75 percent slopes
188	Ornbaun-Zeni complex, 30 to 50 percent slopes
189	Ornbaun-Zeni complex, 50 to 75 percent slopes
196	Quinliven-Ferncreek complex, 2 to 15 percent slopes
199	Shinglemill-Gibney complex, 2 to 9 percent slopes
211	Threechop-Ornbaun complex, 9 to 30 percent slopes
221	Vandamme loam, 9 to 30 percent slopes
223	Vandamme-Irmulco complex, 20 to 50 percent slopes

Property Boundary
Paved Roads
Streams
Other Forest Roads

1 inch = 2,800 feet

0 0.125 0.25 0.5 0.75 1 Miles

Date: 8/6/2019

Map prepared by Lynsey Kelly

Data Sources: The Conservation Fund, SSURGO and ESRI Data & Maps.

Big River LiDAR Slope

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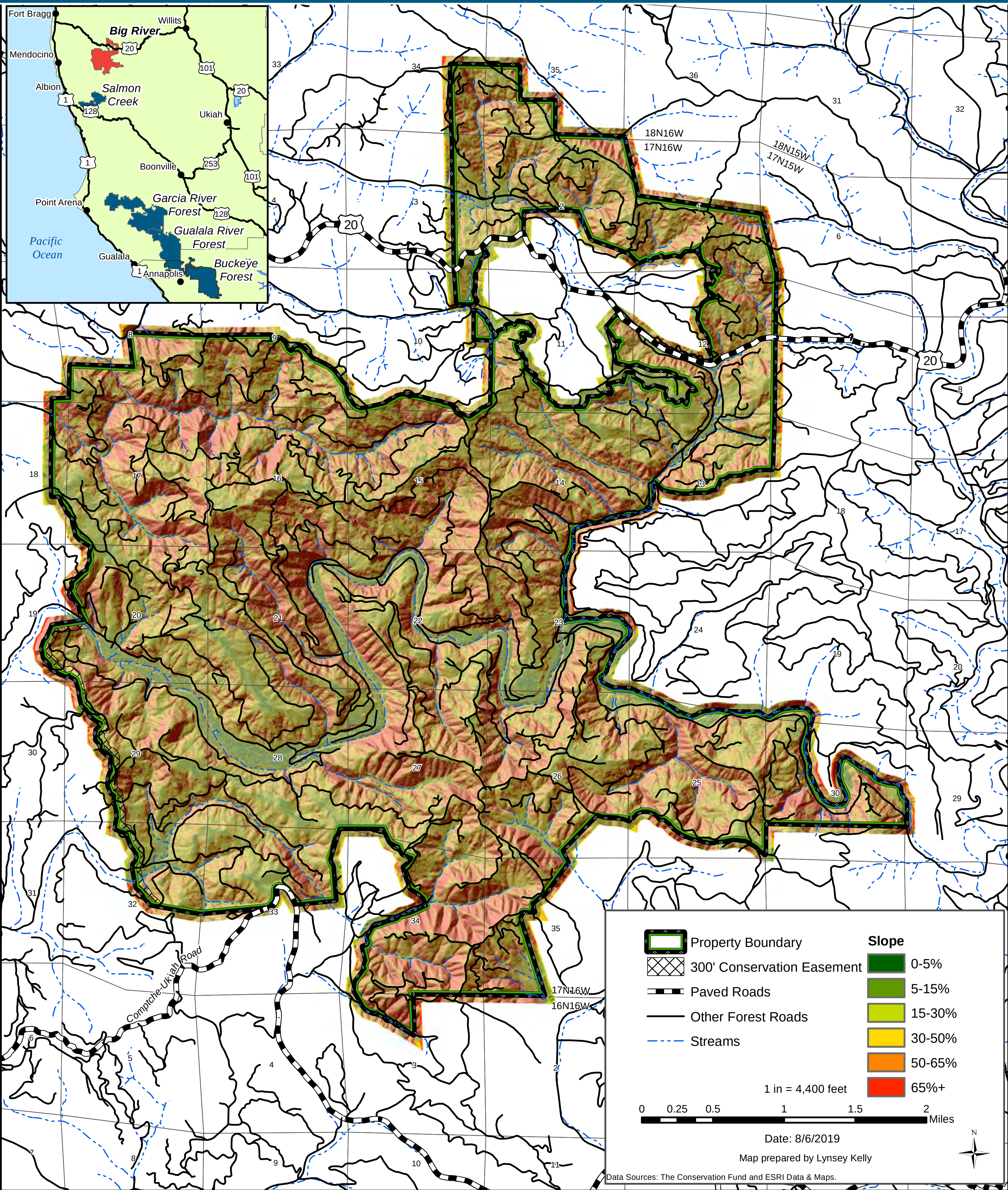

Salmon Creek LiDAR Slope

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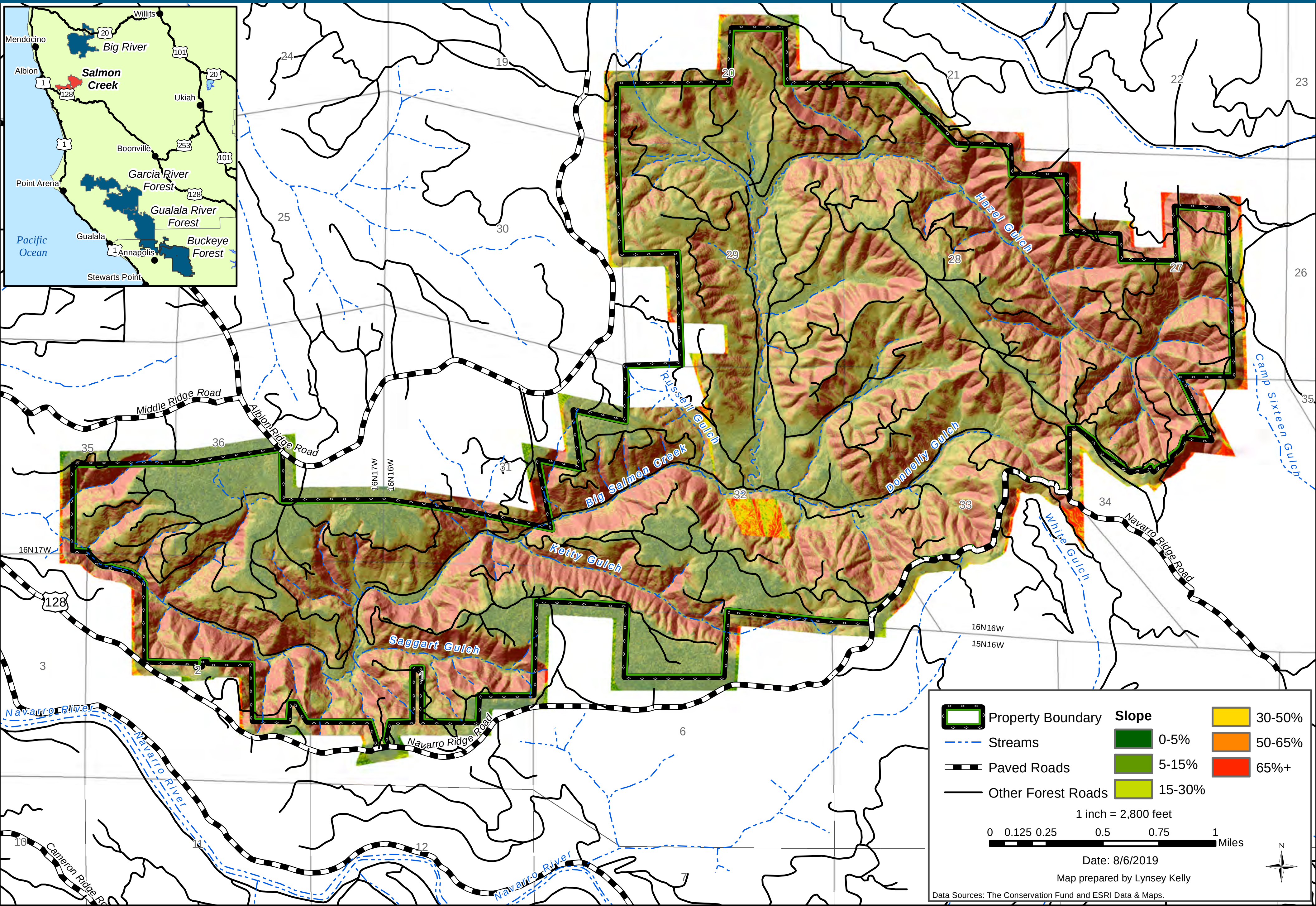

4.1.4. Regulatory Setting

Numerous statutes have been enacted to protect water quality and associated aquatic habitat and terrestrial species, including plants and animals and their habitat in California. Table 4-1 below summarizes the state and federal environmental laws and regulations that pertain to forest management on the North Coast.

Table 4-1: State and Federal Laws Commonly Applicable to Forest Management

Regulation	State or Federal State	Responsible Agency
1600 Lake or Streambed Alteration Agreement	State	CalFire
California Endangered Species Act	State	California Department of Fish and Wildlife (CDFW)
California Coastal Act	State	California Coastal Commission
California Environmental Quality Act (CEQA)	State	Any state or local public agency undertaking a CEQA "project"
Clean Water Act	Federal	U.S. Environmental Protection Agency, U.S. Army Corps of Engineers
Coastal Zone Management Act	State and Federal	National Oceanic and Atmospheric Administration (NOAA), California Coastal Commission
Endangered Species Act	Federal	NOAA, U.S. Fish and Wildlife Service
Porter-Cologne Water Quality Act	State	State Water Resources Control Board
Z'Berg-Nejedly Forest Practice Act	State	California Department of Forestry and Fire Protection

The federal Endangered Species Act (ESA) establishes a process by which animal and plant species can be listed for federal protection. That protection limits any activity that may result in a "taking" – causing death to one or more individuals of a particular species, either through direct action (such as hunting) or indirect action (such as destruction of its habitat). A species may be listed as "threatened" or "endangered," depending on the level of peril and the status of the remaining population; an "endangered" designation carries a greater degree of protection.

The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) has authority for enforcement of marine and anadromous species under ESA, such as coho salmon and steelhead trout. The U.S. Fish and Wildlife Service (USFWS) has authority for enforcement of the ESA for freshwater and terrestrial species such as the northern spotted owl.

The California Endangered Species Act (CESA) is the state law that complements the federal ESA; it is enforced by CDFW. Many of the protected species in the North Coast—including northern spotted owl and coho salmon—are listed under both federal and state acts and are protected by both federal and state agencies.

The state Z'Berg-Nejedly Forest Practice Act was passed in 1973: Public Resources Code; Division 4, Chapter 8 section 4512(c). The Legislature thus declares that it is the policy of this state to encourage prudent and responsible forest resource management, calculated to serve the public's need for timber and other forest products, while considering the public's need for watershed protection, fisheries and wildlife, and recreational opportunities alike in this and future generations. CAL FIRE promulgates rules to implement the law. Over time, the legislature and CAL FIRE have passed laws and regulations increasing the Forest Practice Act scope and detail. The process to permit timber harvest now involves a multiagency review, which may involve up to four state and local agencies, and two or more federal agencies, depending on the location and potential issues involved in the plan. Additional permits from other agencies—both state and federal—may be required.

The federal Clean Water Act (CWA) establishes the broadest framework for water quality regulations, including the protection of wetlands. The Porter-Cologne Water Quality Act is the state corollary. Regulatory authority is coordinated between federal and state agencies, primarily the EPA and SWRCB. The U.S. Army Corps of Engineers has permitting authority under Section 404(d) of the CWA, which regulates discharges into U.S. waters, including wetlands. Section 303(d) of the CWA describes the regulation of "impaired water bodies," a designation given a water body that fails to meet specific water quality standards. Each state is required to maintain a list of impaired water bodies and to develop Total Maximum Daily Loads (TMDLs) for each impaired water body, to address point and nonpoint sources of pollution. An implementation plan, also known as an action plan, identifies a program for implementing the necessary pollution load reduction requirements to meet water quality standards. While not strictly a requirement of the TMDL as described by the CWA and associated regulations, the action plan is required under the Porter-Cologne Act. In California, there are 509 water bodies listed as impaired; 28 of these are within the North Coast Region. The North Coast Regional Water Quality Control Board (NCRWQCB) is charged with developing most TMDLs in the region.

Many of the TMDLs in the North Coast are primarily focused on sediment and temperature pollution, both of which are usually generated from nonpoint sources, such as stormwater runoff and erosion from roads—especially logging roads and unpaved rural residential roads. Poor timber harvest practices in the past have impacted stream health by causing loss of riparian vegetation and increased sedimentation.

The Big River watershed was listed under the Clean Water Act Section 303(d) List of Impaired Water Bodies for excessive sedimentation and subsequent anadromous salmonid habitat loss. The EPA established the Big River TMDL for sediment on December 20, 2001.

Additionally, although not a regulatory listing, the Big River is listed on the National Rivers Inventory, a list of potential wild, scenic and recreational river areas within the United States. The river is listed for five outstandingly remarkable values: scenery, recreation, fish, wildlife and history (NPS 2004).

4.2 Forest and Terrestrial Conditions

4.2.1 Forest Overview

The BRSC is typical of California's North Coast—dominated by native conifers (primarily redwood, Douglas fir and sugar pine), steep slopes, and heavy rainfall that typify the region. The forests are richly productive and support significant wildlife, including many imperiled species, such as coho salmon, steelhead trout and northern spotted owls. The majority of the forests have been harvested at least twice since the arrival of European settlers around the turn of the 20th century. Some of the timber stands are 80 years old, but most are much younger—the result of significant harvesting in the 1950s through the current day. The timber inventory is depleted compared with historic levels but is comparable to other industrial timberland in the region. And because of its unique properties and appearance, redwood is still one of the most valuable lumber species in the world.

The forests are well situated for continued sustainable forestry—there is good road infrastructure and high site productivity for forests in the redwood region, and a mixture of mature forest and rapidly growing young and mature stands. Since the Fund took ownership in 2006, we have selectively harvested most of the mature stands, or about 50 percent of the property, and are now initiating re-entry into some of our earlier harvests. Additionally, some of the older clear-cuts executed by Georgia Pacific Corp. are now available for harvest. The Fund has harvested less than growth, and the overall board foot volume and carbon stocks are increasing under our current management regimen. (For more information, see Appendix I, Option A Sustained Yield Plan) The plan is composed of a forest inventory and extensive growth and yield modeling that demonstrate that harvest levels do not exceed growth (and in fact are substantially less) over a 100-year planning horizon.

The property will continue to be managed for long-term restoration because, despite over 60 years of intensive timber management, there is still viable aquatic habitat and a high diversity of plant communities (including riparian forests, coastal redwood forest, well-stocked riparian areas, and mixed hardwood/conifer forest) in addition to sensitive plant and animal species such as coho salmon and steelhead trout.

4.2.2 Operational Constraints

It is important to understand several key facets of forest management on the BRSC (and coastal Mendocino County forestland, in general) that constrain potential forest management operations—especially low-impact ecological silviculture. These include:

- Steep slopes. The steep slopes characteristic of the Coast Range routinely require specialized cable yarding equipment to move logs from the woods to the landing with the minimum of soil disturbance. This style of harvesting is considerably more expensive than ground-based (tractor) logging, which is only possible on gentle slopes. In addition, care must be taken to properly identify and protect slopes with high potential to fail through landslide or debris torrent so as to avoid potential impacts to riparian and aquatic habitats.
- Low volumes. The history of industrial management, specifically clearcutting, has resulted in young, well-stocked stands, which will take a few more decades to reach merchantable size. Almost all stands are well stocked with conifers that are healthy and growing well. Many stands have been precommercially thinned since the Fund's ownership began.
- Hardwood competition. In some stands the development of the desired characteristics (e.g. closed canopy of large conifers) is hampered by excessive competition from brush and unmerchantable trees. In almost all cases this competition is from native species, such as tanoak, which is an early successional species and may occupy heavily disturbed sites for many years following timber harvesting. Reduction in hardwood competition through manual treatments (sawing) or chemical applications (herbicides) is effective but expensive. Achievement of our long-term objectives will require the dedication of financial and personnel resources to thoughtfully and patiently reduce hardwood competition to levels more closely approximating their natural distribution in the redwood/Douglas fir forest type.
- Operating season. The high rainfall that helps make the forest productive also means harvesting and road improvement operations are limited during the rainy season to avoid damage to the road infrastructure

and delivery of sediment to streams. This means almost all activities need to be completed during the summer, and logging contractors have a very limited window in which they can support their businesses.

- Limited markets for products. The timber market is volatile and dependent on housing starts and state and national economies. The number of sawmills in the region has declined steadily since 1970 but has currently stabilized at seven sawmills in our region. Virtually no markets exist for conifer pulpwood or hardwoods (of any size), which reduces the feasibility of improvement or sanitation-type harvests that typically generate low-quality wood in order to improve future stand conditions.
- Complex regulations. The permitting process for timber harvests and associated road usage is time-consuming, inefficient and complex. While intended to prevent environmental damage, many of the requirements are very challenging to assess, report, implement and/or monitor. The Fund budgets six months and $30,000 to $50,000 to prepare and administer a timber harvest plan (THP), which is five to 10 times the cost of a similar operation in Oregon or Washington. Enhancements to the regulatory process could free up significant time and money to benefit other projects.

4.2.3 Forest Inventory System

The BRSC currently maintains two timber inventories, one for the sustained yield plan and one for carbon sequestration. This has been done because the initial sustained yield plan inventory does not adequately capture all of the elements needed to calculate sequestered carbon. The Fund maintains linked forest inventory and geographic information system (GIS) databases to assess, document and monitor forest conditions. Since acquiring the forests, the Fund has acquired high definition digital imagery LiDAR data, used to provide high resolution timber stand classification, as well as provide the Fund with improved mapping capabilities. These tools are critical for understanding forest conditions, habitat availability, road plans and landslide vulnerability. This updated forest inventory system was used in the sustained yield plan (Appendix I).

As part of the Fund's Improved Forest Management carbon projects, timber cruising (evaluation of forest stands) takes place annually through implementation of a Continuous Forest Inventory (CFI). This provides a continually updated picture of the standing carbon stocks, as well as more traditional metrics like board feet per acre and forest species composition. Forest and Stand Evaluation Environment (FORSEE) software is used to compile and grow the forest inventory in a manner that models the Fund's specific silvicultural prescriptions.

Table 4.2: Inventory Summary

	BRSC 2012 MBF/Acre (2012 inventory)	BRSC 2015 MBF/Acre (2015 inventory)	BRSC 2019 MBF/Acre(combo modeling & CFI plots)
Douglas fir	6.8	7.1	8.3
Redwoods	15.1	15.3	16.9
White Woods	1.1	1.6	1.6
Hardwood	1.6	1.9	2.1

4.2.4 Productivity and Site Index

The BRSC is generally redwood and Douglas fir site class III (Forest Practice Rules 14 CCR 1060). The average measured site index in feet at base age 50 from the 2015 inventory is Douglas fir = 119 and redwood = 99. The 50 year base age aligns with our growth model, CRYPTOS, and to a lesser extent aligns with our second growth forest. Site index is calculated using Krumland and Eng's site index system (Krumland and Eng, 2005).

4.3 Terrestrial Habitat and Species

4.3.1 Habitat Overview

Terrestrial habitat communities present on BRSC include redwood, Douglas fir, coastal oak woodland, montane hardwood, mixed chaparral, coastal scrub and grasslands. On most sites redwood would dominate if vegetation succession were allowed to proceed naturally. Each of the habitat types listed above provide food and cover for a wide variety of wildlife species. Redwood habitats provide food, cover or special habitat elements for 193 wildlife species including a variety of sensitive species (Marcot, 1979). Oak woodlands are reported to provide food (mast) or cover for over 60 wildlife species, including resident populations of quail, wild turkey, squirrel and deer. Primary conifer species are coastal redwood (*Sequoia sempervirens*) and Douglas fir (*Pseudotsuga menziesii* var. *menziesii*), with a substantial volume of sugar pine (*Pinus lambertiana*). The dominant hardwood species on the BRSC is tanoak (*Notholithocarpus densiflorus*), with madrone (*Arbutus menziesii*), oak (*Quercus* spp.), California laurel (*Umbellularia californica*), and other California hardwoods interspersed throughout the forest (NCRM, 2011).

Table 4-3 below details habitat types and approximate associated percentage of the BRSC according to the California Vegetation (CalVeg) system. CalVeg is unreliable at fine-scale classifications because it is based on remote sensing and a brief snapshot of conditions; for example, much of the area classified as annual grasses are roads and landings that are naturally revegetating. A complete survey of vegetation types has not been made of the property. However, Appendix A contains a more detailed discussion of botanical resources of the BRSC by botanist Kerry Heise.

Table 4.3 California Vegetation Types and Approximate Acreage on Big River and Salmon Creek Forests

Big River		Salmon Creek	
Wildlife Habitat Relationships Type	**Acres**	**Wildlife Habitat Relationships Type**	**Acres**
Annual Grasslands (AGS)	30	Annual Grasslands (AGS)	0
Coastal Scrub (CSC)	353	Coastal Scrub (CSC)	247
Douglas Fir (DFR)	15	Douglas Fir (DFR)	0.0
Montane Hardwood-Conifer (MHC)	1,811	Montane Hardwood-Conifer (MHC)	685
Montane Hardwood (MHW)	1,153	Montane Hardwood (MHW)	124
Montane Riparian (MRI)	4	Montane Riparian (MRI)	4
Redwood (RDW)	8,262	Closed-Cone Pine-Cypress (CPC)	13
Non-Forest	80	Redwood (RDW)	3,316
	11,707	Non-Forest	0
			4,389

Source: FRID 2017, North Coast West, Calveg Zone 1

Big River CalVeg WHR Types

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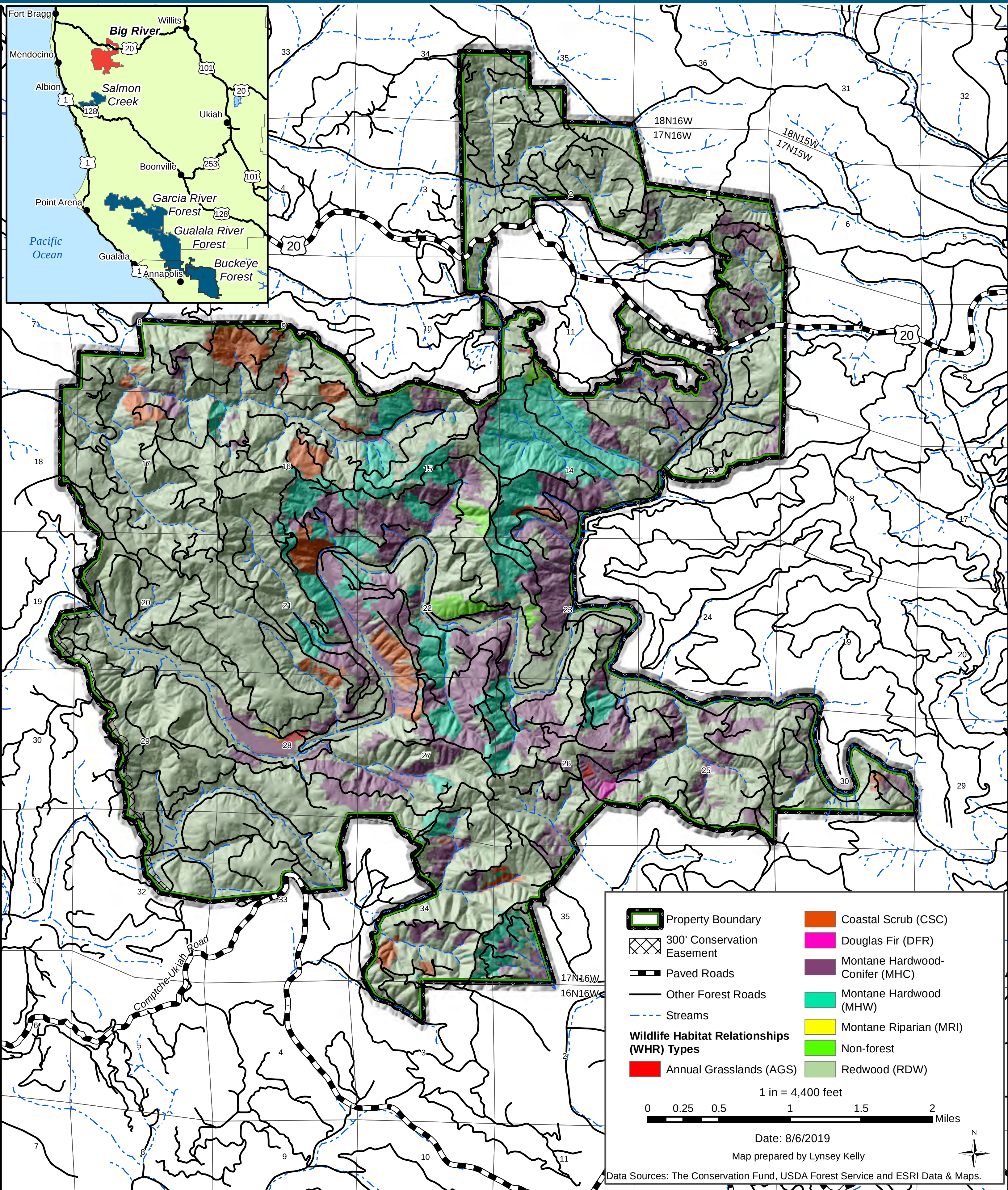

Salmon Creek CalVeg WHR Types

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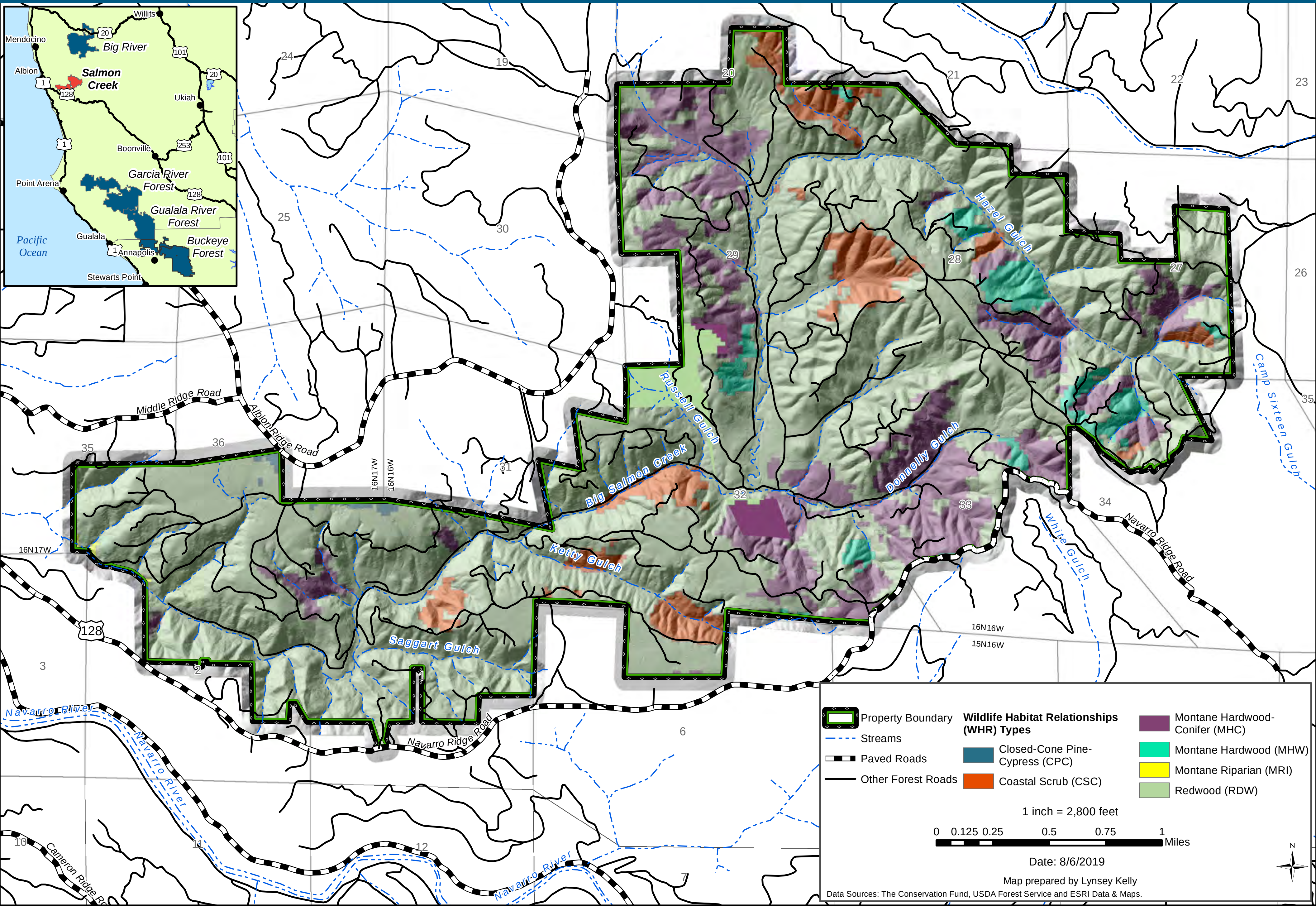


4.3.2 Special Status Species

Federally threatened listed species confirmed in the forest include coho salmon, steelhead trout and northern spotted owl. The northern spotted owl is believed to be the most imperiled and is intended to benefit from our management actions; it is described in more detail below in section 4.3.3. Aquatic species are described in section 4.4.3.

Table 4-4: Terrestrial Rare, Threatened, Endangered, Sensitive and Species of Concern Which May Potentially Occur on the BRSC Forests per the CNDDB

Species	Listing Status	Property
Foothill yellow-legged frog *(Rana boylii)*	CDFW:SSC	Big River, Salmon Creek
Northern spotted owl (*Strix occidentalis caurina*)	FT, SE	Big River, Salmon Creek
Pacific tailed frog *(Ascaphus truei)*	CDFW:SSC	Salmon Creek
Sonoma tree vole *(Arborimus pomo)*	CDFW:SSC	Big River, Salmon Creek
Southern torrent salamander *(Rhyacotriton variegatus)*	CDFW:SSC	Salmon Creek
White-tailed kite (*Elanus leucurus)*	CDFW:FP	Salmon Creek
Coho salmon *(Oncorhynchus kisutch)*	FE, SE	Big River, Salmon Creek
Steelhead *(Oncorhynchus mykiss)*	FT	Big River, Salmon Creek
Plants		
Leafy-stemmed mitrewort *(Mitellastra caulescens)*	Plants of limited distribution; fairly threatened in California	Salmon Creek
Methuselah's beard lichen *(Usnea longissima)*	Plants of limited distribution; fairly threatened in California	Big River, Salmon Creek
Oregon goldthread *(Coptis laciniata)*	Plants of limited distribution; fairly threatened in California	Big River, Salmon Creek
Monterey clover *(Trifolium trichocalyx)*	Plants rare, threatened or endangered in California and elsewhere; seriously threatened in California	Big River
Pygmy cypress *(Hesperocyparis pygmaea)*	Plants rare, threatened or endangered in California and elsewhere; fairly threatened in California	Salmon Creek
Swamp harebell *(Campanula californica)*	Plants rare, threatened or endangered in California and elsewhere; fairly threatened in California	Salmon Creek
White-flowered rein orchid *(Piperia candida)*	Plants rare, threatened or endangered in California and elsewhere; fairly threatened in California	Big River, Salmon Creek

Seacoast ragwort *(Packera bolanderi var. bolanderi)*	Plants rare, threatened or endangered in California, but more common elsewhere; fairly threatened in California	Big River
California sedge *(Carex californica)*	Plants rare, threatened or endangered in California, but more common elsewhere; not very threatened in California	Salmon Creek

Listing Status Codes:

CDFW: SSC = California Species of Special Concern

CDFW: FP = Fully Protected

FE= Federally Endangered

FT= Federally Threatened

Source: California Department of Fish and Wildlife CNDDB 2019

The California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants of California lists 78 special status plant species with the potential to occur on the forest. Fourteen rare vascular species and one rare lichen species were confirmed during rare plant surveys conducted in 2007-18 on the Big River and Salmon Creek forests. The forests host rich botanical resources; 15 special status plants and four special status communities were identified on the properties. One hundred fifty-eight invasive plant species on Big River Forest and 72 on Salmon Creek Forest were identified and prioritized (Heise, 2018).

The initial Botanical Resource Assessment was completed in 2008. In the past 10 years several THP botanical surveys have been conducted throughout BRSC providing a more accurate picture of species diversity. Notably, there have been substantial increases in the number of species documented (Table 4.5).

Table 4.5: BRSC Floristic Summary

	2008	2018
Big River (BR)		
total vascular species	317	538
families	68	89
exotics	88	156
rare	7	9
Salmon Creek (SC)		
total vascular species	234	290
families	62	70
exotics	49	72
rare	10	12
BR and SC bryophytes	35	88
BR and SC lichens	12	35

Photo by Whitney Flanagan

4.3.3 Northern Spotted Owl

The northern spotted owl (NSO) range is north of the San Francisco peninsula throughout the coastal and inland ranges of California and throughout the coastal and Cascade mountain ranges of Oregon and Washington to southern British Columbia. The Redwood Region accounts for only about 9 percent of the northern spotted owl's range.

The Fund surveys annually in areas subject to timber harvest planning, timber harvest implementation or areas subject to CEQA review (such as LWD restoration projects). Recent years' surveys generally find eight to 10 occupied NSO activity centers across the two forests. Additionally, there are several NSO activity centers located immediately outside the Fund's ownership that are routinely detected during surveys. According to CDFW, NSOs prefer dense, old-growth, multilayered mixed conifer, redwood and Douglas fir forests. Prime NSO habitat consists of moderate-to-dense stands of medium-to-large trees and multilayered stands of redwood and Douglas fir, with mature, multilayered stands required for breeding. Based on a study conducted in northwestern California, however, the greatest habitat fitness for NSOs is a mix of mature and late-seral forests interspersed with open vegetation types like brush and younger forest (NCRM, 2011).

Primary prey species for NSO include dusky-footed woodrat, flying squirrels, mice, voles (including the red tree vole), small rabbits, small birds, bats and large arthropods. NSOs roost in forests with a dense, multilayered canopy for seclusion and appear to prefer north-facing slopes in summer due to intolerance for high temperatures. NSOs require a large home range of 100 acres to 600 acres of mature forest with permanent water and suitable nesting trees and snags with broken tops or cavities (NCRM, 2011).

The NSO was listed as a threatened species under the federal ESA in 1990 as concern mounted over the continuing loss of habitat that the owls require for survival and reproductive success. In accordance with the ESA listing, landowners within the range of the NSO are required to survey for their presence if any kind of habitat-altering activity such as timber harvest is proposed.

Historically the USFWS has overseen the administration and consultations with regard to species protected under the ESA. This responsibility is now shifting to CAL FIRE. The USFWS developed an NSO survey protocol in 1991 (revised in 1992), which is followed today. In order to address the presence of barred owls, the USFWS issued an update to the NSO survey protocol in 2011, which was revised in 2012. CAL FIRE has been charged with reviewing NSO data submitted within THPs to determine if harvesting will result in the take of NSO.

The California Forest Practice Rules define minimum foraging and nesting/roosting habitat conditions and require minimum habitat retention levels at the 500-foot, 1,000-foot, 0.7-mile, and 1.3-mile radii of the activity center. Additionally, prior to commencing timber operations, surveys for NSO must be completed in conformance with the USFWS guidelines.

The Fund is fortunate to have Mike Stephens, one of the region's NSO experts, responsible for NSO surveys, habitat classification review, and USFWS and CAL FIRE permit coordination. In addition to what is required by the ESA, the Fund has undertaken exhaustive survey efforts to locate all NSO on our property to facilitate timber harvest as well as road improvement projects and stream habitat improvement projects. The Fund's commitment to predominantly uneven-aged selection silviculture is designed to maintain and increase habitat values. The biggest threat to the future of the forests' owls is not habitat loss but rather the invasive barred owl which displaces the NSO (Kelly et al., 2003), suppresses its calling behavior (Crozier et al., 2006), and is steadily increasing in Mendocino County.

A detailed report on the life history and habitat requirements of the northern spotted owl is included as Appendix D.

4.4 Watershed Conditions

4.4.1 Water Quality Overview

Prior to the Fund's acquisition, the BRSC lands had been managed for industrial timber production for many decades. The Recovery Strategy for California Coho Salmon (Coho Strategy) prepared by the Department of Fish and Game states: "Historical forestry practices and some current forestry practices have been shown to impact several freshwater habitat components important to anadromous salmonids in general, and coho salmon specifically. These impacts include increased maximum and average summer water temperatures, decreased winter water temperature, and increased daily temperature fluctuations; increased sedimentation; loss of LWD [large woody debris]; decreased DO [dissolved oxygen] concentrations; increased instream organic matter; and decreased stream-bank stability" (CDFG, 2004).

Past and potentially current forest management practices have been identified as a principal source of sediments in the Redwood Region. The NPS Implementation Plan says, "Silviculture contributes pollution to 17 percent of the polluted rivers … in California (SWRCB). Without adequate controls, forestry operations may degrade the characteristics of waters that receive drainage from forestlands. For example, (1) sediment concentrations can increase due to accelerated erosion, (2) water temperatures can increase due to removal of overstory riparian shade, (3) dissolved oxygen can be depleted due to accumulation of slash and other organic debris, and (4) concentrations of organic and inorganic chemicals can increase due to harvesting and fertilizers and pesticides."

While past forest management has been a significant contributing cause of impairment of North Coast water bodies, there is broad agreement that preventing fragmentation of large tracts of coastal forests and implementing management measures relating to road maintenance and sustainable forest practices is the most feasible means of enhancing water quality in the region. These measures are described in detail in Section 5.

4.4.2 Stream Conditions

Big River

Big River drains an approximately 180-square-mile watershed in the northern California Coastal Range in western Mendocino County. The Big River Forest contains approximately 11 miles of mainstem Big River and 13 miles of tributaries with habitat attributes conducive to salmonid production. Vegetation is primarily conifer forest comprised of coast redwood (*Sequoia sempervirens*) and Douglas fir (*Pseudotsuga menziesii*). The primary constituents of the riparian canopy are coast redwood, Douglas fir, red alder (*Alnus rubra*) and willow (*Salix* sp.), all of which are nearly continuous throughout the stream network. Streambed gradient is generally low (2 percent or less) throughout the mainstem reaches. The regional climate is characterized as Mediterranean with wet, mild winters and dry summers. Rainfall averages 55 to 65 inches annually.

The entire Big River watershed support runs of coho salmon and steelhead trout. Chinook have been reported occasionally, but presently there are no significant runs (Downie et al, 2006). Historical anecdotes indicate that Big River supported significant populations of coho salmon and steelhead with an associated recreational and local commercial fishery. By the 1950s agency reports indicated that the populations were depleted and in serious decline. The Big River Basin has been listed as a temperature- and sediment-impaired waterbody, and as such, considerable literature has been generated regarding stream conditions and their historical context. The summer water temperatures in the mainstem are unsuitable for rearing salmonids, whereas most of the perennial tributaries are within suitable limits for rearing salmonids (Campbell Timberland Management, 2008).

Big River Aquatic History

Before the European settlement of the Mendocino area and subsequent logging operations in the basin, Big River likely hosted three species of anadromous Pacific salmonids: coho salmon, steelhead and, possibly to a lesser extent, Chinook salmon. Presently the watershed still supports coho salmon and steelhead in reduced numbers compared with presumed prehistoric populations; based on studies conducted in the nearby Noyo basin (Gallagher and Wright, 2007), a small population of Chinook salmon may persist in Big River, however their presence is undocumented.

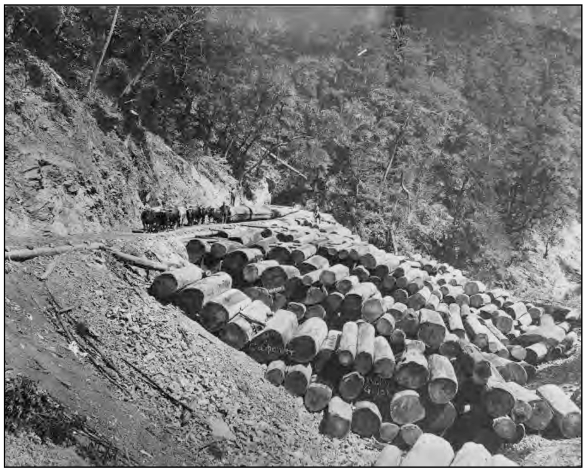
Logging began in the watershed in the 1850s, with early loggers using animals such as oxen to skid logs down to the river where they were moved downstream to the mill at the river's mouth by high water flows (see photos, next page). Railroad logging began in the mid-1880s, but the railroad never extended downstream to the mill. Instead, the logs were dropped into the estuary at the "rail dump" a few miles upstream, then floated to the "boom" and then to the mill. The mill operated from about the mid-1850s to the late 1930s. The rail line was constructed throughout the estuary and lower basin and essentially terminated in Laguna Gulch and the East Branch of the Little North Fork. Upstream of the lower areas serviced by the rail line, logs were moved to the mill by the use of hydrologic force in the practice known as splash dam logging. Splash dam logging consisted of a series of dams constructed in sequence; when the stored water capacity and stream flow was sufficient, the dams were sequentially “tripped” or released to allow a whitewater torrent to move the logs down-channel, eventually arriving at the mill. This method of transport was employed throughout the upper basin and all major tributaries. The history of this practice in Big River is well documented by W.F. Jackson in *Big River was Dammed* (1991). During this era, timber generally was dragged downslope with cables powered by “steam donkeys” or oxen, either directly to the mainstem channel or by gulch-running tramways that brought logs to the channel.

The practice of splash dam logging likely contributed to the decline of anadromous Pacific salmonids in the watershed due to channel homogenization. Log quantities by the tens of thousands, stored throughout the fluvial network in summer were annually sluiced through the larger channels, essentially scouring the channel of most complexity and roughness elements. Whatever obstructions to log passage that remained were systematically blasted from the channel by crews during summer low flows. The net result is a U-shaped channel with little heterogeneity. Adequate habitat complexity is vital to the survival of anadromous fish, as well as many other aquatic organisms.

In addition to channel simplification, it’s likely that splash dam log drives also widened and decreased the depth of the overall channel, consequently increasing the probability of additional solar radiation to the stream channel and thereby increasing stream temperatures. Excessive water temperature is another well-known factor affecting anadromous salmonids.

Typical Northern California Stream Condition After Historic Logging Operations, Circa 1955 (GP Photo)

Log Drive in Big River, Circa 1924 (The Robert J. Lee Photographic Collection of The Mendocino County Historical Society)



Logs Stored In Stream Channels Awaiting Winter Flows, Circa 1880 (The Robert J. Lee Photographic Collection of The Mendocino County Historical Society)

Big River Splash Dam, Circa 1925 (The Robert J. Lee Photographic Collection of The Mendocino County Historical Society)

Typical Barrier to Fish Passage From Historic Logging Operations, Circa 1955 (GP Photo)

Salmon Creek

Salmon Creek is a relatively small coastal watershed in Northern California, with much of the watershed presently managed for timber production, and nearly 48 percent of the watershed is owned and managed by The Conservation Fund. Vegetation in the area is primarily conifer forest comprised of coast redwood (*Sequoia sempervirens*) and Douglas fir (*Pseudotsuga menziesii*). The primary constituents of the riparian canopy are coast redwood, Douglas fir and red alder (*Alnus rubra*), which is nearly continuous throughout the stream network. Streambed gradient is generally low (less than 2 percent) throughout the mainstem reaches. The regional climate is characterized as Mediterranean with wet, mild winters and dry summers.

This watershed has a number of geographic and ecologic features that promote coho salmon and steelhead production, and since the early 1990s studies based on electrofishing surveys and other methods have shown that Salmon Creek has supported stable populations of both species (Campbell Timberland Management, 2008). Salmon Creek is within 8 miles of the coast and the associated cool marine climate, which moderates stream temperature during the relatively hot Northern California summer.

The low stream gradients with meandering, sinuous channels found at the watershed scale in Salmon Creek favor coho salmon in particular. The canopy formed by the coniferous forest type also promotes cooler stream temperatures during the summer and adds a roughness element to stream channels in the form of large woody debris, which further slows stream velocity and increases pool habitat and habitat complexity. Salmon Creek has optimal coho salmon habitat conditions and, considering the small drainage area, has had relatively high rates of coho salmon production (Campbell Timberland Management, 2008).

Salmon Creek Aquatic History

Logging and ranching operations were initiated in the Salmon Creek watershed as early as the 1860s. By 1880 a logging railroad had been constructed within the floodplain and linked the coastal mill at the ocean confluence (Whitesboro), with reaches as far upstream as Hazel Gulch. In that period logs were generally skidded downslope to floodplain-based railcars and logging camps, moving soil downslope to the active stream channel. In the upper areas of Hazel Gulch, logs were likely skidded by oxen down the active channel, which had been cribbed or converted to a log skid road to facilitate log transport. Remnants of the cribbing within the active channel still exist in parts of upper Hazel Gulch (small channels were often converted to oxen skid roads by planking logs crosswise to the channel to allow oxen to pull logs downstream).

The present-day effects from the railroad-era logging practices on fish production are a presumed increased sediment load in the active channel and floodplain. However, the legacy impacts on stored instream bedload, and, consequently, on present day fish production is unknown. The remnants of the railroad grade, which in many areas ran within or adjacent to the floodplain, are presently sloughing off into the watercourse in some areas during peak flow events, increasing sediment delivery into the watercourse. More information is available in Appendix G.

Photo provided by Campbell Timberland Management LLC

4.4.3 Aquatic Species Affecting Management

As mentioned previously, the aquatic species focus of this plan is on the salmonid species known to or currently inhabiting the BRSC watersheds: steelhead (*Oncorhynchus mykiss*) and coho salmon (*Oncorhynchus kisutch*). Selecting an analyzed species to be used for evaluating the impacts of watershed activities on a range of native aquatic species is an accepted premise. In California's North Coast watersheds, salmonids are used as an indicator of watershed and ecosystem health, and information and management recommendations provided throughout this plan are predominantly relevant to salmonid habitat and populations (GRWC, 2013).

In the winter of 2008-09, CDFW began implementation of regional salmonid spawner survey abundance estimates. For independent population streams, such as Big River, CDFW surveys reaches (1-4 km stretches of stream) using a spatially balanced design. A sample size of six reaches in a watershed is the minimum needed to estimate returning adult abundance. Typically, CDFW surveys one reach on Big River and one reach on Salmon Creek annually. To estimate abundance, spawning surveys are conducted every two weeks in selected survey reaches from mid-November through April each year. CDFW counts and measures all redds and fish encountered. The average annual coho salmon spawner/redd ratios are used from the life cycle monitoring stations at Pudding Creek and SF Noyo River to convert redd counts into fish numbers for each reach surveyed (Gallagher et al. 2010a).

Table 4-6: BRSC coho salmon population estimates (derived from redd counts) provided by California Department of Fish and Wildlife. Population Target: 5,500

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of coho salmon on BR	134	160	269	894	507	1310	744	221	1054
Number of coho salmon on SC	10	NS	NS	233	30	NS	NS	NS	NA

NS: not surveyed
NA: data not available

Large Woody Debris

The placement of large woody debris (LWD) in streams is a high priority for salmon habitat restoration. The addition of LWD enhances spawning and rearing habitats by providing cover and refuge from peak winter flows, increasing pool complexity, depth and frequency, and sorting and collecting spawning gravels, all of which will increase the quality and quantity of rearing habitat within the project reach. To date the Fund has added 299 pieces of LWD to three Class I streams (Little North Fork, East Branch Little North Fork, Two Log Creek) on BR, totaling 5.4 miles; on SC the Fund has added 240 pieces of LWD to 3.48 miles of Salmon Creek.

4.4.4 Existing Road Conditions

The BRSC has an extensive network of maintained roads. Most roads have locked gates to control access. The BRSC property maps show the forests' primary roads. In addition to frontage on county-maintained roads (Highway 20, Comptche Ukiah Road, Albion Ridge Road, Navarro Ridge Road), there is an extensive system of gravel and dirt roads on the forests, which were developed for timber harvesting, The majority of the road network within BRSC and much of the coastal Redwood Region was developed after World War II when logging with tractors became cost effective for timberland and sawmill owners. During the war, tractors were used extensively for construction projects at home and overseas and many improvements were made to the machines, which made tractor logging economical and efficient. Tractors allowed timberland owners to access much more ground more quickly than railroads, and truck roads were constructed from the mainline roads to points previously inaccessible by rail.

More recently progress has been made to improve BRSC roads. Many bridges have been installed on the larger watercourses, road surfaces have been rocked, rolling dips installed and in some cases road widths have been reduced. The roads on the forests at the time of the Fund's purchase could generally be characterized as average forest roads. The rock surface applied by previous owners protected the permanent roads and prevented major failures from occurring due to gullying and culvert diversions. As part of the THP process roads are evaluated and upgraded to conform to modern design criteria, including the installation of rolling dips, critical dips, and outsloping the running surface.

Sediment source assessments have been completed on BRSC. These assessments are available at https://www.conservationfund.org/projects/north-coast-forest-conservation-initiative/north-coast-reference-documents. Common problems noted include: perched or raveling fills on the outside edge; gullying of fills at watercourse crossings; shot-gunned culverts or short culverts; inadequate or missing downspouts; and plugged inside ditches. Some secondary roads are impassable due to brush encroachment. Due to the past harvesting history there is an extensive, and mostly unmapped, network of skid trails (used for tractor logging). Many of these roads are on steep slopes where new construction would not be appropriate. Roads are being maintained and upgraded by the Fund to meet current standards, concurrently with timber harvesting. Roads are upgraded in relationship to their intended use: permanent roads are maintained with a rock surface and permanent drainage structures; seasonal roads generally have a native soil surface and sediment control is achieved with a combination of permanent drainage and temporary or seasonal drainage structures. Since acquiring the forests in 2006 the Fund has made significant improvements to the roads and infrastructure, improving 79 miles of road and preventing 37,878 cubic yards of sediment from entering the watershed (PWA, 2010) (Steinbuck and Blencowe, 2011). A summary report of road upgrades to date is attached as Appendix E.

4.5 Archaeology and Cultural History

The Big River and Salmon Creek watersheds lie within the Pomo ethnographic province, which indicates that the prehistoric resources most likely to be encountered on the forests are lithic scatters with ground stone tool fragments reflecting generalized use of the area. Native American sites are commonly situated along trending ridgelines or spurs, broad mid-slope terraces, and areas adjacent to seasonal and perennial watercourses, including springs (Van Buren, 2005). Vegetation ecotones such as a meadow/forest interface along these geographic features are generally preferred.

The most likely types of historic sites to be encountered are those related to early timber harvests. These types of sites range from simple logging camps and historic trails to mill sites and infrastructure related to timber transport. Most of the substantial historic sites in the region are associated with watercourses and historic era dams and camps and are relatively common throughout the watersheds.

A California Historic Resources Information System (CHRIS) property-wide records search was received by the Fund from the Northwest Information Center (NWIC) at Sonoma State University. Appropriate NWIC base maps, referencing cultural resources records and reports, historic-period maps, and literature for Mendocino County were reviewed as part of the request. NWIC cultural resources include archaeological resources and historical buildings and/or structures.

For the Big River Forest, the NWIC has record of 66 previous surveys covering roughly 45 percent of the project area (NWIC, 2010). For the Salmon Creek Forest, the NWIC has record of 26 previous surveys covering roughly 50 percent of the project area (NWIC, 2015). Archaeological and cultural resource surveys have been conducted by previous landowners during the preparation of THPs; many cultural sites have been located on the property. Existing cultural resources are protected from management activities through exclusion of heavy equipment operation in the immediate vicinity. Specific areas proposed for timber harvest are surveyed during the timber-harvest planning process to detect and protect any previously unknown sites or artifacts.

In accordance with the American Indian Religious Freedom Act and the Antiquities Act, the California cultural records database (maintained at Sonoma State University) is consulted prior to any land-disturbing activities. Continued assessments will be made to locate cultural resources before any significant activity in the forests, and personnel trained in archaeological inventory methods will inventory all sites before timber harvesting. Both acts require that site locations and descriptions be kept confidential to protect the resources; therefore, no listing is included in this plan.

PHOTO BY MATTHEW GERHART

4.5.1 Big River Cultural Resources

Cultural resources within the Big River Forest include remnants of historic occupation by indigenous people and nonindigenous settlers. The indigenous village of Búldam was located not far from the Big River Forest, just east of the town of Mendocino. The Pomo were the earliest known inhabitants of the Big River watershed. They hunted, gathered and fished, often using fire as a vegetation management tool to favor the maintenance of habitat that supported plants and game animals. Colonization by Mexicans, Europeans, and later, North Americans, began to substantially alter the watershed, especially when commercial timber harvest began. Following the discovery of gold in California in 1849, the demand for lumber spiked (Van Buren, 2005).

Evidence of early settlers can still be seen in what remains of the Piccolotti homestead, remnants of logging camps on some of Big River's bends, and a partially collapsed cabin near Two Log Crossing. In 1852, mill owners constructed the first sawmill at the mouth of the Big River. In 1860, mill owners constructed the first splash dams to facilitate log transport. Use of splash dams along Big River and its tributaries continued through the early 1900s when a railroad was built in the watershed. As detailed previously, the watershed continues to experience legacy effects from over a century of timber harvest and log transport practices. The Big River channel was scoured from the force of the logs released from dams and the channel lacks habitat diversity to this day.

4.5.2 Salmon Creek Cultural Resources

Cultural resources within the Salmon Creek Forest include remnants of historic occupation by indigenous people and nonindigenous settlers. The indigenous village of Kaba'toda was located on top of the high narrow ridge separating the Albion River from Salmon Creek a mile or two from the ocean (Barrett, 1908). The Northern Pomo preferred to live inland, out of the fog and dense redwood canopy, and closer to more plentiful acorns. Tools for acorn processing are likely to be found in this area, as well as chert or obsidian flakes or tools, sandstone mortars and pestles and shell middens.

Commercial harvesting of timber began along Salmon Creek when the White's Mill was built at the mouth of Salmon Creek around 1876; it was fed by the railroads that extended through Salmon Creek at that time. Many of these railroad grades were later converted to the trucking haul roads that are still used today. By the late 1870s families had settled in Salmon Creek with homesites occurring near Ketty, Hardell and Pullen gulches. A few remnants of these historic ranches remain including collapsed structures, vehicles, fencing and orchards. The Pullen family built a mill in 1876 at the confluence of the north and main forks of Hazel Gulch. The Salmon Creek timberlands changed hands many times over the next 150 years, and harvesting continued, with much of the large timber removed from 1880-1930.

Pullen Mill on Salmon Creek in Albion (photo courtesy of the Mendocino County Historical Society, date unknown)

5. Forest Management Goals and Measures

5.1 Forest Management Overview

The following forest management policies and strategies have been developed to guide the long-term management of the forest resources of the BRSC to ensure sustainability and fulfill the overall project purpose. Forestry is an inherently site-specific endeavor, and policies must retain the flexibility to adapt to individual stand conditions, market characteristics or logging contractor capabilities.

5.1.1 Forest Management Strategies

- Silviculture practiced on the forests will be primarily uneven-aged single-tree or small group selection in order to develop and maintain a range of tree sizes and ages within a stand—with the goal of producing valuable saw timber and utilizing natural regeneration. Even-aged variable retention harvests (to retain large trees and habitat features) may be used to rehabilitate conifer sites now dominated by hardwood and may be used in the future in salvage situations in the event of forest loss. Variable retention may also be used on Douglas fir sites where tree vigor is low and adequate leave trees are absent. Where variable retention is used, the site will be planted with conifer seedlings to ensure conifer dominance in the future. Group selection has recently been used in small areas dominated with tanoak, and the groups have been planted with redwood and Douglas fir seedlings. All other harvests will encourage natural conifer regeneration. See Appendices H and I for further discussion of silvicultural methods and practices.
- The forests must generate sufficient revenue to cover management costs and invest in restoration and enhancement measures (e.g. restoration projects, road upgrades).
- Harvest levels will be significantly less than growth rates over the next ~30 years so as to increase timber inventory and carbon storage.
- Special attention will be given to developing and retaining critical wildlife habitat features, such as snags, downed wood and trees of significant size.
- While the forests presently contain smaller trees and more hardwoods than would have occurred naturally, over time the selected silvicultural methods are intended to ensure they more closely approximate natural conditions.
- There are no undisturbed old-growth stands on the forests; there are individual trees that are residual old growth—these and other very large trees and true oaks will be maintained [see retention requirements in 5.1.5].
- Include ample internal and external review of proposed and completed THPs through the Field Consultation, Annual Operations Review and public tours [described further in 6.2].
- The Fund has obtained, and will continue to maintain, certification under the FSC and Sustainable Forestry Initiative (SFI) standards.
- The Fund will continue to report carbon sequestration through the California Air Resources Board.

5.1.2 Forest Pests

There are relatively few diseases that impact trees throughout the forests and most impact individual or small groups of trees. At this point, landscape-scale disease outbreaks resulting in significant and widespread mortality have not been observed. The following is a list of diseases known to occur on the ownership which may result in declining tree vigor and mortality:

- Red Ring Rot (*Phellinus pini)* causes heartwood and sapwood decay in a wide range of conifer species and is the most common form of wood decay seen in coastal California forests. Infections in Douglas fir are common on the property, and it is also seen in sugar pine. Visual indicators of infestation include brownish, bracketlike conks on the bole of the tree and swollen branch nodes. Damage is most prevalent in older stands (generally over 50 years) and in areas that have been subject to multiple partial harvest entries as broken limbs and bole scars serve as entry points for the disease.
- Black stain root disease (*Leptographium wageneri* var *pseudotsugae)* is a vascular root disease common to Douglas fir throughout the ownership. It does not cause a decay but rather disrupts the trees vascular system and leads to declining vigor and often death. The disease causes a black staining in the sapwood of the roots and lower bole. Outward signs of infection include chlorotic foliage and reduced leader growth. Patches of trees infested with this disease are most commonly seen in areas with disturbed soil, such as adjacent to truck roads, landings and skid trails.
- Velvet top fungus (*Phaeolus schweinitzii)* causes a root and butt rot in Douglas fir and sugar pine. This disease is most common in older trees and often leads to loss of structural support and windthrow. There are few outward signs of infection other than clumps of brownish, irregularly lobed caps that emerge from roots around the base of infected trees.
- Brown cubical rot (*Poria sequoiae)* and white ring rot (*Poria albipellucida)* cause heart rot in redwood but almost never lead to tree mortality.
- Sudden Oak Death is caused by the exotic oomycete *Phytophthora ramorum.* The disease has a very wide host range, and mortality has been seen in tanoak, Shreve's oak, interior live oak, California black oak and canyon live oak. Tanoak is the most highly susceptible species to this disease, and tanoak mortality caused by sudden oak death has been observed on the ownership. Mortality in true oaks on the ownership due to sudden oak death has not been observed. Outward signs of infection include reddish, oozing stem cankers and foliage dieback. Tanoak mortality associated with this disease is almost always in close proximity to California bay trees. California bay trees are not killed by the disease but are suitable hosts and important sources of inoculum.
- *Armillaria mellea* infects a wide range of species across the ownership including Douglas fir, sugar pine, tanoak and true oaks. *Armillaria* colonizes the roots of infected trees causing a white rot. *Armillaria* root disease-caused tree mortality has been observed across the ownership, but it is relatively uncommon and not considered to be problematic. Fading crowns and chlorotic foliage are common symptoms in infected trees. However, definitive identification is difficult without seeing the characteristic clusters of yellow-brown mushrooms around the base of infected trees.

5.1.3 High Conservation Value Feature Protection

Most of the forest management policies are intended to guide the management of those areas of the BRSC that will support commercial timber harvesting operations. However, one of the most important steps in determining how to manage a forest is recognizing which areas have unique ecological values that outweigh their potential contribution from a commercial harvest perspective. The protection of these features is critical to achieving the program objectives of restoring habitat for species of concern and increasing the natural diversity and ecological health of these forests.

Specific policies to address these features include the following:

- There are no true oak (*Quercus* spp.) woodlands or native grasslands on BRSC, however individual tree oak do exist and shall be protected when they are encountered.

- There are no large wetlands on the property, but springs, seeps and small wetlands shall receive protection measures as required by the FPR.

- Riparian forests, particularly along Class I streams, will be managed to provide for closed canopy mature forest with a high component of downed logs and other late-seral features. [Some removal of timber can be consistent with this objective. See WLPZ Protection Measures in Section 5.3.]

- Nest sites for NSOs are to be managed in accordance with the requirements of the USFWS and the Fund's biological consultant, Mike Stephens (see Section 4.3.3 and Appendix C for details). Inactive nest sites will be protected (because of the likelihood of repeat nesting).

Additional information on the identification and protection of these features can also be found in the High Conservation Value Features Program Memo, which is included in the North Coast Forest Conservation Program Policy Digest (Appendix H).

5.1.4 Harvest Levels

For the BRSC, growth forecasting and harvest scheduling was completed as part of development of the Option A for the ownership. The Option A, "A plan to Demonstrate Long Term Sustained Yield, (LTSY)" was developed for the GRF, BRSC and GuRF forests as a requirement of the FPR (TCF, 2014). The rules require that LTSY must be demonstrated for each landowner owning more than 50,000 acres. The plan is composed of a forest inventory and state of the art modeling, to demonstrate that harvest levels do not exceed growth over a 100-year planning horizon. The forest inventory is stratified by timber type, utilizing a stratification system based on LIDAR imagery to delineate stand boundaries. Growth and harvest assumptions, along with the Fund's management constraints and the appurtenant FPR restrictions, are entered into the FORSEE growth and yield model to develop a harvest schedule unique to BRSC.

Per the Fund's Option A, the LTSY for BRSC is 10,500 MBF per year, however the MOU restriction is for not greater than 5,100 MBF per year for the first two decades. Average harvest for the last 10-year period has been approximately 2,700 MBF annually, with a high of 5,480 MBF in 2010 and a low of 649 MBF in 2011. For more information please see the entire Option A as Appendix I.

5.1.5 Silvicultural Objectives

The principle silvicultural objectives are to grow large high-quality conifer trees, increase structural complexity and natural diversity and establish a high level of sustainable timber production through selective harvests. These measures should maximize value growth and develop and maintain important late-seral habitat characteristics for wildlife and nontimber forest vegetation going forward. Future "crop tree" target diameters are 30 inches to 36 inches for redwood and 22 inches to 28 inches for Douglas fir. Forest management will seek to emulate late-seral ecological functions and processes to the extent feasible, within a managed forest. Ultimately, these measures are intended to develop stands that have high canopy closure, some large mature trees, and a high degree of structural diversity.

For additional information on silviculture decisions, THP development, harvest operations and contractor selection please see the North Coast Policy Digest attached as Appendix H.

Photo by Sheila Semans

5.1.5 Harvest Retention Requirements and Guidelines

Within a harvest area, the Fund will permanently retain or recruit downed wood, snags and trees with high wildlife value, given their recognized ecological role and ability to enrich the surrounding stand. The following policies for downed wood, snags and wildlife trees are meant to implement this strategy by providing clear rules and numerical targets for certain types of features. [The Forest Practices Rules (FPR) do not categorically address general wildlife habitat retention trees (although there are some requirements for protection of active raptor nests), but additional guidance is available from CDFW.] Retention trees will be painted with a “W” or tagged by the field foresters as they are marking the timber harvest; this will communicate the value of these features not just to the loggers but also the public and future foresters. A harvest can include many retention trees and thus, not all are mapped or recorded unless they are suspected to be an NSO nest tree. While maintaining trees with high wildlife value is important, it is also critical to recognize the wildlife value of the surrounding stand and the conserved landscape; harvest stands do not always mimic or contain all features, which may be better represented in other areas of the forests.

Downned Wood

Target: two pieces per acre (at least one conifer, 18-inch minimum diameter and 10-foot minimum length).

Actions:

- Retain existing downed wood except in situations of recent windfall or fire outside of Watercourse and Lake Protection Zones (WLPZ). (In most stands this should be sufficient to meet the target.)
- Retain snags and mark trees for recruitment snags to eventually become downed wood.
- Redistribute cull conifer logs from the landing where practical (unless used for instream restoration projects).

Snags and Wildlife Trees

Target: four per acre on average across stand which may be composed of any combination of trees from the list below.

Criteria for mandatory retention:

- Snags (minimum 18-inch DBH and 20-foot height).
- Conifers greater than 48-inch DBH (Retain a minimum of one and not more than three per acre for recruitment).
- Old-growth trees (generally in the upper 20 percent diameter class for the species on-site, deep bark patterns, flattened or irregular crowns, large limbs, crown debris accumulation).
- Raptor nest trees.
- Hardwoods over 20 inches.
- Murrelet habitat trees (low elevation old-growth and mature conifers, multilayered canopies, mistletoe, other deformations or damage present for nest platforms). Generally, Douglas fir with limbs 6 inches in diameter or larger are preferred.
- Den trees (cavity greater than 3-inch diameter and greater than 10 feet above ground).
- Trees with basal hollows or other significant features (cavities, acorn granaries, significant burn scars, significant or unusual lichen accumulation, signs of deformity, decadence, unusual bark patterns, or other unique structure or features).

Actions:

- Retain all mandatory trees and snags except where necessary to fall for operator safety and protect with screen trees if appropriate.
- If below the target number, mark and retain additional recruitment trees. [Additional wildlife trees will likely be marked in the future from the surrounding stand as it develops.]

General Harvest Retention Guidelines

- Marked wildlife trees should be considered “escapement” trees—they are not intended for future harvest and are allowed to grow beyond the crop tree target size.

- In the absence of mandatory retention trees, on average at least one conifer per acre should be retained from the largest 10 percent of the diameter distribution of the stand.

- Marking of the wildlife trees (with paint or tags) is intended to communicate the recognition of the importance of that stem to future foresters, agency reviewers and the public.

- For the next 20 years some preference for snag and downed log creation and wildlife tree recruitment will be given to cull trees and whitewoods (because of their low financial value) even though they may have a shorter lifespan.

- All retention is subject to operational considerations; the felling of any tree is permitted when necessary for operator safety, road right of way, or yarding corridors. Loggers have been directed to avoid locating yarder corridors where they would conflict with mandatory retention wildlife trees.

- Targets shall be assessed across the entire harvest stand, not on an individual acre basis.

- Preference is for spatial grouping (clumps of downed wood, snags, and/or wildlife trees).

- The above criteria shall apply to selection harvests. When marking variable retention harvests, extra screen trees may be appropriate.

All of the foregoing requirements and guidelines are subject to further review and amendment as the science and practice of forest management evolves and new research is developed and applied.

Due to past practices, some portions of the forests do not have sufficient wildlife features, and the initial targets set forth above are intended to guide the long-term retention and recruitment of these features. Two or three of anything per acre is an admittedly arbitrary number chosen to put the forests on the right trajectory for the development and maintenance of late-seral habitat characteristics within a managed forest; achieving some of these targets will likely take more than one entry. These distribution and size targets are not expected to be the ultimate value but merely what is appropriate to select and recruit in the next 20 years; the development of late-seral habitat elements is a long-term process and will be shaped over several harvest entries.

5.1.6 Timber Marking Guidelines

Timber marking (designating individual trees for harvest) is the art of shaping future forest stand conditions by extracting merchantable trees from the forest. The intention is for the remaining trees to be vigorous and free to grow, while protecting and enhancing wildlife habitat. The result is a well-stocked forest—rapidly growing and healthy with abundant and diverse wildlife habitat features. Approaches to timber marking vary by stand condition and silvicultural objective, and it is thus difficult to identify a universal prescription.

When in the field, foresters make thousands of individual judgment calls while marking a stand. Thus, even individual foresters with the same objective would inevitably make slightly different decisions. The general goal of timber marking by the Fund is relatively simple: Current (preharvest) conditions should be improved by the time of the next entry (typically 10 to 20 years). “Improved” is a subjective term, but for the purposes of this plan, it means an increase in conifer basal area, merchantable volume, snags and downed logs per acre. These are also some of the values to be used to monitor forest trends across the forests.

The North Coast Policy Digest (Appendix H) includes criteria drafted by experienced foresters, which strive to capture the art of achieving the desired balance between habitat recruitment and retention, while removing sufficient conifer volume to satisfy the economic needs of the project. Timber marking will be conducted with these criteria in mind. One of the purposes of the field consultations (both pre- and post-harvest) is for the forestry team to discuss the timber marking, particularly in riparian stands, understocked areas, and near NSO activity centers.

5.1.7 Hardwood Management

In addition to the ecological imbalance, the high concentration of tanoak in some stands significantly reduces conifer growth and stocking, and therefore the future financial value of the forests, since tanoaks have effectively no commercial value (it costs more to log and deliver than they are worth as firewood). The long-term goal is to maintain an appropriate level of tanoak and other hardwoods (probably around 10 percent on average). To achieve these objectives, the following management measures will be implemented:

- All true oak (*Quercus* spp.) woodlands, individual true oaks, Madrone, Chinquapin, California bay and Red or White Alder are to be retained wherever possible. All hardwood wildlife trees are to be retained (which includes all of the above and tanoak 20 inches or greater), except where removal is required for safety concerns or necessary for yarding or road corridors.

- Where the post-harvest hardwood basal area would exceed 30 square feet of basal area per acre (averaged across the stand), hardwoods shall be controlled through manual falling or girdling or herbicide treatment through direct basal injection (hack-and-squirt) or stump treatment to provide a post-harvest hardwood basal area of 15 to 30 square feet per acre. This may take more than one entry to achieve. These targets may be adjusted once the inventory has been completed.

- Most hardwood reduction can be achieved within a selection or thinning harvest by selective falling of tanoaks to release existing conifers. While the tanoak stumps will likely resprout, the conifers should have established dominance and will eventually shade-out most of the sprouts. In this type of incremental treatment (selective falling), clumps of hardwoods and individual hardwoods which do not compete with desirable conifers will be left alone. Where tanoaks make up more than half of the stand, herbicides have been used to control the tanoak. Currently there is a temporary moratorium on the use of herbicides in Mendocino County, but we will maintain it as an option in the event the moratorium is lifted.

- Smaller areas of intact hardwoods would be intentionally retained (for biodiversity reasons). Preference for hardwood retention will be given to large trees (greater than 20 inches), true oaks, chinquapins and madrones, and groups of hardwoods. Rehabilitation treatments (including the use of herbicides) are intended to be one-time interventions and should not need to be repeated because of the decreased openings and ground disturbance associated with subsequent harvests.

- The only herbicide to be used in hardwood control treatments currently is imazapyr (tradename Arsenal). Only licensed and insured contractors with a good track record for safety and compliance may apply herbicides. All herbicide application must be in conformance with label guidelines and applicable laws. Additional herbicides may be considered in the future as they are developed and tested and reviewed with respect to FSC and SFI standards.

- Any planned use of herbicide will be clearly identified in the THP and THP summary.

- Any area where herbicide use is proposed shall be clearly posted in the forest at least 30 days prior to application.

- Reduction in the use of herbicides is an important objective; alternatives to herbicide treatment have been and will continue to be evaluated on a periodic basis. A comparison of herbicide treatment and cutting of tanoaks for hardwood control was conducted on the Jarvis Camp THP on the Big River Forest. Compared to stem injection of herbicide, cutting and logging of the hardwoods resulted in significantly greater disturbance and resprouting.

- There will be no hardwood control with herbicides in WLPZs; manual falling or girdling of small hardwoods may be used, but only as part of a riparian shade enhancement project (likely with conifer underplanting).

- Priority for rehabilitation treatments will be given to high site, tractor-operable ground, with existing desirable redwood growing stock. Hardwood control measures will be reviewed periodically and revised as appropriate based on knowledge and experience gained in the field. Herbicides will likely also be used to control certain exotic invasive plants, primarily jubata grass, western star thistle French Broom and Scotch Broom. No other uses of herbicides or pesticides are anticipated.

5.1.8 Fire Management

Fire is both a natural and human-caused presence on the North Coast landscape, which requires careful consideration and preparation. The included Fire Plan Map illustrates relevant fire management features, including drafting sites, water sources and helicopter landing sites. The Fund has developed a Fire Management Plan (included as Appendix J) to specify the fire prevention and response measures to be used on the forests. This plan was submitted to CAL FIRE and is provided to all equipment operators working on-site and to the local volunteer fire departments. Decisions about fire control strategy and remediation will be made on a case-by-case basis by the Fund's North Coast timberland manager. In the event of a catastrophic fire, a landscape scale fire rehabilitation plan will be created and implemented.

The 2008 Navarro Fire on the Salmon Creek Forest was lightning-caused and resulted in a mostly benign low-intensity burn. The fire spread to include a total of 2,700 acres, including approximately 700 acres on BRSC, with approximately 50 acres burning through several clearcuts (completed by the prior owner) which burned hot and thoroughly with perhaps 75 percent mortality. The area was replanted with conifer seedlings in 2010. Dangerous fuel and potential wind conditions meant the damage could have been much worse.

More recently there has been a focus on creating forests that are fire resilient through forest thinning, vegetation management and the creation of shaded fuel breaks along county roads and trending ridges. The Fund will also take similar steps to create a more fire-resilient forest.

Photo by Jenny Griffin

5.1.9 Monitoring and Forest Certification

Ongoing monitoring of both activity implementation and program effectiveness is a critical part of adaptive management and successful initiatives. Several monitoring strategies will be utilized in combination to ensure thorough review across multiple sectors and different temporal and geographic scales. There is detailed discussion of the aquatic monitoring strategies in Section 5.3.2, which are critical to and complementary of the forest-monitoring strategies described in this section. Three broad categories of forest monitoring will be utilized: short-term harvest monitoring, long-term forest monitoring, and forest management certification. These are described in detail below.

5.1.9.1 Short-Term Harvest Monitoring

Due to the sensitivity and significance of the timber harvest program, it will receive more detailed monitoring than other program activities. Numerous efforts are undertaken before, during and following a timber harvest to ensure it is completed in accordance with the Fund's management policies, including safety, regeneration, residual stand quality and aesthetic issues. This monitoring process begins before the harvest operation, with each THP's Field Consultation, which brings together all of the Fund's resource management team to identify any sensitive issues that deserve additional attention. In addition, there is a public THP tour, prior to operation and again following completion, to solicit suggestions and answer questions from interested stakeholders.

During the harvest the supervising forester is on-site at least weekly to review the performance of the licensed timber operator and address any issues that may arise. Following the harvest, the Fund's resource management team is reconvened for the Annual Operations Review, which inspects completed operations to evaluate conformance with the Fund's policies and discuss any special issues. In connection with field consultations, weekly harvest inspections, the Annual Operations Review, and/or the required agency reviews, certain sites or issues will be identified for continued specialized monitoring (e.g. Erosion Control Plan sites are typically monitored for at least two winters).

5.1.9.2 Long-Term Harvest Monitoring

The Conservation Fund has developed an Option A plan to demonstrate long-term sustained yield in compliance with the Forest Practice Rules (FPR). The plan utilizes the FORSEE growth and yield model which simulates forest growth and harvest in compliance with the FPR and the Fund's internal management policies, which restrict harvest to less than growth. The tables below are the FORSEE model output, which clearly demonstrate that by following the provisions in the Option A the forest will, over time, increase in standing inventory. To ensure compliance with the Option A, the Fund is required to report annually to CAL FIRE the previous year's harvest.

Table 5-1: Long-Term Forest Monitoring Targets

	Salmon Creek MBF/Acre Results					Big River MBF/Acre Results		
Period	Pre-Harvest Standing (All Acres)	Harvest (All Harvested Acres)	Post-Harvest Standing Plus Forest Growth (All Acres)		Period	Pre-Harvest Standing (All Acres)	Harvest (All Harvested Acres)	Post-Harvest Standing Plus Forest Growth (All Acres)
2014-2018	32.1	7.4	35.6		2011-2013	21.2	NA	NA
2019-2023	35.6	13.8	39		2014-2018	24.5	7.2	28
2024-2028	39	11.5	42.1		2019-2023	28	9.4	31.5
2029-2033	42.1	9.9	45.1		2024-2028	31.5	10.9	34.7
2034-2038	45.1	10.5	47.1		2029-2033	34.7	8.9	37.9
2039-2043	47.1	10.7	51.1		2034-2038	37.9	9.8	40
2044-2048	51.1	8.9	53.9		2039-2043	40	10.1	43.4

2049-2053	53.9	11	55.9		**2044-2048**	43.4	9.8	46.3
2054-2058	55.9	9.1	58.7		**2049-2053**	46.3	10.7	47.5
	Salmon Creek MBF/Acre Results						**Big River MBF/Acre Results**	
2059-2063	58.7	13.1	62		**2054-2058**	47.5	9.9	50.6
2064-2068	62	9.3	65.2		**2059-2063**	50.6	12.8	51.9
2069-2073	65.2	13.1	67.2		**2064-2068**	51.9	11.7	54.5
2074-2078	67.2	11.1	69.3		**2069-2073**	54.5	11.9	55.8
2079-2083	69.3	12.1	72.9		**2074-2078**	55.8	11.3	58.1
2084-2088	72.9	8.5	77.1		**2079-2083**	58.1	12.4	60.9
2089-2093	77.1	15	79		**2084-2088**	60.9	12.1	63.6
2094-2098	79	15.2	80.9		**2089-2093**	63.6	14.5	64.8
2099-2103	80.9	15.4	82.7		**2094-2098**	64.8	13	66.1
2104-2108	82.7	12	84.9		**2099-2103**	66.1	13.6	67.8
2109-2113	84.9	16.1	87.5		**2104-2108**	67.8	12	70.4

5.1.9.3 Forest Certification

Since 2007, the Fund's North Coast Forest Conservation Program has been certified as in conformance with the FSC and SFI standards for sustainable forest management by the accreditation firms Scientific Certification Systems and NSF International Strategic Registrations. These broad-ranging standards are intended to ensure all forest management activities are planned and conducted to meet the established sustainability criteria, which include hundreds of individual indicators, covering everything from water quality protection and biodiversity conservation to worker training and community involvement. Recertifications are scheduled to occur every five years with surveillance audits annually. The standards are publicly available at: www.fscus.org and www.sfiprogram.org; the reports of the Fund's auditors are available at http://www.conservationfund.org/projects/north-coast-forest-conservation-initiative/north-coast-reference-documents or from the Fund's North Coast office.

This rigorous system of third-party audits is intended to help land managers evaluate and improve their practices and communicate their success. The Fund views participation in these programs as an important measure of program effectiveness and its commitment to advancing sustainable forestry.

The BRSC is also an approved and verified Improved Forest Management Project (IFM) through the California Air Resources Board (CARB). The Fund is subject to annual reporting and periodic audits, during which independent auditors review the forest inventory system, the growth and yield modeling, and greenhouse gas reporting system to ensure that the forest stocks contain greenhouse gas emission reduction credits claimed. General information on the CARB Forest Project Protocol can be found at https://www.arb.ca.gove/cc/capandtrade/offsets/offsets.htm. Specific project details are available at https://www.climateactionreserve.org.

5.2 Watershed Management Overview

As noted above, fundamental goals of the purchase and subsequent management of the forests are to "protect, restore and enhance water quality and salmonid habitat, improve forest structure and increase natural diversity [and] provide a sustainable harvest of forest products." Described in detail in the pages that follow, the primary means of restoring water quality and salmonid habitat will be to: a) reduce direct and potential sediment inputs; b) increase riparian canopy density and structure; and c) improve stream habitat complexity. To meet these goals, we will implement uneven-age silviculture where possible, improve the road network to reduce sediment inputs, maintain larger than required riparian buffers and actively place large wood into stream channels to improve habitat complexity.

5.2.1 Road Management

Salmon Creek roads were inventoried as part of a sediment source assessment conducted by Pacific Watershed Associates in 2009, with grant funding from California Department of Fish and Wildlife. The Big River sediment source assessment was completed in 2011 by Christopher Blencowe, Registered Professional Forester, and Elias Steinbuck, Registered Professional Geologist. The road assessments utilize the CDFW-approved "Upslope Assessment and Restoration Practices" methodologies described in the California Salmonid Stream Habitat Restoration Manual (Flosi et al., 2004). The methodologies provide a uniform, standardized and accepted protocol for identifying existing and potential erosion problems, and prescribing cost-effective treatments.

The goal of the road assessment is to develop an erosion control and prevention plan that, when implemented, will: 1) substantially reduce the potential for future sediment delivery to nearby streams by improving road surface drainage; 2) upgrade road drainage structures to accommodate a 24-hour, 100-year storm discharge; 3) decommission unnecessary or poorly located roads, such as roads crossing headwall swales or near stream roads, where practical; 4) reduce long-term road maintenance requirements and landowner costs through proper road shaping and installation or permanent drainage structures. Upgraded roads will be out sloped with rolling dips to control surface runoff wherever possible.

5.2.2 Road Management Implementation Plan Timeframe

Road improvement (upgrading and decommissioning) and repairs will be conducted annually as part of the Fund's ongoing maintenance. The Fund also will continue to upgrade roads within timber harvest plans consistent with the Regional Water Board's General Waste Discharge Requirement (GWDR).

Sediment Reduction Plan

To reduce sediment delivery from the road system, emphasis will be placed on increasing the number of drainage points along roads and reducing the potential for diversion at culverted watercourse crossings. Reducing diversion will be accomplished by the following management practices:

- New culverts and culverts proposed for replacement will be sized to meet the 100-year storm event.
- New or replaced culverts will be installed at stream grade with a critical dip.
- A trash rack or stake shall be installed upstream of the culvert to catch or turn debris prior to reaching the pipe. The stake shall be centered upstream of the culvert a distance equal to the culvert diameter; e.g. the stake shall be 2 feet upstream of a 24-inch diameter culvert.
- Rock armored fill or temporary crossings will be used on secondary or seasonal roads, which see only periodic activity, to reduce maintenance requirements. Minor crossings on permanent roads may be converted to rock armored fill crossings over time.
- New roads will be designed with gentle grades, and long rolling dips will be constructed into the road and outsloped to relieve surface runoff. Where possible, watercourse crossings will be designed such that road grades dip into the crossing and then climb out of the crossing eliminating the need for abrupt critical dips.

Permanent Roads: Roads used year-round shall be designed, constructed, reconstructed or upgraded to permanent road status with the application of an adequate layer of competent rock for surface material and the installation of permanent watercourse crossings and road prism drainage structures. These roads shall receive regular and storm period inspection and maintenance as required throughout the winter period.

Seasonal Roads: Roads used primarily during the dry season, but to a limited extent during wet weather, shall be designed, constructed, reconstructed and upgraded to provide permanent watercourse crossings—either culverts or rock armored fill crossings and road surface drainage structures. Roads shall be upgraded as necessary with the application of spot-rocking where needed to provide a stable running surface during the specified period of use. These roads shall receive inspection at least once during the wet weather period and shall receive at least annual maintenance.

Temporary Roads: Roads designated as temporary shall be designed to prevent erosion such that regular and storm period maintenance is not needed to prevent sediment discharges to a watercourse. All watercourse crossings, except rock armored fill crossings, shall be removed prior to October 15 of each year of installation. Inspections of these roads will occur for three years after use. Ordinary maintenance will be performed when the road is opened for use.

Road Decommissioning: Two types of “at risk” roads have been identified as a priority for decommissioning: temporary or seasonal near-stream roads, and roads on unstable slopes (typically those that traverse headwall swales). As road assessments are conducted, such at-risk roads will be identified and evaluated for decommissioning. Where alternative haul roads exist or can be constructed that replace the need for maintaining the at-risk roads, such roads will be scheduled for decommissioning. Alternatively, if no alternate access can be identified, then the at-risk road may be upgraded or temporarily decommissioned.

“The Handbook of Forest and Ranch Roads” prepared by Weaver and Hagans (2014) will be used as a guideline for all proposed road construction and improvement projects.

5.2.3 Road Improvement Monitoring

Effectiveness monitoring to evaluate road upgrades and sediment inputs associated with THPs enrolled into the GWDR program are conducted annually in keeping with the NCRWQCB's GWDR enrollment program. A Controllable Sediment Discharge Source inventory and implementation schedule, also known as an erosion control plan, is prepared per requirements and submitted for review and approval with the THP to CalFire and the THP review team which includes NCRWQCB. Annual monitoring reports are sent to the NCRWQCB every June for plans enrolled in the GDWR program describing the condition of each site identified during the THP process, any new sites created or discovered, and whether implemented mitigation is working as intended. To the extent possible all permanent and seasonal roads will be checked for erosion problems after large storm events, and all opened roads will be checked at least once a year for erosion problems. Corrective action will be taken as necessary to maintain crossings in a condition that will not deliver sediments.

Long-term monitoring consists of mapping and tracking watercourse crossings using GIS in which each crossing will be mapped with Global Positioning System (GPS) tools and the condition of the crossing shall be noted. Any changes made and the year they were made shall also be noted in the GIS database. Over time a complete inventory of all road watercourse crossings will exist in the GIS database. The data can then be used to detail annual or cumulative sediment reduction activities on the forests.

5.3 Riparian Habitat Protection and Restoration Measures

5.3.1 Riparian Habitat Protection

The California FPR and other requirements of the NCRWQCB and CDFW provide extensive and complex protections for watercourses. By most estimations, in combination they are the world's most comprehensive and restrictive regulations governing forestry operations near watercourses. These rules are designed to protect against changes in sediment delivery, shade, large wood recruitment, late seral wildlife habitat, bank stability, and many other issues. The rules were developed in response to major declines in salmonid habitat conditions over the past three decades.

In general, aquatic conditions seem to be slowly recovering from past practices, and current regulatory protective measures should prevent further degradation. But it is unclear whether aquatic conditions are recovering quickly enough to recover and sustain salmonids, particularly in light of human impacts on other life stages. The acceleration of both aquatic and terrestrial restoration measures proposed in this plan is intended to improve the prospects for the recovery and maintenance of salmonids in the BRSC.

Improvement of spawning and migration habitat for salmonid species is a key management goal for the Fund and one of the principal motivations for acquiring the forests. Prohibiting development and agricultural uses on the property will preclude large-scale impacts on water quality. Comprehensive forestwide road assessments have been completed to identify and prioritize sites with sediment delivery potential. See Appendix E for a full list of sediment-reduction projects that have been implemented. In addition, the following silvicultural practices (discussed previously in Section 5.1.4) also will be implemented to improve water quality:

1. Upslope silviculture. Practicing principally uneven-age single-tree selection silviculture to maintain a mature forest across the BRSC with minimal openings will reduce the potential hydrologic impacts often associated with even-aged management, which studies at Caspar Creek have linked to temporary increases in peak flows, sediment yields, and ambient temperature (see http://www.fs.fed.us/psw/topics/water/caspar/). Uneven-aged management does, however, require more frequent entries and increased road infrastructure, which is why the next strategy is so important.

2. Commitment to improving the road infrastructure including upgrading stream crossings, stabilizing the road running surface, and hydrologically disconnecting the roads from the streams.

Watercourse and Lake Protection Zone Measures

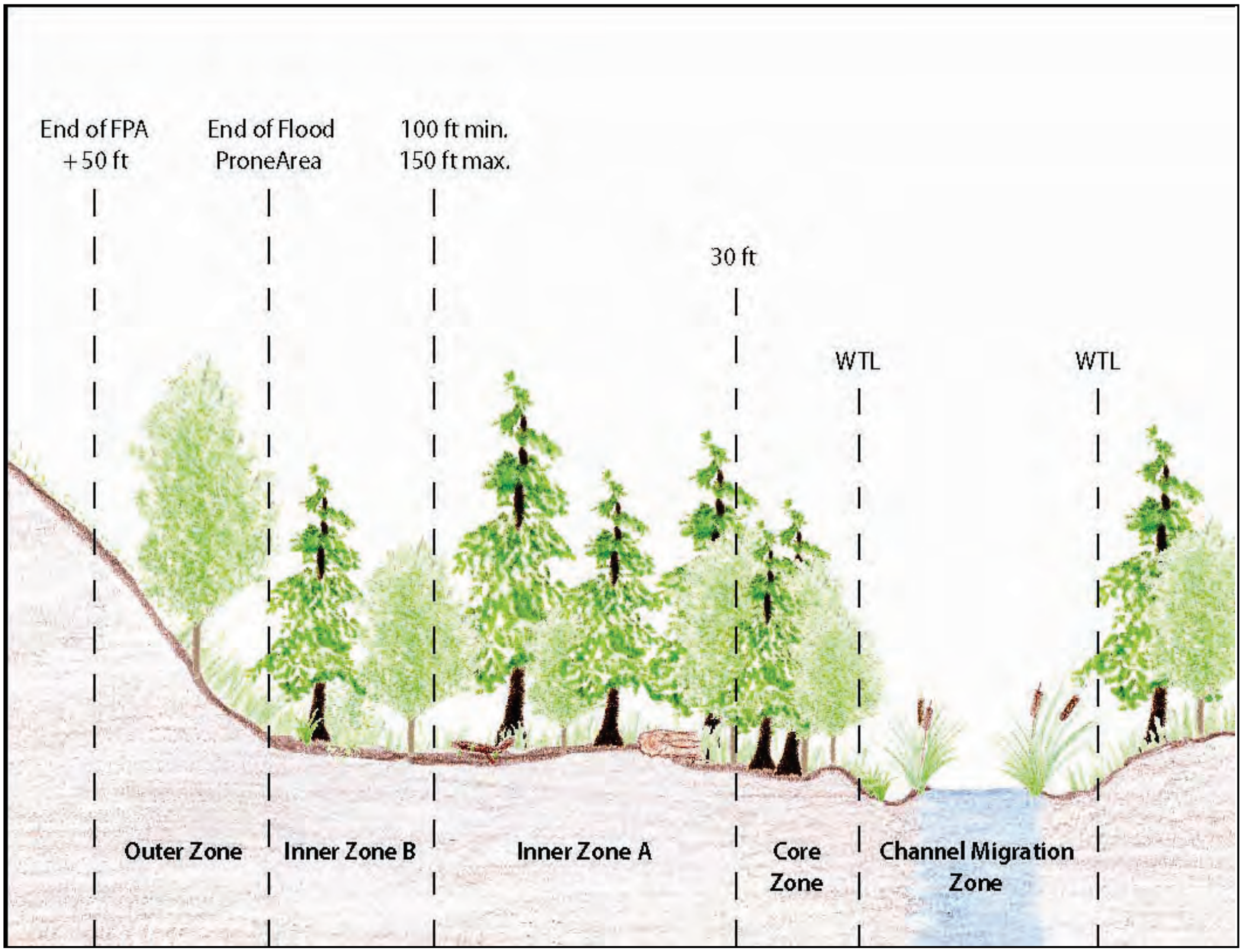
Class I Watercourses:

Timber operations within the Class I WLPZ have been designed and will be conducted to protect, maintain and contribute to restoration of properly functioning salmonid habitat and listed salmonid species. To achieve this goal, timber operations will:

- Prevent significant sediment load increase to a watercourse system or lake;
- Prevent significant instability of a watercourse channel or of a watercourse or lake bank;
- Prevent significant blockage of any aquatic migratory routes for any life stage of anadromous salmonids or listed species;
- Prevent significant adverse effects to stream flow;
- Protect, maintain and restore trees (especially conifers), snags, or downed large woody debris that currently, or may in the foreseeable future, provide large woody debris recruitment needed for instream habitat structure and fluvial geomorphic functions;
- Protect, maintain and restore the quality and quantity of vegetative canopy needed to provide shade to the watercourse or lake to maintain daily and seasonal water temperatures within the preferred range for anadromous salmonids or listed species where they are present or could be restored; and provide a deciduous vegetation component to the riparian zone for aquatic nutrient inputs;
- Prevent significant increases in peak flows or large flood frequency.

The following measures describing Watercourse and Lake Protection were taken directly from the California Forest Practice Rules.

Figure 5-1: Profile View of Class I WLPZ in Flood Prone Areas and Channel Migration Zones (not to scale)



Channel Migration Zone: When a channel migration zone (CMZ) is present upslope of the watercourse transition line (WTL), it is incorporated into the Core Zone. No timber harvesting is proposed in this zone.

Core Zone: The primary objective for this zone is streamside bank protection to promote bank stability, wood recruitment by bank erosion and canopy retention. Timber operations are generally excluded from this zone and limited to actions that meet the objectives stated above or improve salmonid habitat consistent with 14 California Code of Regulations (CCR) 916.9 subsections (a) and (c). The width of the Core Zone is 30 feet measured from the watercourse transition line or lake transition line. No timber harvesting is proposed within the 30-foot-wide core zone.

Inner Zone A: The primary objective for this zone is to develop a large number of trees for large wood recruitment, to provide additional shading, to develop vertical structural diversity, and to provide a variety of species (including hardwoods) for nutrient input. This is accomplished through the establishment of high basal area and canopy retention by retaining or more rapidly growing a sufficient number of large trees. Additional specific objectives include locating large trees retained for wood recruitment nearer to the Core Zone and maintaining or improving salmonid habitat on flood prone areas and CMZs when present. Timber operations within WLPZs are limited to those actions which meet the objectives stated above or to improve salmonid habitat consistent with 14 CCR 916.9 subsection (a) and (c).

The Inner Zone A generally encompasses the portion of the flood prone area from 30 feet beyond the WTL (Core Zone perimeter) up to 150 feet from the WTL. The minimum width of the Inner Zone A shall be the greater of the area from the landward edge of Core Zone to the landward edge of the Inner Zone B or 70 feet. The maximum width is 120 feet. **Within Inner Zone A, harvesting is subject to the following additional restrictions:**

- The silvicultural method in this area is single-tree selection.
- The postharvest stand shall have a minimum 80 percent overstory canopy cover.
- The postharvest canopy may be composed of both conifers and hardwood species and shall have at least 25 percent overstory conifer canopy.
- The postharvest stand shall retain the 13 largest conifer trees (live or dead) on each acre of the area that encompasses the Core and Inner Zones.
- Large trees retained shall be the most conducive to recruitment to provide for the beneficial functions of riparian zones (e.g. trees that lean toward the channel, have an unimpeded fall path toward the watercourse, are in an advanced state of decay, are located on unstable areas or downslope of such an unstable areas, or have undermined roots). These large trees are to be given priority to be retained as future recruitment trees.
- Harvesting is planned so the quadratic mean diameter (QMD) of the flood prone area timber stand will increase.

When no floodplain or Channel Migration Zone is present the maximum width of the WLPZ is 100 feet, the harvest restrictions in the Core Zone and Inner Zone A apply.

Inner Zone B: The Inner Zone B is applicable when there are very wide flood prone areas. The Inner Zone B encompasses the portion of the flood prone area from the landward edge of the Inner Zone A (i.e. 150 feet from the WTL) to the landward edge of the flood prone area. The landward edge of the Inner Zone B (i.e. the landward perimeter of the flood prone area) shall be established in accordance with flood prone area. Timber operations are permitted in this zone when conducted to meet the goals of this section, including those for the Inner Zone as follows: The primary objective for this zone is to develop a large number of trees for large wood recruitment, to provide additional shading, to develop vertical structural diversity, and to provide a variety of species (including hardwoods) for nutrient input. This is accomplished through the establishment of high basal area and canopy retention by retaining or more rapidly growing a sufficient number of large trees. Additional specific objectives include locating large trees retained for wood recruitment nearer to the Core Zone and maintaining or improving salmonid habitat on flood prone areas and CMZs when present. Timber operations within WLPZs are limited to those actions which meet the objectives stated above.

Within Inner Zone B harvesting is subject to the following additional restrictions:

- The silvicultural method in this area is single tree selection.

- The postharvest stand will retain the 13 largest conifer trees (live or dead) on each acre of the Core and Inner Zones.
- Postharvest stand shall have a minimum 50 percent overstory canopy cover.
- The postharvest canopy may be composed of both conifers and hardwood species and will have at least 25 percent overstory conifer canopy.
- Harvesting is planned so that the QMD of the flood prone area timber stand will increase.

Outer Zone:

- Postharvest stand shall have a minimum 50 percent overstory canopy cover. The postharvest canopy may be composed of both conifers and hardwood species and shall have at least 25 percent overstory conifer canopy.
- Priority shall be given to retain wind-firm trees.

Preferred Management Practices in the Inner and Outer Zones: When timber operations are considered pursuant to 14 CCR 916.3 [936.3, 956.3], subsection (c) and 916.4 [936.4, 956.4], subsection (d), the following Preferred Management Practices should be considered for inclusion in the plan by the Registered Professional Forester (RPF) and by the director:

- Preflagging or marking of any skid trails before the preharvest inspection;
- Heavy equipment should be limited to slopes less than 35 percent with low or moderate erosion hazard rating (EHR);
- Use feller bunchers or hydraulic heel boom loaders which do not drag/skid logs through the zone;
- Minimize turning of heavy equipment which would result in increased depth of ground surface depressions; and
- Use mechanized harvesting equipment which delimb harvested trees on pathway over which heavy equipment would travel.

Table 5-2: Summary of Watercourse and Lake Protection Zone and Equipment Limitation Zone Widths

Slope Class	Class II-S WLPZ Zone Width (feet) Core/Inner Zones	Class III ELZ Width (feet)	Wet Area ELZ Width (feet)
<10%	0 / 50	30	30
10 - 30%	15 / 35	30	30
30 - 50%	15 / 60	50	50
>50%	15 / 85	50	50

Class II Watercourses: All Class II WLPZs shall be composed of two zones regardless of the watercourse type: a Core Zone and an Inner Zone. The Core Zone is nearest to the water; the Inner Zone is contiguous to the Core Zone and is furthest from the water. The width of the Core and Inner Zones vary depending on the following three factors: (i) side slope steepness in the WLPZ, (ii) whether the watercourse is a Class II-S or Class II-L watercourse type, and (iii) whether the watercourse is within a watershed in the coastal anadromy zone or outside the coastal anadromy zone (all watercourses within the Fund's ownership are within the coastal anadromy zone).

Class II Large:

Core Zone: 30 feet in which no harvest may occur.

Inner Zone: The widths of the Inner Zone are 70 feet and adjacent to the core zone forming a total zone of 100 feet for all class II L streams. Harvesting within the inner zone is allowed providing the 13 largest trees per acre are retained and at least 80 percent canopy is retained. Silvicultural systems for harvesting are limited to the use of commercial thinning or single tree selection.

Class II Standard:

Core Zone: Variable zone (0-15 feet) based on slope in which no harvesting can occur.

Inner Zone: Variable zone (35-85 feet) based on slope at least 50 percent of the total canopy covering the ground shall be left in a well-distributed multistoried stand configuration composed of a diversity of species similar to that found before the start of operations. The residual overstory canopy shall be composed of at least 25 percent of the existing overstory conifers.

Class III Streams: Using the variable width Equipment Limitation Zone (ELZ) defined by the FPR, where there are no overstory retention requirements under the FPR, the Fund will retain at least 50 percent canopy and a minimum of 25 percent overstory conifer. [Note: Conformance with all canopy requirements will be measured as an average across not less than a 200-foot lineal WLPZ segment—the same as the FPR.]

5.3.2 Aquatic Habitat Restoration

Aquatic habitat degradation has resulted from increased bedload and excess stream siltation caused by erosion and increased water temperature caused by pool filling and a reduction in riparian vegetation. Aquatic habitat restoration includes reducing sediment inputs and increasing shade canopy as described in the previous sections. Baseline data that will be used to measure anticipated improvements in aquatic habitat include stream habitat surveys and spawning surveys conducted by CDFW.

Due to the complexity of the stream environment and difficulty of working directly in stream channels, aquatic habitat restoration is expected to progress naturally as stored sediment loads are transported downstream and potential sediment inputs are removed or mitigated. The riparian management strategy described herein will result in increased stream shading over time and reduced water temperature. Direct instream habitat enhancement may occur if and when logical opportunities present themselves and stream survey data indicates that direct action is warranted.

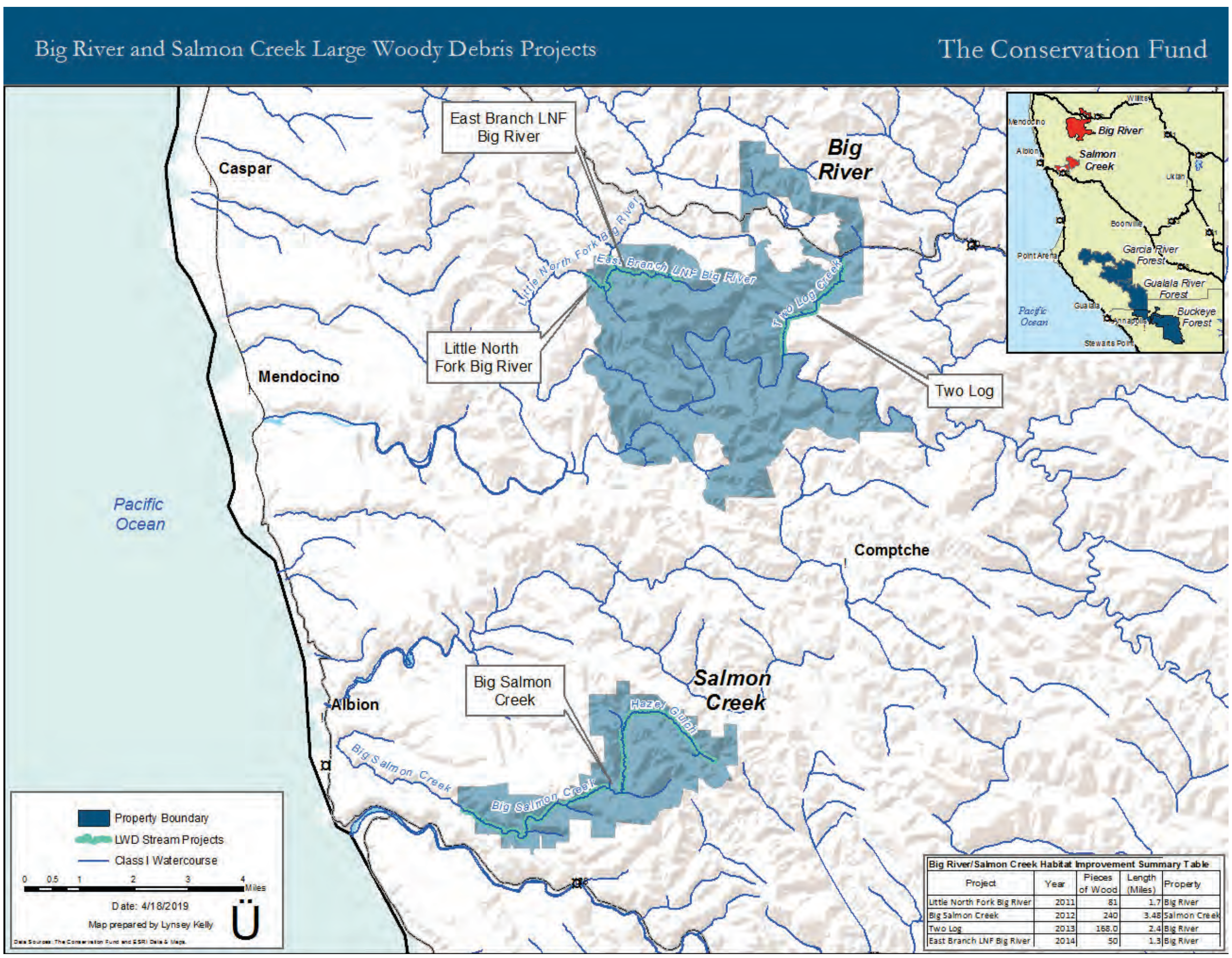
The placement of LWD in streams is a high priority for salmon habitat restoration. The addition of LWD enhances spawning and rearing habitats by providing cover and refuge from peak winter flows, increasing pool complexity, depth and frequency, and sorting and collecting spawning gravels, all of which will increase the quality and quantity of rearing habitat within the project reach. To date the Fund has added 299 pieces of LWD to three Class I streams (Little North Fork, East Branch Little North Fork, Two Log Creek) on BR, totaling 5.4 miles, and on SC the Fund has added 240 pieces of LWD to 3.48 miles of Salmon Creek.

Gravel extraction can be beneficial in some systems with high levels of gravel aggradation because it can promote gravel movement and pool development in some cases. However, because of the potential technical and regulatory challenges, instream gravel removal is likely to be a low priority.

5.3.3 Aquatic Habitat Restoration Monitoring

Habitat improvements in the stream environment shall likely be monitored using stream habitat data derived from the habitat sampling methodology found in the California Salmonid Stream Habitat Restoration Manual (Flosi et al., 2010) currently in use by CDFW. Some baseline data exists for many coastal streams from CDFW stream surveys conducted in the past 10 years.

Another available stream habitat sampling method adopted by the EPA is the Environmental Monitoring and Assessment Program (EMAP) methodology which is in use on the GRF and may be used in the future in the BRSC. Both methods are acceptable; however, since baseline data exists in the California Salmonid Stream Habitat Restoration Manual protocol, the Fund has elected to continue with that sampling methodology for now. As a complement to either system, it will be important to maintain the network to monitor instream temperature with remote water and air temperature sensing probes (HOBO temps). Additionally, since a principal objective of this plan is to increase salmonid populations and productivity, the Fund will seek to expand on the CDFW spawner survey reaches as the program develops.



Big River/Salmon Creek Habitat Improvement Summary Table				
Project	Year	Pieces of Wood	Length (Miles)	Property
Little North Fork Big River	2011	81	1.7	Big River
Big Salmon Creek	2012	240	3.48	Salmon Creek
Two Log	2013	168.0	2.4	Big River
East Branch LNF Big River	2014	50	1.3	Big River

The Fund expects positive changes from the road and riparian protection practices mentioned in the previous sections. Instream stored sediment is slow to respond, however the addition of LWD aids significantly in sorting gravels, creating pools and providing cover. Because of the slow response time for stream recovery, measuring stream habitat more than once every 10 years is generally not recommended. The CDFW stream habitat assessment protocol does suggest that streams be inventoried after large storm events. The need to reinventory will be assessed if such an event does occur; timing of the previous inventory and other previously planned management activities will be factors when deciding to reinventory streams ahead of the recommended 10-year interval.

The 11 habitat inventory components of the California Salmonid Stream Habitat Restoration Manual include: flow, channel type, temperature, habitat type, embeddedness, shelter rating, substrate composition, canopy, bank composition and vegetation, large woody debris count, and average bankfull width. The stream assessments conducted by CDFW in 2003 are available at the CDFW Coastal Watershed Program website: http://coastalwatersheds.ca.gov.

5.4 Invasive Weed Management

Many of the more conspicuous exotics are associated with the roads that traverse the forests and represent disturbed habitat. Two species, pampas/jubata grass (*Cortaderia jubata*) and French Broom (*Genista monspessulana*) are on the California Invasive Plant Council (Cal-IPC) List A-1 (Most Invasive Wildland Pest Plants: Widespread) and have been observed along the roadways. These species, once established, have the most potential to displace native species. Cal-IPC has rated these species as “high” because they “have severe ecological impacts on physical processes, plant and animal communities and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment.” Most are widely distributed. Cal-IPC rated distaff thistle (*Carthamus lanatus*) as a “Red Alert” species—a species with the potential to become widely invasive in the state or has been recently reported as expanding in their range within California (Pirosko, 2003). Red Alert species have a reproductive biology given to high rates of dispersal but are not yet widespread in distribution in the county. Mendocino County conducts an eradication program for distaff thistle removal.

The Fund may employ chemical and mechanical control techniques to slow and possibly reverse the spread of invasive species, with a preference for mechanical (including manual) control measures where they will be effective. Only licensed and insured contractors with a good track record for safety and compliance may apply herbicides. All herbicide application must be in conformance with label guidelines and applicable laws.

The highest priority for treatment will be areas planned for upcoming timber harvest or road improvement projects so as to discourage the further spread of invasives. If done prior to flowering, the physical removal of plants during road grading can reduce the spread of invasive species. However, this generally does not permanently remove the plant from a site once established, and subsequent treatments to reduce the population will be required. General road maintenance such as grading and roadside brushing will be the second line of defense to prevent invasives from reinvading a site once the initial treatment has occurred.

Addressing the invasives promptly is a high priority; ultimately, forest management which promotes dense forest cover to shade out invasive plants like jubata grass and broom will have the greatest and most long-lasting impact on controlling invasive species.

5.4.1 Invasive Weed Monitoring

Ongoing monitoring will focus on the distribution of invasive plants and the effectiveness of treatment efforts. Project botanists and field foresters will continue to identify and record locations of invasives primarily in the context of timber harvest planning. Additional evaluation projects will monitor the effectiveness of treatment efforts by long-term survivorship of individual populations. In THP-related botanical surveys, 158 invasive plants on Big River Forest and 72 on Salmon Creek Forest were identified and prioritized (Heise, 2018).

5.5 Role of Forests and the Atmosphere

A rapidly growing forest can sequester and store a remarkable amount of carbon dioxide, a greenhouse gas and the driver of global climate change. As a result, how forests are managed has an effect on our atmosphere.

The 2007 Intergovernmental Panel on Climate Change (IPCC) report estimated that 18 percent (and increasing) of global greenhouse gas emissions are the result of deforestation and subsequent release of carbon to the atmosphere; the report recognizes financial incentives to reduce deforestation and to maintain and manage forests as one of only a handful of policy measures proved to be effective at reducing emissions (IPCC, 2007). The Redwood Region is an important and impactful location to promote forest conservation and growth because the forests of the North Coast have an almost unparalleled ability to grow and store carbon dioxide. The careful management of these redwood forest "carbon sponges" can play a role in reducing net greenhouse gas emissions.

As a conserved working forest, the BRSC can have a positive climactic impact on several fronts.

In addition to carbon storage in standing forests, the use of wood building materials has a lower carbon footprint compared to concrete or steel (because of the much greater amount of energy utilized in manufacturing and distributing metal and masonry and because wood products act as carbon reservoirs). Thus, increasing the use of California's native species as lumber and long-lived wood products can also result in decreased greenhouse gas emissions.

5.5.1 Climate Action Reserve

Due to the Fund's recognition of the need to take action on climate change, the BRSC forests were registered and verified as a voluntary improved forest management project, through CAR in 2007. In 2015 the project was transitioned to a slightly different protocol with the California Air Resources Board (CARB) compliance market. Verification of the project requires that landowners model the long-term carbon storage of their forests and report emission reductions resulting from storing more carbon than required by regulation. This requirement necessitates a verifiable field inventory system that generates statistically reliable estimates of carbon within the forest (including living trees, snags and below-ground carbon in trees). General information on the CARB Forest Project Protocol can be found at https://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm. Specific project details are available at https://www.climateactionreserve.org.

5.5.2 Preparing for Likely Climate Change

Planning for the future of the forests must include a realistic assessment of the likely implications of climate change on management objectives and strategies. A recent study on the implications of expected climate change on California's native plants found, with the exception of some particularly sensitive oak species, the Redwood Region is not likely to experience significant losses in plant diversity (Loarie et al., 2008). However, there will be significant changes in species' ranges (some expanding, some contracting, for both plants and animals).

While details of the future climate cannot be known with certainty, the general indication is summers will get hotter and winter storms will likely increase in severity. Some practical conclusions can be drawn relative to management of the forest in anticipation of climate change:

- Managing for ecological resiliency will become even more important—especially maintaining the full range of natural diversity and ecological succession processes. Practically speaking, Douglas fir may become a more significant component of the forests. Establishing redwoods in large openings, especially south-facing slopes, will likely become more difficult. Even on sites with moderate moisture, retaining summer soil moisture will be important, in turn increasing the importance of maintaining shade, downed logs and soil nutrients. Silvicultural practices on the forests, therefore, should continue to be focused on maintaining shade to retain soil moisture through the use of uneven-age management, maintain mixed species stands that are well stocked and retain wildlife habitat features.

- Invasive species may become more prevalent, especially those that originate from warmer climates. Monitoring and treatment of invasive plants and animals is already part of this plan, but climate change will increase the importance and challenge of this responsibility. It also means greater emphasis should be placed on prevention of non-native species introductions and effective early control efforts, since those approaches are considerably more cost-efficient than later eradication efforts. Control of jubata (pampas) grass, broom and other weeds will continue to be our highest priorities.

- An expected increase in the severity of winter storms only increases the importance of storm-proofing the road system, an effort already well underway.

- If severity of winter storms increases, and/or fewer storms come in more concentrated rainfall events, providing winter-time flow refuge habitat for juvenile salmonids will become more important. Adding LWD is one important way to reconnect stream channels to their floodplains and provide flow refuge habitat.

- Fires, both natural and human-caused, will likely increase in frequency and severity. The Fund will need to maintain the capacity and expertise gained during previous fire seasons.

PHOTO BY RIXANNE WEHREN

6. Community Use and Involvement

The Fund will provide a range of opportunities for community use and involvement consistent with the protection of natural resources, long-term restoration and enhancement, and active forest management.

To foster community involvement and support, the Fund provides guided tours of areas intended for timber harvests, road improvement and restoration projects, and native plant interpretive walks, as well as tours tailored for youth education. These programs familiarize the public with sustainable management methods and goals and build community partnerships. The Fund is evaluating the potential for unsupervised public access.

6.1 History of Community Use and Involvement

Beginning in the 1850s and continuing until purchase by the Fund, the BRSC was managed as private industrial timberland. The landowner officially had “no trespassing” policies, including warnings on property boundaries and security patrols, but trespass was difficult to prevent, and a range of unauthorized recreational and illegal activities occurred on the forests, including hunting and dirt bike/off-highway vehicle use. Marijuana growers cause pollution through the use of unauthorized herbicides and insecticides, break gates and locks to gain access, and can be a safety concern for field personnel and other users. Motorcycle usage can tear up the roads, causing erosion and potentially damaging streams. The dumping of trash is unsightly, a pollution hazard to fish and wildlife, and costly to remove. These activities can be disruptive to the forests’ ecology but are typically difficult to monitor. When these activities are observed, they will be reported to the proper authorities. Unauthorized activities will be discouraged, but they are an ongoing problem, and it is unrealistic to expect they will ever be completely absent from the forests.

6.2 Goals and Objectives for Community Use and Involvement

The Fund intends to provide a range of opportunities for community use and involvement that can be reasonably managed in a manner consistent with the protection of natural resources, long-term restoration and enhancement, and active forest management. These opportunities range from research, education and demonstrations to participation in restoration activities. The following are the Fund's guidelines for community use and involvement.

- Be a good neighbor by holding to the highest professional standards, cooperating with other neighboring landowners, discouraging illegal trash dumping, patrolling for illegal activities and providing assistance with community-based projects.

- Provide reasonable dispute management. Should a dispute arise with a local citizen, neighbor, partner organization, current or potential contractor, or other interested entity, the Fund will first seek to resolve the dispute through open communication, prior to more formal dispute resolution through mediation or litigation.

- Provide THP tours either before or shortly after submission of harvest plans to CAL FIRE and again following completion of the operation. Fund staff will actively seek community review of its operations and programs and will be responsive to questions or concerns raised by the local community. THP summaries will be provided to facilitate community understanding.

- Provide opportunities for on-site demonstrations of watershed restoration projects, sustainable forest management and other best management practices, public participation in research opportunities, educational tours and restoration workdays.

- Build partnerships with local organizations that are mutually beneficial.

6.3 Recreational Access Activities and Policies

6.3.1 Recreational Uses

Permission for additional recreational activities may be expanded on a case-by-case basis. Currently walking, mountain biking, swimming and fishing are allowed activities on the forests, and access can be gained by acquiring an entry permit from the Caspar office. Group events such as equestrian access on Salmon Creek and seasonal firewood cutting on Big River are also encouraged. Evaluations of requests will be based on safety, potential resource damage, community benefit and administrative impact.

6.3.2 Unauthorized Activities

The Fund conducts frequent security patrols of the forests to deter unauthorized access and illegal uses. These illegal activities include marijuana cultivation, trash dumping, poaching and off-highway vehicle use. Violators may be prosecuted.

6.4 Outreach Activities

The Fund will provide guided tours of timber harvest areas, road improvements and restoration projects, as well as conduct native plant interpretive walks and youth educational trips. These events familiarize the public with sustainable management methods and goals and build community partnerships. Tours of THPs serve to demonstrate to the public the planning and process behind managing the forests sustainably and to solicit feedback on management activities. The Fund has benefited in the past from generous time donations by local naturalists that have resulted in tours focused on such topics as native plants, giving participants a solid connection with the natural world.

Public tours of road and other infrastructure improvements offer opportunities to demonstrate and share information regarding the methods and steps the Fund is taking to improve the ecological conditions on the forests. The Fund welcomes and appreciates community participation in restoration projects.

6.5 Monitoring Strategies for Community Involvement

The goal of monitoring is to provide the Fund with the necessary background and feedback to appropriately manage the natural and cultural resources on the BRSC. Monitoring will be conducted continually, reviewed annually and incorporated into policies and annual program evaluation.

Glossary

ANADROMOUS: fish that leave freshwater and migrate to the ocean to mature then return to freshwater to spawn (e.g. salmon, steelhead)

BF: board feet (a measure of wood volume 1" x 12" x 12")

BANKFULL WIDTH: width of the channel at the point at which overbank flooding begins

BASAL AREA: area in square feet of all conifer stems on an acre

BASIN: see "watershed"

BASIN PLAN: Water Quality Control Plan for the North Coast Region

BLUE LINE STREAM: stream that appears as a broken or solid blue line (or a purple line) on a USGS topographic map

BOLE: trunk of a merchantable-sized tree

CALWATER: set of standardized watershed boundaries for California

CANOPY: overhead branches and leaves of streamside vegetation

CANOPY COVER: vegetation that projects over a stream

CANOPY DENSITY: percentage of the sky above the stream screened by the canopy of plants

CLASS I STREAM: watercourse with fish present

CLASS II STREAM: watercourse providing aquatic habitat for nonfish species

CLASS III STREAM: watercourse with no aquatic life present but capable of sediment transport

COBBLE: stream substrate particles measuring 2.5-10" (64-256 mm) in diameter

CONIFER: softwood, cone-bearing tree species suitable for commercial timber production (e.g. redwood, Douglas fir)

CONIFEROUS: any of various mostly needle-leaved or scale-leaved, chiefly evergreen, cone-bearing gymnospermous trees or shrubs such as pines, spruces and firs

CONSERVATION EASEMENT: a legal agreement between a landowner and a qualified conservation organization that restricts usage rights of the property, such as real estate development and commercial and industrial uses

CORD: measure of fuel-wood volume (a stacked cord occupies 128 cubic feet [4' x 4' x 8'] and contains about 85 cubic feet of solid wood)

COVER: anything providing protection from predators or ameliorating adverse conditions of streamflow and/or seasonal changes in metabolic costs, such as instream cover, turbulence, and/or overhead cover, for the purpose of escape, feeding, hiding or resting

CROP TREE: a tree that has been selected for future timber harvest on which we will focus growth and subsequent increases in volume and value

CRYPTOS: Cooperative Redwood Yield Project Timber Output Simulator, a computer program that can model stand growth in redwood forests, including the effects of partial harvests

CWHR: California Wildlife Habitat Relationships, a system developed by CDFW to model the interactions between wildlife species and their habitats

DBH: diameter at breast height, tree diameter in inches, measured outside bark 4.5' above ground level

DEBRIS: material scattered about or accumulated by either natural processes or human influences

DEBRIS JAM: log jam or an accumulation of logs and other organic debris

DEBRIS LOADING: quantity of debris located within a specific reach of stream channel, due to natural processes or human activities

DEPOSITION: the settlement or accumulation of material out of the water column and onto the streambed, occurring when the energy of flowing water is unable to support the load of suspended sediment

DO: Dissolved Oxygen, concentration of oxygen dissolved in water, expressed in mg/l or as percent saturation, where saturation is the maximum amount of oxygen that can theoretically be dissolved in water at a given altitude and temperature

EMBEDDEDNESS: the degree that larger particles (boulders, rubble or gravel) are surrounded or covered by fine sediment, usually measured in classes according to percentage of coverage of larger particles by fine sediments

EROSION: the group of natural processes, including weathering, dissolution, abrasion, corrosion and transportation, by which material is worn away from the Earth's surface

FILL: a) the localized deposition of material eroded and transported from other areas, resulting in a change in the bed elevation; b) the deliberate placement of (generally) inorganic materials in a stream, usually along the bank

FINE SEDIMENT: fine-grained particles in stream banks and substrate defined by diameter, varying downward from 0.24” (6 mm)

FISH HABITAT: the aquatic environment and the immediately surrounding terrestrial environment that, combined, afford the necessary biological and physical support systems required by fish species during various life history stages

FLUVIAL: relating to or produced by a river or the action of a river, or situated in or near a river or stream

GIS: Geographic Information System, computer system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data related to positions on the Earth's surface. Typically, a GIS is used for handling maps of one kind or another. These might be represented as several different layers where each layer holds data about a particular kind of feature (e.g. roads). Each feature is linked to a position on the graphical image of a map.

GRADIENT: the slope of a streambed or hillside (for streams, gradient is quantified as the vertical distance of descent over the horizontal distance the stream travels)

GRAVEL: substrate particle size between 0.08-2.5” (2-64 mm) in diameter

GULLY: deep ditch or channel cut in the earth by running water after a prolonged downpour

HABITAT: the place where a population lives and its surroundings, both living and nonliving; includes the provision of life requirements such as food and shelter

HABITAT TYPE: a land or aquatic unit, consisting of an aggregation of habitats having equivalent structure, function, and responses to disturbance

HARDWOOD: nonconifer trees (e.g. tanoak, madrone, live oak, black and white oaks)

HERBACEOUS: nonwoody seed plant (e.g. grass)

HYDROGRAPHIC UNIT: a watershed designation at the level below Hydrologic Region and above Hydrologic Sub-Area

INDICATORS: measurable reflections of conservation goals such as structure, composition, interactions, and abiotic and biotic processes; these must be maintained to ensure the long-term viability of conservation goals

INGROWTH: volume increase due to premerchantable timber attaining size where board foot volume can now be measured (e.g. 10-12" DBH)

INSTREAM COVER: areas of shelter in a stream channel that provide aquatic organisms protection from predators or competitors and/or a place in which to rest and conserve energy due to a reduction in the force of the current

INTERMITTENT STREAM: seasonal stream in contact with the groundwater table that flows only at certain times of the year when the groundwater table is high and/or when it receives water from springs or from some surface source such as melting snow in mountainous areas. It ceases to flow above the streambed when losses from evaporation exceed the available stream flow

LATE SERAL, LATE SUCCESSIONAL: having biological characteristics and functions similar to old-growth forests

LIMITING FACTOR: environmental factor that limits the growth or activities of an organism or that restricts the size of a population or its geographical range

LOP: to sever branches and trunks of cut trees so that resulting slash will lie close to the ground

LWD: Large Woody Debris, large piece of relatively stable woody material having a diameter greater than 12" (30 cm) and a length greater than 6' (2 m) that intrudes into the stream channel. Large organic debris

MAI: Mean Annual Increment, the average annual growth rate of a forest stand, determined by dividing stand volume (including partial harvests) by stand age. Culmination of mean annual increment occurs at the age when MAI is greatest and determines the optimal rotation age for maximizing long-term yields in even-aged management

MAINSTEM: principal, largest or dominating stream or channel of any given area or drainage system

MELANGE: mix of sheared shale with blocks of other rock imbedded within

MERCHANTABLE: sound conifer trees at least 10" in diameter

MERCHANTABLE SPECIES: commercial conifer timber species being purchased by local sawmills, including redwood, Douglas fir, grand fir, western hemlock, sitka spruce and bishop pine

NET VOLUME: tree volume remaining after deducting unmerchantable and cull material

OLD GROWTH: see attached Appendix G for detailed definitions

PLUGS: seedling stock grown in plastic foam nursery containers

POLES: trees 4-11" DBH

PRECOMMERCIAL THINNING: cutting in a premerchantable conifer stand (2-10" DBH) to reduce unwanted trees and improve growth on remaining trees

REDD: a spawning nest made by a fish, especially a salmon or trout

REGENERATION: renewal of a tree crop, either by planting or natural seeding

RELEASE: freeing a tree (usually a conifer) from competition by cutting growth (usually a hardwood) surrounding or overtopping it

RESIDUAL GROWTH: mature trees (often of lower quality) left after original logging

RIFFLE: shallow area extending across a streambed over which water rushes quickly and is broken into waves by obstructions under the water

RILL: erosion channel that typically forms where rainfall and surface runoff is concentrated on slopes. If the channel is larger than 1 square foot, it is called a gully

RIPARIAN: pertaining to anything connected with or immediately adjacent to the banks of a stream or other body of water

RIPARIAN AREA: area between a stream or other body of water and the adjacent upland identified by soil characteristics and distinctive vegetation. It includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation

RIPARIAN VEGETATION: vegetation growing on or near the banks of a stream or other body of water on soils that exhibit some wetness characteristics during some portion of the growing season

RUBBLE: stream substrate particles between 2.5-10” (64-256 mm) in diameter

SALMONID: fish of the family *Salmonidae*, including salmon, trout, chars, whitefish, ciscoes and grayling

SAPLINGS: trees 1-4" DBH

SCOUR: localized removal of material from the streambed by flowing water, opposite of fill

SECOND-GROWTH TREES: established as seedlings after original old-growth logging (also called young-growth)

SEDIMENT: fragmented material that originates from weathering of rocks and decomposition of organic material that is transported by, suspended in, and eventually deposited by water or air, or is accumulated in beds by other natural phenomena

SEEDLINGS: trees less than 1" DBH

SERAL STAGES: series of relatively transitory plant communities that develop during ecological succession from bare ground to the climax stage

SILVICULTURE: care and cultivation of forest trees; forestry

SITE CLASS, SITE INDEX: used in relation to stocking regulations, it means one of the site classes or indexes listed in Forest Practice Rules 14 CCR 1060. When used in relation to growth modeling, it usually refers to the site system developed by Krumland and Wensel for the CRYPTOS growth simulator

SITE INDEX: productive capacity of an area to grow trees, based on height of dominant trees at given age; often expressed as a numeral from I (very good site) to V (poor site)

SKID TRAIL: temporary road for tractor/skidder travel to logging landing

SLASH: branches and other residue left on a forest floor after the cutting of timber

SMOLT: juvenile salmonid one or more years old that has undergone physiological changes to cope with a marine environment, the seaward migration stage of an anadromous salmonid

SNAG: dead standing tree

SPAWNING: to produce or deposit eggs

STAND TABLE: graph that shows the number of trees of each diameter class per acre

STAND: tree community sharing characteristics that can be silviculturally managed as a unit

STOCKING: number, or density, of trees in a given area

STREAM CORRIDOR: geomorphic formation, with the corridor occupying the continuous low profile of the valley. The corridor contains a perennial, intermittent or ephemeral stream and adjacent vegetative fringe

STUMPAGE: net value of standing timber to owner, exclusive of logging or trucking costs

SUBSTRATE: material (silt, sand, gravel, cobble, etc.) that forms a stream or lakebed

SUSTAINABLE: a method of harvesting or using a resource so that it is not depleted or permanently damaged

SUSTAINED YIELD PLAN: yield that a forest can continually produce at a given intensity of management

THALWEG: the line connecting the lowest or deepest points along a streambed

THIN FROM BELOW: selective removal of intermediate and/or suppressed conifers from the understory to allow more space for remaining trees

THRIFTY: describes a healthy and fast-growing tree

UNDERCUT BANK: a bank that has had its base cut away by the water action along man-made and natural overhangs in the stream

V*: measures amount of sediment filling a stream pool with deposits such as silt, sand and gravel compared with the total volume of water and sediment

VEXAR: plastic mesh tube used to protect young trees from animal browsing

WATERSHED: total land area draining to any point in a stream, as measured on a map, aerial photograph or other horizontal plane (also called catchment area or basin)

WATERSHEDS WITH THREATENED OR IMPAIRED VALUES: any planning watershed where populations of anadromous salmonids that are listed as threatened, endangered, or candidates under the State or Federal Endangered Species Acts with their implementing regulations, are currently present or can be restored

WETLAND: an area subjected to periodic inundation, usually with soil and vegetative characteristics that separate it from adjoining noninundated areas

WHITE WOODS: grand fir and hemlock

WORKING FOREST: forest managed for or including timber production

YARDER: logging machine that uses a suspended cable to lift logs

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Big River and Salmon Creek Forests Integrated Resource Management Plan

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APPENDIX A

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding ("MOU") is entered into by and among the State Water Resources Control Board ("State Water Board"), the California State Coastal Conservancy ("SCC"), the Wildlife Conservation Board ("WCB") and The Conservation Fund ("TCF") (collectively, the "Parties"; sometimes individually, a "Party") this ___ day of October, 2006.

Background

1. TCF has entered into an agreement dated January 11, 2006 (as later amended) to purchase approximately 16,100 acres of forestland in Mendocino County ("Properties") from Hawthorne Timber Company for $48,500,000 on or before October 15, 2006 ("Agreement"). The purpose of the acquisition is to prevent fragmentation of forest-lands; protect, restore and enhance water quality and salmonid habitat; improve forest structure and increase natural diversity; and provide public access where appropriate.

2. On June 29, 2006, SCC approved a grant of $7,250,000 to TCF (the "SCC Grant") to assist with the acquisition of the Properties, subject to the conditions in Exhibit A-1 (the "SCC Approval").

3. On July 19, 2006, the State Water Board approved a State Revolving Fund (SRF) loan to TCF of $25,000,000 (the "SWB Loan") to assist with the acquisition of the Properties, subject to the conditions in Exhibit A-2 (the "State Water Board Approval").

4. On August 17, 2006, WCB approved a grant of $7,250,000 to TCF (the "WCB Grant") to assist with the acquisition of the Properties, subject to the conditions in Exhibit A-3 (the "WCB Approval").

5. The State Water Board Approval requires as a condition of funding the State Water Board Loan that the Parties enter into a memorandum of understanding to, among other things, "ensure that the [Properties] will be used, managed, and restored to the conditions that are agreed upon by the applicant and the funding agencies… [and] will also include the essential terms of conservation easements and/or Covenants, Conditions, and Restrictions (CCR) that will ensure that the properties will not be sold at a later date for any purpose other than intended."

6. The SCC Approval, the State Water Board Approval and the WCB Approval (collectively, the "Approvals") each have established specific conditions and requirements which must be met prior to the disbursement of funds to complete the purchase of the Properties. In some cases, the conditions and requirements of a Party require the fulfillment of conditions by another Party or the Parties.

7. In light of the foregoing, the Parties desire to enter into this MOU to fulfill the requirements of the State Water Board Approval, to coordinate their respective requirements and conditions with respect to the purchase of the Properties and to establish an understanding as to the fulfillment of certain post-closing matters as provided below.

Understandings

1. Project Purposes. Without modifying or limiting in any way the requirements, conditions or terms of the Approvals, the Parties additionally desire to state in this memorandum their understanding and agreement that the general purposes of the acquisition and subsequent management of the Properties are (a) to ensure the permanent protection of the Properties from subdivision, residential and commercial development, mining (except for gravel mining for use on the property, in a manner otherwise consistent with and in furtherance of the purposes stated in this paragraph), water diversion, and conversion to non-forest uses, and (b) protect, restore and enhance water quality and salmonid habitat improve forest structure and increase natural diversity, provide a sustainable harvest of forest products, and, where appropriate, provide public access, through the implementation of the Plan, as defined in Section 3, and the interim management guidelines, as described in Section 6 (the “Project Purposes”).

2. Securing the Project Purposes. In addition to the agreements between TCF and each of the Parties as contemplated in each of the Approvals, the Parties intend that the Project Purposes will be permanently secured by recording at closing an Offer to Dedicate and Declaration of Restrictive Covenants (the “OTD”) in favor of the Coastal Conservancy and a Notice of Unrecorded Grant Agreement (with covenants affecting real property) in favor of WCB (the “Notice”). The purpose of the OTD and the Notice is to provide legal assurance that the Project Purposes are fulfilled irrespective of any breach or failure of TCF to meet its obligations or the subsequent transfer or transfers of the Properties. The Parties further agree that a conservation easement consistent with the Project Purposes and approved in writing by the Parties (the “Approved Conservation Easement”) can be substituted for the OTD, in which case the OTD will be of no further effect. The Parties further agree that the Grant Agreement between WCB and TCF will provide, among other things, that upon a future sale or transfer of the Properties and the substitution of an Approved Conservation Easement, the Approved Conservation Easement shall include the terms and conditions of WCB's Grant Agreement in lieu of the Notice.

3. The Plan. Each of the Approvals requires that TCF prepare a document that describes how the Properties will be managed. The SCC Approval and the WCB Approvals each require that TCF work with certain public agencies, local stakeholders and other interested parties to “prepare a forest management and restoration plan, plan sustainable timber harvests which eventually will fund the repayment of loans taken to purchase and /or manage the [P]roperties, the implementation of the forest management and restoration plan, and provide public access” by December 31, 2008. The State Water Board Approval requires “that no later than two years after the acquisition of the [Properties] the [T]CF develop a water quality management and restoration plan (WQMRP). This plan will explain the measures the [T]CF will implement to correct and prevent deterioration of the watersheds due to past, current, and proposed forest management practices , and how performance and benefits of the Project will be measured”. The Parties will agree on the form of the plans required under the Approvals and may consider the preparation of a single plan which conforms to the respective conditions and requirements of each of the Approvals (individually, or collectively, the “Plan”). The Plan will include all of the elements

specified therefore in the Approvals and such other elements as the Parties may agree to include during the development of the Plan.

4. Plan Development. TCF will lead the work necessary to develop and gain approval of the Plan in accordance with the Approvals. TCF will invite and encourage the participation of public agencies, the local community and other stakeholders. The public agencies involved will include at least the Parties, the California Departments of Fish and Game, Forestry and Fire Protection and Parks and Recreation and the North Coast Regional Water Quality Control Board (the "Regional Water Board"). A final draft of the Plan will be submitted to SCC, State Water Board , WCB and the Regional Water Board not later than two years following the acquisition of the Properties.

5. Management of the Properties upon Completion of the Plan. Upon completion and approval of the Plan as required by the Approvals, the Properties will be managed in a manner consistent with the Plan once it has been completed and approved in accordance with the Approvals.

6. Interim Management Guidelines. Until the Plan is approved, the Properties will be managed in a manner consistent with the following general guidelines:

A. Forest Management. TCF intends to promptly seek and maintain certification of its management of the Properties by the Forest Stewardship Council ("FSC"). Such certification, so long as it is maintained, will be sufficient evidence of TCF's fulfillment of the Parties' forest management requirements as set forth in the Approvals. The Parties understand that attaining FSC certification may take a year or more following the purchase of the Properties. In the interim, TCF's management of the Properties will generally be guided by the following management guidelines:

(i) Reduce harvest levels by between 40 to 50% below the levels allowed under the Forest Practice Rules in effect at the time of the purchase of the Properties ("Forest Practice Rules"), as established in the appraisal of the Properties prepared by Appraisal Associates dated April 13, 2006 and revised July 6, 2006. The Parties agree that harvest level reductions will vary from year to year and in any given year may not be attained (or may be exceeded) and that the attainment of these levels will be determined by averaging harvest levels over a period of 5 years.

(ii) Use single tree or small group selection as the primary silvicultural prescription, with the recognition that other harvest methods such as commercial thinning and variable retention prescriptions may be necessary to achieve the Project Purposes.

(iii) Establish riparian buffers that are wider than required under the Forest Practice Rules.

B. Water Quality Measures. Implementation of the forest management measures described above and the permanent protection of the Properties from subdivision, residential and commercial development, mining, water diversion, and conversion to non-forest uses such as vineyard development, as required by the Approvals, will prevent further degradation and will enhance water quality on the Properties. In addition to these measures, TCF will:

(i) Implement management measures consistent with the Nonpoint Source Program Strategy and Implementation Plan, 1998 – 2013 ("NPS Implementation Plan") and the Big River Total Maximum Daily Load for Sediment developed by the US EPA, Region IX in December, 2001 ("Big River TMDL"), as adopted by the Regional Water Board in Resolution No. R1-2004-0087.

(ii) Review the Garcia River Forest Site Specific Management Plan as approved by the Executive Officer of the Regional Water Board, dated May 8, 2006 (the "Garcia SSMP") and adopt the appropriate provisions thereof as interim water quality management measures for the Properties. TCF will seek guidance from staff of the Regional Water Board in selecting the appropriate provisions for use on the Properties.

7. Amendment. This MOU may be amended at any time by the mutual written consent of the Parties.

8. Scope. As stated above, the purpose of this MOU is to fulfill the requirements of the State Water Board Approval, to coordinate the Parties' respective requirements and conditions with respect to the purchase of the Properties and to establish an understanding as to the fulfillment of certain post-closing matters as provided herein.

9. Conflicts. In the event of conflicts between this MOU and any one or more of the Approvals, deference will be given to the pertinent provisions of the Approval or Approvals deemed to conflict with this MOU.

10. Notices. Notices and other communications between the Parties should be delivered to the following Party representatives at the locations provided:

State Water Resources Control Board
c/o Barbara Evoy
1001 I Street, 16th Floor
Sacramento, CA 95812
Phone: (916) 341-5632
Fax: (916) 341-5707

State Coastal Conservancy
c/o Executive Officer
1330 Broadway, Suite 1300
Oakland, CA 94612-2530
Phone: (510) 286-4185
Fax: (510) 286-0470

Wildlife Conservation Board
c/o Executive Director

1807 13th Street, Suite 103
Sacramento, CA 95814
Phone: (916) 445-8448
Fax: (916) 323-0280

The Conservation Fund
c/o Chris Kelly
P.O. Box 5326
Larkspur, CA 94977
Phone: (415) 927-2123
Fax: (415) 924-7354

11. Counterparts. This MOU may be signed in counterparts.

12. Concurrent Funding. The Parties agree that each Party's deposit of funds into escrow is contingent upon the concurrent assurance from each of the other Parties that their funds are similarly obligated and ready for deposit. The Parties will provide for this assurance through their respective escrow instructions.

APPENDIX B

GEOLOGY AND SOILS
ELIAS STEINBUCK

BIG RIVER AND SALMON CREEK PROPERTIES

1. GEOLOGY

The regional geologic landscape of the Big River and Salmon Creek properties were shaped by the tectonic collision of the Farallon and North American plates during the Mesozoic and early to middle Tertiary. As the Farallon plate was subducted beneath the North American plate a deep subduction trench formed and a majority of the rock that comprises the Coast Range Mountains was deposited in this offshore basin as deep sea fan deposits. Tectonic forces mixed these sediments with other less common rock types as subduction continued, subsequent metamorphism and accretion of this new terrane to the western margin of North America resulted in what we collectively refer to as the Franciscan Complex (Blake and Jones, 1981).

The Franciscan Complex is composed of three distinct belts: the eastern belt, the central belt, and the coastal belt. Generally they decrease in age and metamorphic grade from east to west (Blake and Jones, 1981). Geologic mapping conducted in the region indicates that the Big River and Salmon Creek properties are solely underlain by the coastal belt Franciscan complex (Kilbourne, 1983a. and 1983b.; Manson, 1984; Braun and others, 2005). Generally, the coastal belt Franciscan consists of arkosic sandstone and andesitic greywacke sandstone that underwent low grade metamorphism as a result of subduction. Shear strength of the exposed bedrock is highly variable and dependent upon the local structure, bedding, and lithology.

The orientation of the structural grain of the Franciscan complex is controlled by the northwest-southeast trending San Andreas Fault Zone, a right-lateral strike slip fault whose main trace is located offshore approximately 5 miles west of the Salmon Creek property and 15 miles west of the Big River property. Geologic research indicates the Pacific Plate has been moving north relative to the North American Plate along the San Andreas Fault Zone for the past 30 million years (Atwater, 1970). The related Maacama Fault Zone trends northwest-southeast down the Ukiah and Willits valleys approximately 15 miles east of the Big River property.

Unique to the Salmon Creek property, uplift of the Coast Range Mountains coupled with global sea level fluctuations created topographic steps along the present day coastline where quartz sand was deposited on broad wave cut terraces. Through the combined effect of tectonic uplift and lower sea level the coastal river canyons became deeply incised, cutting down through the marine terrace deposits. Subsequent retreat of continental glaciers resulted in rising sea levels that flooded the mouths of coastal rivers and formed present day estuaries (Fuller and others, 2004). Remnants of the marine terrace deposits can be found along the broad low-gradient ridge tops on the Salmon Creek property.

Landslides are widespread across the Coast Range Mountains. Large deep-seated rockslides (e.g. translational-rotational landslides) occur on both the Big River and Salmon Creek properties and are generally characterized by a very slow moving slide mass and deep slide plane extending well into bedrock. A majority of the shallow landslides (e.g. debris slides and flows) occur on slopes over 65% and are concentrated on steep streamside slopes along the outside of meander bends along the mainstems of Big River and Salmon Creek and their larger tributaries (Kilbourne, 1983a. and 1983b.; Manson, 1984; Braun and others, 2005).

Recent unconsolidated channel deposits composed primarily of sand, silt and gravel are exposed along the active channels on both the Big River and Salmon Creek properties.

2. SOILS

The Natural Resource Conservation Service soil survey depicts 13 distinct soil complexes in the Big River and Salmon Creek properties (Rittiman and Thorson, 2001). Formed from the weathering of sedimentary rock, colluvial soils blanket a majority of the hillslopes across the Coast Range Mountains. Rittiman and Thorson (2001) mapped the following soils on the Big River and Salmon Creek properties:

- Irmulco-Tramway complex
- Dehaven-Hotel complex
- Vandamme-loam
- Vandamme-Irmulco complex
- Ornbaun-Zeni complex
- Glenblair gravelly loam
- Threechop-Ornbaun complex
- Boontling loam
- Big River loamy sand
- Carlain loam
- Quinliven-Ferncreek complex
- Ferncreek sandy loam
- Shinglemill-Gibney complex

Thickness of the overlying colluvial soil can be highly variable. Generally, colluvium is thin along ridges and upper sideslopes (typically 1-2 feet), and thick (as much as 5-10 feet) within deep swales and local depressions. Soil types are identified and described in detailed below in, "Soil Types and Descriptions."

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For more information on Soil Types and Descriptions, see Rittiman, C, and T. Thorson, 2002. *Soil Survey of Mendocino County, California, Western Part.* Natural Resources Conservation Service. Available online: http://www.ca.nrcs.usda.gov/mlra02/wmendo/

APPENDIX C

BOTANICAL RESOURCE ASSESSMENT FOR THE CONSERVATION FUND'S BIG RIVER AND SALMON CREEK PROPERTIES, MENDOCINO COUNTY, CA

Prepared for:

The Conservation Fund
North Coast Forest Conservation Program
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By:

Kerry Heise
Botanical Consultant
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Ukiah, CA

November 20, 2018

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Introduction

The purpose of this Botanical Resource Assessment is to bring the original 2008 Botanical Resource Assessment authored by Geri Hulse-Stephens up to date in terms of new species occurrences, taxonomic revisions, current status of rare as well as invasive species, pathogens (SOD), and lastly, current vegetation classification conventions. Where applicable, updated management recommendations for rare species are provided.

The original assessment summarized special status plants and communities, vegetation habitat types, gaps in surveys, and invasive plants and pathogens. Species lists for Big River and Salmon Creek Forest were compiled based on all available surveys at the time. Recommendations were made which largely stressed the need for more inventories since large un-surveyed areas existed in 2008. This gap in our understanding of species richness including the status of rare and endangered species would soon be narrowed as field surveys continued.

The preliminary inventory of vascular flora of the Big River property was represented in 2008 by at least 317 species in 203 genera and 68 families. The preliminary inventory of vascular flora of the Salmon Creek property was represented by at least 234 species in 159 genera and 62 families. Twelve special status plants and two special status communities were identified on the Properties. Eighty-eight invasive plants on Big River and 49 on Salmon Creek were identified throughout six distinct vegetation types. Lastly, 35 bryophytes and 12 lichens had been identified in 2008. Additional baseline surveys of both properties were recommended to better provide informed management decisions.

Over the past ten years a number of THP botanical surveys have been conducted throughout Big River and Salmon Creek Forest parcels providing a more accurate picture of species diversity. Notably, there have been substantial increases in the number of species documented i.e., 219 additions to the Big River Forest vascular plant flora, and 55 additions to the Salmon Creek flora since 2008 (Table 1). Due to increased survey efforts the bryophyte flora more than doubled, and lichens tripled in number. Current species list for vascular plants as well as bryophytes and lichens are provided at the end of this report in Appendices B, C, and D.

Table 1. Floristic Summary

	2008	2018
Big River (BR)		
total vascular species	317	538
families	68	89
exotics	88	156
rare	7	9
Salmon Creek (SC)		
total vascular species	234	290
families	62	70
exotics	49	72
rare	10	12
BR and SC bryophytes	35	88
BR and SC lichens	12	35

Vegetation of Big River and Salmon Creek Forests: an overview

The vegetation descriptions herein combine both physiognomic (relating to structure, i.e. pond, seep, river, forest etc.) and floristic elements (redwood forest, slough sedge swards). Alliances are floristic in nature and describe dominant or co-dominant species within homogeneous stands. They follow the National Vegetation Classification Hierarchy as applied to California vegetation (Sawyer et al. 2009).

Big River Forest

Conifer Forest

Within most stands, redwood (*Sequoia sempervirens*), Douglas fir (*Pseudotsuga menziesii*), and tanoak (*Notholithocarpus densiflorus*) occur in varying combination of dominance which determine the vegetation Alliance. Grand fir (*Abies grandis*) and western hemlock (*Tsuga heteropylla*) are occasionally encountered along with Pacific madrone (*Arbutus menziesii*), California bay (*Umbellularia californica*), and wax myrtle (*Morella californica*). The *Sequoia sempervirens* Forest Alliance is the primary vegetation type across the Big River Forest along with at least three associations including *Sequoia sempervirens-Notholithocarpus densiflorus, Sequoia sempervirens - Notholithocarpus densiflorus/Vaccinium ovatum,* and *Sequoia sempervirens-Pseudotsuga menziesii.* Stands primarily of Douglas fir and tanoak are placed in the *Pseudotsuga menziesii* - *Notholithocarpus densiflorus* Alliance of which many potential associations exist (Sawyer et al. 2009), depending on the scale at which vegetation units are mapped.

Common mid canopy taxa include: salal (*Gaultheria shallon*), Columbia manzanita (*Arctostaphylos columbiana*), Western raspberry (*Rubus leucodermis),* California blackberry (*R. ursinus*), thimble berry (*R. parviflorus*), honeysuckle (*Lonicera hispidula*), California coffeberry (*Frangula californica*), cascara (*F. purshiana*), blue blossom *(Ceanothus thysirflorus),* California rose-bay *(Rhododendron macrophyllum*), California huckleberry *(Vaccinium ovatum),* red huckleberry (*V. parvifolium*), poison oak *(Toxicodendron diversilobum),* and wood rose *(Rosa gymnocarpa*). Widespread forest understory ferns include sword fern (*Polystichum munitum*) and bracken fern (*Pteridium aquilinum* var. *pubescens*) while others such as giant chain fern (*Woodwardia fimbriata*), deer fern (*Struthiopteris spicant*), lady fern (*Athyrium filix-femina var. cyclosorum)*, and five-finger fern (*Adiantum aleuticum*), are more common in and around seeps, gullies, and creek banks.

The composition of the herbaceous layer varies with aspect, available light, and litter depth. In fertile soils in more open canopy, modesty *(Whipplea modesta),* hawkweed (*Hieracium albiflorum*), star flower (*Lysimachia latifolia*), Douglas iris (*Iris douglasiana*), California harebell (*Asyneuma prenanthoides*), western trillium (*Trillium ovatum*), trail plant (*Adenocaulon bicolor*), evergreen violet (*Viola sempervirens*), redwood ivy (*Vancouveria planipetala*), yerba buena (*Clinopodium douglasii*) are common. Low light tolerant species in dense canopy included spotted coralroot *(Corallorhiza maculata*), Hooker's fairybell (*Prosartes hookeri*), sweet scented bedstraw (*Galium triflorum*), fetid adders' tongue (*Scoliopus bigelovii*), and redwood sorrel (*Oxalis oregana*).

A variety of grasses and sedges occur across forest stands including the native species: western fescue *(F. occidentalis),* sweet grass *(Anthoxanthum occidentale),* Columbia brome *(Bromus vulgaris),* California oat grass (*Danthonia californica*), crinkle-awned fescue (*Festuca subuliflora*), blue wildrye (*Elymus glaucus*), Alaskan oniongrass (*Melica subulata*), Kellogg's bluegrass (*Poa kelloggii*), and slender hairgrass (*Deschampsia elongata*), as well as round-fruit sedge (*Carex globosa*), Harford's sedge (*C. harfordii*) and timber sedge (*C. hendersonii*). Common exotic grasses include: sweet vernal grass (*Anthoxanthum odoratum*), velvet grass (*Holcus lanatus*), and jubata grass (*Cortaderia jubata*).

<u>Riparian</u>

Along the main stem of Big River upland coniferous forest extends down to the channel including Douglas fir, redwood, and grand fir. Woody plants more or less confined to the riparian corridor include large leaf maple (*Acer macrophylla*), red alder (*Alnus rubra*), white alder (*A. rhombifolia*), Oregon ash (*Fraxinus latifolia*), western azalea (*Rhododendron occidentale*), California blackberry (*Rubus ursinus*), Sitka willow (*Salix sitchensis*), Scouler's willow (*S. scouleriana*), and Pacific bay (*Umbellularia californica*).

Common herbaceous perennial species include mugwort (*Artemesia douglasiana*), lady fern (*Athyrium filix-femina* var. *cylosorum*), torrent sedge (*Carex nudata*), Chilean wormseed (*Dysphania chilensis*), streamside orchid (*Epipactis gigantea*), common scouring rush (*Equisetum hymale*), giant scouring rush (*E. telmateia* subsp. *braunii*), white sweet clover (*Melilotus albus*), false waterpepper (*Persicaria hydropiperoides*), willow weed (*P. lapathifolium*), and panicled bulrush (*Scirpus microcarpus*). Common bryophytes include leafy liverworts – *Conocephalum conicum* and *Marchantia polymorpha*, and mosses – *Brachythecium frigidum, Kindbergia oregana, Rhizomnium glabrescens,* and *Porotrichum bigelovii* along shady banks, while *Scleropodium obtusifolium* is the most common seasonally submerged species of creek channels.

Upland seasonal drainages such as Peterson, Kidwell and Wheel gulches vary in vegetation with gradient and accumulated debris. Where gradients are steep and debris dense the plant community is less diverse with sword fern, giant chain fern (*Woodwardia fimbriata*), and hydrophytic mosses such as *Scleropodium obtusifolium*, which forms mats on boulders in streams and *Leucolepis acanthoneuron* which forms dense patches on moist soil along streams. Where the gradient is more gradual and some ponding occurs in the summer months, slough sedge (*Carex obnupta*) can form dense communities along with big-leaf sedge (*Carex* *amplifolia*). Wild ginger (*Asarum caudatum*), lady fern (*Athyrium felix-femina*), and giant horsetail (*Equisetum telmateia* subsp. *braunii*).

Areas of off-channel bottomlands adjacent to the Big River mainstem consist of dense slough sedge (*Carex obnupta*) along with western raspberry (*Rubus leucodermis*), surrounded by redwood forest. Along the secondary tributary, Two Log Creek, California wax myrtle (*Morella californica*) is the dominant woody species along with thimble berry (*Rubus parviflorus*), western azalea (*Rhododendron occidentalis*), poison oak (*Toxicodendron diversilobum*), arroyo willow (*Salix lasiolepis*), and sitka willow (*S. sitchensis*). Other common species include elk clover (*Aralia californica*), lady fern (*Athyrium filix-femina* var. *cylosorum*), Boykinia (*Boykinia occidentalis*), torrent sedge (*Carex nudata*), Durango root (*Datisca glomerata*), giant horsetail (*E. telmateia* subsp. *braunii*), leopard lily (*Lilium pardalinum*), western sweet coltsfoot (*Petasites fridgidus* var. *palmatus*), and chain fern (*Woodwardia fimbriata*).

Springs and Seeps

Seeps associated with roadsides, upland springs, and gullies include a variety of ferns including five-finger fern (*Adiantum aleuticum*), lady fern (*Athyrium felix-femina* var. *cyclosorum*), deer fern (*Struthiopteris spicant*), bracken fern (*Pteridium aquilinum* var. *pubescens*), giant chain fern (*Woodwardia fimbriata*), and giant horsetail (*Equisetum telmateia* subsp. *braunii*); common herbaceous perennial species include elk clover (*Aralia californica*), wild ginger (*Asarum caudatum*), selfheal (*Prunella vulgaris* var. *lanceolata*), Bolander's rush (*Juncus bolanderi*), Pacific rush (*J. effusus* var. *pacificus*), spreading rush (*J. patens*), speedwell (*Veronica america*), willow herb (*Epilobium ciliatum*), and slender foot sedge (*Carex leptopoda*). Where water ponds for prolonged periods native Bolander's starwort (*Callitriche heterophylla* var. *bolanderi*) and exotic pennyroyal (*Mentha pulegium*) are common.

Ponds

N39.33349 W123.64805 - A deep excavated pond known as "Dry Lake" occurs at the top of the ridge above the East Branch Little N. Fork Big River. Adjacent to the pond a marshy area supports a dense stand of slough sedge (*Carex obnupta*), inflated sedge (C. *vesicaria)*, panicled bulrush (*Scirpus microcarpus),* lady fern (*Athyrium filix-femina* var. cyclosorum)*,* and coast hedge nettle (*Stachys chamissonis).*

N39.33766, W123.66779 - A terrace pool app. 10x20m near the northwestern corner of the Big River Forest. The vegetation surrounding the pond includes Scouler's willow (*Salix scouleriana*), tan oak (*Notholithocarpus densiflorus*), and Douglas-fir (*Pseudotsuga menziesii*), under a larger redwood (*Sequoia sempervirens*) canopy. The shrub layer is comprised of California huckleberry (*Vaccinium ovatum*), creeping snowberry (*Symphoricarpos mollis*) and salal (*Gaultheria shallon*). Aquatic plants include Bolander's starwort (*Callitriche heterophylla* *var. bolanderi*), the aquatic moss, *Fontinalis neomexicana,* and *Rhizomnium glabrescens,* a large-leafed moss of wet shady habitat.

Pond at N39.33766, W123.66779

Roadbeds and Clearings

Portions of main roads, skid trails, and other semi-natural forest openings provide a niche for species ordinarily uncommon underneath dense forest canopy. These areas often have high species diversity, as well as provide important habitat for rare species, such as the rare Monterey clover (*Trifolium trichocalyx*). Such disturbance related areas host a rich variety of both native and exotic herbaceous forbs and grasses. Native grasses include California brome (*Bromus carinatus* var. *carinatus*), Columbia brome (*B. vulgaris*), California oatgrass (*Danthonia californica*), slender hairgrass (*Deschampsia elongata*) and blue wildrye (*Elymus glaucus* subsp. *glaucus*). Exotic grasses include silver European hairgrass (*Aira caryophllea*), little quaking grass (*Briza minor*), soft chess (*Bromus hordeaceus*), sweet vernal grass (*Anthoxanthum ordoratum*), six-weeks fescue (*Festuca bromoides*), and hairy oatgrass (*Rytidosperma penicillatum*).

Common native herbaceous eudicots include modesty (*Whipplea modesta*), redwood sorrel (*Oxalis oregana*), star-flower (*Lysimachia latifolia*), hawkweed (*Hieracium albiflorum*), Douglas iris (*Iris douglasiana*), Spanish lotus (*Acmispon americanus*), deervetch (*A. parviflorus*), smooth hawksbeard (*Crepis capillaris),* little tarweed (*Madia exigua*), coast tarweed (*M. sativa*), self-heal (*Prunella vulgaris* var. *lanceolata*), woodland buttercup (*Ranunculus uncinatus),* small-headed clover (*Trifolium microcephalum*), thimble clover (*T. microdon*), variegated clover (*T. varigatum*), and tomcat clover (*T. willdenovii*). Exotics forbs include star cudweed (*Euchiton sphaericus)*, hairy cat's ear (*Hypochaeris radicata*), tansy ragwort (*Senecio jacobaea*), coastal burnweed (*S. minimus*), shamrock clover (*Trifolium dubium*), clustered clover (*T. glomeratum*), nodding glover (*T. cernuum*), rose clover (*T. hirtum*), and subterranean clover (*T. subterraneum).*

<u>Grassland</u>
Small, mostly semi-natural openings of graminoids and forbs occur here and there; one such opening on the Picolotti THP below the main access road 23000 below gate B10 supports a diverse mix of native and exotic grasses including California oat grass, *Danthonia californica,* Mediterranean barley (*Hordeum marinum*), Italian ryegrass (*Festuca perennis*), common velvet grass (*Holcus lanatus*), soft chess (*Bromus hordeaceus*) and rip-gut brome (*B. diandrus*). Native blue wild rye (*Elymus glaucus* spp. *glaucus*) grows at the forest edge. At the toe of slope the grassland transitions into a sedge meadow dominated by native foothill sedge (*Carex tumulicola*).

Salmon Creek Forest

<u>Conifer Forest</u>
The *Sequoia sempervirens* Forest Alliance is the primary vegetation type along with two dominant associations including *Sequoia sempervirens-Notholithocarpus densiflorus* and *Sequoia sempervirens-Pseudotsuga menziesii* (Sawyer et al. 2009). Within most stands all three of the above species are common with occasional grand fir (*Abies grandis*), western hemlock (*Tsuga heterophylla*), Pacific madrone (*Arbutus menziesii*), California bay (*Umbellularia californica*), and wax myrtle (*Morella californica*). Patches of Mendocino pygmy cypress forest (*Hesperocyparis pygmaea*) with associated Bolander's beach pine (*Pinus contorta* subsp. *bolanderi*) occur on uplifted marine terraces south of Albion River Road. These are described more fully in the following rare plant descriptions.

Shrubs and semi-woody plants and ferns: Common mid canopy taxa observed during the surveys include: hazelnut (*Corylus cornuta* subsp. *californica*), salal (*Gaultheria shallon*), Columbia Manzanita (*Arctostaphylos columbiana*), Western raspberry (*Rubus leucodermis),* California blackberry (*R. ursinus*), thimble berry (*R. parviflorus*), California coffeberry (*Frangula californica*), cascara (*F. purshiana*), blue blossom *(Ceanothus thysirflorus),* California rose-bay *(Rhododendron macrophyllum*), California huckleberry *(Vaccinium ovatum),* red huckleberry (*V.*

parvifolium), poison oak *(Toxicodendron diversilobum),* and wood rose *(Rosa gymnocarpa*). Widespread forest understory ferns include sword fern (*Polystichum munitum*) and bracken fern (*Pteridium aquilinum* var. *pubescens*) while others such as giant chain fern (*Woodwardia fimbriata*), deer fern (*Struthiopteris spicant*), lady fern (*Athyrium filix-femina var. cyclosorum)*, and five-finger fern (*Adiantum aleuticum*), are more common in and around seeps, gullies, and creek banks.

Herbaceous layer plants: The composition of the herbaceous layer varies with aspect, available light, and litter depth. In fertile soils in more open canopy, modesty *(Whipplea modesta),* hawkweed (*Hieracium albiflorum*), star flower (*Lysimachia latifolia*), honeysuckle (*Lonicera hispidula* var. *vacillans*), Douglas iris (*Iris douglasiana*), California harebell (*Asyneuma prenanthoides*), western trillium (*Trillium ovatum*), trail plant (*Adenocaulon bicolor*), evergreen violet (*Viola sempervirens*), redwood ivy (*Vancouveria planipetala*), yerba buena (*Clinopodium douglasii*) were common. Low light tolerant species in dense canopy included spotted coralroot *(Corallorhiza maculata*), Hooker's fairybell (*Prosartes hookeri*), sweet scented bedstraw (*Galium triflorum*), fetid adders tongue (*Scoliopus bigelovii*), and redwood sorrel (*Oxalis oregana*).

Under semi-open canopies a variety of native grasses and sedges occur that include, western fescue *(F. occidentalis),* sweet vernal grass *(Anthoxanthum occidentale),* Columbia brome *(Bromus vulgaris),* California oat grass (*Danthonia californica*), crinkle-awned fescue (*Festuca subuliflora*), blue wildrye (*Elymus glaucus*), Alaskan oniongrass (*Melica subulata*), Kellogg's bluegrass (*Poa kelloggii*), and slender hairgrass (*Deschampsia elongata*), as well as round-fruit sedge (*Carex globosa*), Harford's sedge (*C. harfordii*) and timber sedge (*C. hendersonii*).

<u>Roadbed and Cleared Landings</u>

The main roads along Big Salmon and Hazel Creeks along with numerous skid trails and other relatively flat clearings create forest openings that provide a niche for species ordinarily uncommon underneath dense forest canopy, and in some cases provide important habitat for rare species as well as wetland plants associated with roadside ditches. Such disturbance related areas host a rich variety of both native and exotic herbaceous forbs and grasses. Native grasses include California brome (*Bromus carinatus* var. *carinatus*), Columbia brome (*B. vulgaris*), California oatgrass (*Danthonia californica*), slender hairgrass (*Deschampsia elongata*) and blue wildrye (*Elymus glaucus* subsp. *glaucus*). Exotic grasses include silver European hairgrass (*Aira caryophllea*), little quaking grass (*Briza minor*), soft chess (*Bromus hordeaceus*), sweet vernal grass (*Anthoxanthum ordoratum*), six-weeks fescue (*Festuca bromoides*), and hairy oatgrass (*Rytidosperma penicillatum*).

Native forbs include Spanish lotus (*Acmispon americanus*), deervetch (*A. parviflorus*), *Crepis vesicaria,* little tarweed (*Madia exigua*), coast tarweed (M. sativa), cudweed (*Pseudognaphalium* *californicum*), self-heal (*Prunella vulgaris* var. *lanceolata*), and woodland buttercup (*Ranunculus uncinatus).* Exotics forbs include star cudweed (*Euchiton sphaericus)*, hairy cat's ear (*Hypochaeris radicata*) and coastal burnweed (*Senecio minimus*). A high diversity of clover species occupies roadbeds and clearings. These include both exotics such as nodding glover (*T. cernuum*), shamrock clover (*Trifolium dubium*), clustered clover (*T. glomeratum*), and subterranean clover (*T. subterraneum),* as well as natives such as pinole clover (*T. bifidum*), the rare Santa Cruz clover (*T. buckwestiorum*), small-head clover (*T. microcephalum*), thimble clover (*T. microdon*), variegated clover (*T. varigatum*), and tomcat clover (*T. willdenovii*).

<u>Riparian and Seep Wetland</u>

The largest wetland features found on the Salmon Creek Forest includes the riparian areas along Big Salmon and Hazel Creeks. Additionally, seeps and springs are located within the deep cuts of numerous gullies that descend steep south and east facing slopes. In some places old haul roads have bisected some of these perennial springs keeping the road surface sufficiently wet and thus providing habitat for native wetland species.

Big Salmon Creek is densely shaded by redwood, tanoak, Douglas fir, and grand fir. Red alder (*Alnus rubra*) and willow (*Salix lasiandra, S. sitchensis, S. scouleriana)* are patchy along Big Salmon Creek especially. Other common trees and shrubs include California bay (*Umbellularia californica*), western burning bush (*Euonymus occidentalis),* California wax myrtle (*Morella californica*), hazelnut *(Corylus cornuta* subsp. *californica),* and western azalea *(Rhododendron occidentalis*).

Common ferns and herbaceous species include giant horsetail (*Equisetum telmateia* subsp. *braunii*), sword fern (*Polystichum munitum*), five finger fern (*Adiantum aleuticum*), giant chain fern (*Woodwardia fimbriata*), lady fern (*Athyrium felix-femina*), coltsfoot (*Petasites frigidus* var. *palmatus*), coast boykenia (*Boykenia occidentalis*), wild ginger (*Asarum caudatum*), stream violet (*Viola glabella*), candy flower (*Montia siberica*), lace flower (*Tiarella trifoliata* var. *unifoliata*), slender-foot sedge (*Carex leptopoda*), slough sedge (*C. obnupta*), and panicled bulrush (*Scirpus microcarpus*).

Bryophytes are a conspicuous component of the herbaceous understory along the edges of Big Salmon and Hazel creeks and add to the forest's native plant diversity while providing bank stability. Species occupying the wetter central portions of creek channels and gullies that can tolerate submergence for long periods include the liverworts *Conocephalum conicum* and *Marchantia polymorpha* along with several mosses such as *Porotrichum bigelovii, Fissidens grandifrons,* and *Scleropodium obtusifolium.* Off-channel species, occupying slightly higher terraces on moist ground include mosses such as *Fissidens crispus, Plagiomnium venustum, Rhizomnium glabrascens, Kindbergia oregana, Brachythecium frigidum,* and *Leucolepis acanthoneuron,* as well as the liverworts *Targionia hypophylla* and *Scapania bolanderi*.

CNPS Inventory of Rare and Endangered Plants - Changes from 2008-2018

Since 2008 yearly queries of the California Native Plant Society Inventory of Rare and Endangered Plants are made to determine which rare species are documented within USGS 7.5' minute quads around the state. A current list of potentially occurring rare species for both the Big River and Salmon Creek Forests is provided in App. A. The query incorporates 15 USGS quads that encompass both Big River and Salmon Creek Forests in addition to all adjacent quads. All CRPR (1A – 4) are included in quad based queries in Version 8 of the Inventory, an improvement when CRPR 4 species were only obtainable for county wide queries.

Over the past ten years many important changes have been made regarding the description and status of rare plant species in California. First, Version 8 of the Online Inventory was released in Dec. of 2010. Preparation of environmental documents for review under the California Environmental Quality Act (CEQA) often use the Online Inventory to help determine the potential for resource conflicts, and to develop project-specific lists of rare plants to target during botanical surveys. The Online Inventory is continually updated as the status of rare species changes, thus providing a timely resource for rare plant protection efforts, conservation planning, and management. Bryophytes (mosses, liverworts, and hornworts) and lichens are now included in the Inventory.

CNPS initially created five California Rare Plant Ranks (CRPR), formally "CNPS Lists", in an effort to categorize degrees of concern; however, in order to better define and categorize rarity in California's flora, the CNPS Rare Plant Program and Rare Plant Program Committee developed the new California Rare Plant Ranks (CRPR) 2A and CRPR 2B.

- CRPR 2A: Plants Presumed Extirpated in California, But Common Elsewhere

- CRPR 2B: Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere

Lastly, the 2nd edition of the Jepson Manual: Vascular Plants of California (Baldwin et al. 2012) was released reflecting significant taxonomic revisions and changes to nomenclature. These have been applied throughout the body of this report and to the species lists that follow.

BR and SC taxa that have undergone changes in rarity status since 2008

- White rein orchid (*Piperia candida*) has been upgraded from CRPR 4 to CRPR 1B.2.

- Oregon goldthread (*Coptis laciniata*), has been downgraded from CRPR 2B.2 to CRPR 4.2.

- The CNPS Rare Plant Program began including Lichens of Conservation Concern in the CNPS *Inventory* in 2014; subsequently Methuselah's beard lichen (*Usnea longissima*) was assigned to CRPR 4.2.

- The pygmy cypress was changed from (*Cupressus goveniana ssp. pigmaea)* to (*Hesperocyparis pigmaea*). Its CRPR 1B.2 ranking is unchanged.

- The leafy stemmed miterwort (*Mitellastra caulescens)* was changed from CRPR 4.3 to CRPR 4.2. The older name for this taxon was *Mitella caulescens*.

Timber Harvest Plan Review

Botanical surveys within Timber Harvest Plans provide the basis, to a large extent, of our current knowledge of species occurrences and distribution in Big River and Salmon Creek Forests. Table 2 provides a list of THPs from 1996 – 2018 that were consulted for both the 2008 and 2018 Botanical Resource Assessments. Geri Hulse-Stephens reviewed plans as far back as 1996 and several in 1997, 1998, 1999 in her 2008 report. In a conversation with Charles Martin, a CDF forester she learned that full botanical surveys were not required until the California Native Plant Society (CNPS) listings of rare, endangered and threatened species were adopted around 2001 by the California Department of Fish and Game (CDF&G).

Early botanical surveys were often focused on a small group of target species, namely those rare species with the potential to occur in a project area. Current botanical survey guidelines for THPs developed by CDFW and CNPS state that surveys be floristic in nature, that is, all species, rare or otherwise, are to be documented. This insures that a more comprehensive assessment of botanical resources is provided and that rare species beyond their known range are not missed. Floristic surveys are robust and can only be achieved by personnel with a good understanding of the local flora.

The current vascular species lists for Big River (App. B) and Salmon Creek (App. C), as well as a combined list for bryophytes and lichens (App. D) reflect additions and nomenclatural changes since 2008 from botanical surveys largely conducted by Kerry Heise, Geri Hulse-Stephens, and Zoya Akulova between 2008 – 2016, and Kerry Heise, Madison Thomson, and Lauren Fety from 2016 – 2018.

Sensitive Plant Communities

As in 2008, this assessment queried a current list of Sensitive Natural Communities. Similar to Alliance and Association subgroups which are floristically based, Natural Communities are also State and Globally ranked (CDFW 2018). RareFind 5 and Bios data viewer were used to query and examine CNDDB records for Natural Communities within USGS quads for TCF Big River and Salmon Creek parcels which included: Mendocino Pygmy Cypress Forest, Coastal Valley and Freshwater Marsh, Northern Coastal Marsh, Sphagnum bog, Grand Fir Forest, Coastal Brackish Marsh, and Sphagnum Bog. Bulrush Salt Marsh was added to CNDDB after examining the Picolotti THP botanical survey report. Those Natural Communities considered sensitive (NatureServe ranks of 1-3) and that occurred within the Big River and Salmon Creek boundaries are shown below:

Salmon Creek Forest

Mendocino Pygmy Cypress Forest (G1 S1)
Areas of uplifted marine terraces and associated sandstone. Soils are acidic spodosols of the Blacklock soil series with cemented hardpans that are seasonally flooded (Sawyer et al. 2009). Regionally, stands occur from Pudding Creek to the Navarro River in Mendocino County, and scattered in Sonoma County. In the Salmon Creek Forest patches occur primarily between the Albion River Road and Little Salmon Creek.

Big River Forest

Bolboschoenus maritimus Herbaceous Alliance - Salt marsh bulrush marshes (G4 S3)
N39.30727, W123.65580: An unusual alkali spring/marsh system within the Big River floodplain just below Picolotti Crossing surrounded by redwood forest. The shallow pond is rimmed on the north and east with a dense mat of native salt grass (*Distichlis spicata*) and *Chenopodium chenopodioides,* and on the west and south sides by a monospecific stand of alkali bulrush (*Bolboschoenus maritimus* ssp. *paludosus*) and adjacent patches of slough sedge (*Carex obnupta*) and spikerush (*Eleocharis macrostachya*). Other species include Coville's rush *Juncus Covillei*), Nootka rose (*Rosa nutkana var. nutkana*), Italian ryegrass (*Festuca perennis)* and California meadow barley (*Hordeum brachyantherum* subsp. *californicum*).

Alkali marsh on Big River Forest with *Bolboschoenus maritimus* subsp. *paludosus.* Photo: K. Heise

Coastal and Valley Freshwater Marsh (G3 S2)
N39.29343, W123.67102: East end of the Big River Laguna lies just outside of the Big River Forest boundary below the confluence of Feldman Gulch and Laguna Creek. This unique fen is considered the state's largest floating mat of vegetation and is dominated by sphagnum moss (*Sphagnum* sp.), Labrador tea (*Rhododendron columbianum*), Cusick's sedge (*Carex cusickii*), and broadleaf cattail (*Typha latifolia*) (Leppig et al. 2018). Mapped in CNDDB as Coastal and Valley Freshwater Marsh but could also be described as a sphagnum bog.

Carex obnupta Herbaceous Alliance – Slough sedge swards (G4 S3)
Patches of slough sedge are common throughout Big River Forest where water accumulates in flats, or in low gradients seeps. Two larger, notable stands are presented here:

N39.30273, W123.61821: upper SW fork of Portuguese Gulch with dominant *Carex obnupta.* Other associated species include *C. leptopoda, C. amplifolia, Woodwardia fimbriata, Polystichum munitum, Equisetum telmateia, Athyrium felix-femina, Asarum caudatum, and Oenanthe sarmentosa.*

N39.31094, W123.66064: Slough sedge swards below main road 23000 and main stem Big River, between Peterson and Wheel Gulches. A long, narrow floodplain influenced meadow with slough sedge dominant along with sneezeweed (*Helenium puberulum)*, Scouler's willow (*Salix scouleriana*) and redwood around the margins. Photo: K. Heise, 4/22/2010.

Table 2. Timber Harvest Plans either reviewed or surveyed between 1996 and 2018

Salmon Creek					
THP Name	**Map**	**Finds**	**Surveyor(s)**	**Ac**	**Date**
Saghart Gulch	Yes	CABO, HEPI, MICA	Shayne Green		Pre 2008
East Rumbler	Yes	No finds	Shayne Greene		Pre 2008
Pulllman	Yes	No finds	Shayne Greene/J. McIntosh	124	Pre 2008
Mezner	Yes	CABO, MICA, HEPI, CACA	Shayne Greene	166	Pre 2008
Upper Salmon Creek	Yes	CACA, MICA, CABO, VEFI	Shayne Greene/ Jim McIntosh		Pre 2008
Pullman	Yes	No finds	Shayne Greene	407	Pre 2008
Upper Hazel	Yes	COLA	Kerry Heise / Geri Hulse-Stephens		2015
West Hazel	Yes	COLA, PICA, TRBU	Kerry Heise		2017
Big River					
Berry Gulch	Yes	No finds	Shayne Greene	334	Pre 2008
Two Log	Yes	SIMA, CABO, PICA	Shayne Greene		Pre 2008
River Bends	Yes	No finds	M. Richmond/ K. Wear/ J. McIntosh		Pre 2008
Blind Gulch	Yes	CABO	K. Heise/G. Hulse-Stephens		2008
N. of Hwy 20	Yes	CABO	K. Heise/G. Hulse-Stephens		2008
Tunzi	Yes	No finds	K. Heise/G. Hulse-Stephens		2008
Wheel Gulch	Yes	SIMA, CABO	Z. Akulova, G. Hulse-Stephens		2009
Coombs Gulch	Yes	No finds	K. Heise/G. Hulse-Stephens/Z. Akulova		2009-2010
Kidwell	Yes	CABO	K. Heise/G. Hulse-Stephens		2009-2010
Little N. Fork	Yes	CABO, COLA	K. Heise/G. Hulse-Stephens		2010
Picolotii	Yes	CABO	K. Heise/G. Hulse-Stephens		2009-2010
Shaftsky	Yes	No finds	K. Heise/G. Hulse-Stephens		2010
EBLNF	Yes	COLA, CABO	K. Heise/G. Hulse-Stephens		2010-2012
Elephant Seal	Yes	No finds	K. Heise/G. Hulse-Stephens		2011
O	Yes	CABO	K. Heise/G. Hulse-Stephens		2011
Changeling	Yes	COLA	K. Heise/G. Hulse-Stephens, M. Thomson		2013
Docker Hill	Yes	TRBU	K. Heise/G. Hulse-Stephens		2016
Ironing Board	Yes	COLA, PICA	K. Heise/G. Hulse-Stephens		2016
Rabbit Ears	Yes	COLA	K. Heise/G. Hulse-Stephens, M. Thomson		2015-2016
Elf	Yes	CABO, TRTR	K. Heise/L. Fety		2017
Jarvis	Yes	CABO, PICA	K. Heise/L. Fety/M. Thomson		2018

Table 3. Rare taxa at Salmon Creek and Big River Forest. CRPR updated Nov. 2018

Scientific Name	**Common Name**	**CRPR S/G**	**Location and notes**
Calamagrostis bolanderi CABO	Bolander's reed grass	4.2 S4 G4	**Salmon Creek** and **Big River**. Found at many locations around the properties
Campanula californica CACA	Swamp harebell	1B.2 S3 G3	**Salmon Creek**. Bogs and fens, Meadows and seeps North Coast coniferous forest
Carex californica CARCA	California sedge	2B.3 S2 G5	**Salmon Creek.** Understory of Bolander's beach pine and pygmy cypress south of Albion River Road.
Coptis laciniata COLA	Oregon goldthread	4.2 S3 G4	**Salmon Creek** and **Big River** Meadows and seeps, forest stream banks
Hesperocyparis pigmaea HEPI	Pygmy cypress	1B.2 S1 G1	**Salmon Creek**. and **Big River**, Closed-cone forests. (podizol-like soil)
Lilium rubescens LIRU (no cnddb record)	Redwood lily	4.2 S3 G4	**Big River**. Broad leafed upland forests, North Coast coniferous forests, sometimes roadsides.
Mitellastra caulescens MICA	Leafy stemmed mitrewort	4.2 S4 G5	**Salmon Creek**. North Coast coniferous forest, mesic
Pinus contorta subsp. *bolanderi* PICOBO	Bolander's beach pine	1B.2 S2 G5	**Salmon Creek**. Closed cone coniferous forest (podizol-like soil)
Piperia candida PICA	White-flowered rein orchid	1B.2 S3 G3	**Big River** and **Salmon Creek**. Broadleaved upland forest, North Coast coniferous forest.
Pityopus californicus PITCA	California pinefoot	4.2 S4 G4	**Salmon Creek**. North Cost coniferous forests, mesic
Sidalcea malachroides SIMA	Maple-leaved checkerbloom	4.2 S3 G3	**Big River**. Two locations, Broadleafed upland forest
Trifolium buckwestiorum TRBU	Santa Cruz clover	1B.1 S2 G2	**Salmon Creek** and **Big River.** Along road margins at few locations.
Trifolium trichocalyx TRTR	Monterey clover	1B.1 S1 G1	**Big River**. One location above E. Branch Little N. Fork of Big R. Along roadside, n-facing slope, Douglas fir and redwood.
Veratrum fimbriatum VEFI	Fringed false hellebore	4.3 S3 G3	**Salmon Creek.** Riparian areas in low gradient streams, Closed-cone coniferous forests, North Coast coniferous forests
Usnea longissima USLO	Long bearded lichen	4.2 S4 G4	**Salmon Creek** and **Big River,** North Coast coniferous forests

RARE SPECIES OCCURRENCES

Maple-Leafed Checkerbloom (*Sidalcea malachroides)* Malvaceae
CRPR 4.2 S3 G3

Known Range
The known range of the maple-leafed checkerbloom is restricted to sites from sea level to 720 m, near the coast, in Del Norte, Humboldt, Mendocino, Monterey, Santa Cruz and Sonoma counties and Oregon. "Threatened by logging and associated road usage, non-native plants, competition, low reproduction, road maintenance and development. Endangered in Oregon (CNPS 2018)." It has only been found in two locations at the western end of Big River Forest (Table 4).

Plant Description
A California endemic, maple-leafed checkerbloom is a perennial plant that grows from a woody base.
Stems: range between 1 to 4.5 feet tall and are bristly throughout.
Leaves: are grape-leaf-like, coarsely toothed with shallow lobes and evenly arranged on the stem.
Inflorescence: is a head-like unit of many flowers that are pistillate, staminate, bisexual or mixed.
Flowers: with petals are white and often tinged purple between 3/8 and 5/8 inches long with a notch in the tip of the petal.

Photo by Kerry Heise

Habitat
Edges of seasonally wet openings such as old log landings and dense thickets along roadsides with mixture of mostly native woody and herbaceous plants. Associated species include coyote brush (*Baccharis pilularis*), poison oak and blue blossom (*Ceanothus thyrsiflorus*), Pacific rush (*Juncus effusus*), spreading rush (*Juncus patens*), giant horsetail (*Equisetum telmateia*), Harford's sedge (*Carex harfordii*), Indian thistle (*Cirsium brevistylum*), Bolander's phacelia (*Phacelia bolanderi*), black-cap raspberry (*Rubus leucodermis*), California blackberry (*Rubus ursinus*), California canary grass (*Phalaris californica*), and Columbia brome (*Bromus vulgaris).*

Recommendations
Plants with a California Rare Plant Rank of 4 are of limited distribution or infrequent throughout a broader area in California, and their status should be monitored regularly. Should the degree of endangerment or rarity of a California Rare Plant Rank 4 plant change, it will be transferred to a more appropriate rank by CNPS rare plant botanists. Some of the plants constituting California Rare Plant Rank 4 meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and few, if any, are eligible for state listing. Nevertheless, many of them are significant locally, and CNPS strongly recommends that CRPR 4 plants be evaluated for impact significance during preparation of environmental documents relating to CEQA.

Given this, where possible a minimum buffer of 25 feet should be considered to avoid direct impact. New occurrences of the maple-leafed checkerbloom should be mapped and included into the TCF rare species databases as well as a CNDDB field form submitted.

Oregon goldthread (*Coptis laciniata*) Ranunculaceae CRPR 4.2 S3 G4

Known Range
The known range of Oregon goldthread extends between sea level and 1000 m, on moist riparian areas of the North Coast coniferous forest in Del Norte, Humboldt and Mendocino counties in California extending into Oregon and Washington where occurrences are more common. Distribution records for Mendocino County in the Consortium of California Herbaria indicate collections as far south as the Noyo River. According to Calflora there are 36 literature records for Mendocino County some dating back to 1899 and ranging from the coast to fifteen miles inland and as far south as Point Arena. The Point Arena occurrence is the most southern in its range. Occurrences within TCF parcels are along main branch and North Fork, Big River, as well as an upland site above East Branch N.F. (Table 4). In the Salmon Creek Forest is occurs along Little Salmon Creek and Hazel Creek (Table 5).

Plant Description
Oregon goldthread is an herbaceous perennial that grows from both rhizomes and stolons.
Stems: It reaches a height of approximately 10 inches.
Leaves: Plants have 3 to 8 leaves that grow from the base of the plant and are pinnately divided into three leaflets each of which has three lobes with coarsely toothed margins. The leaves are shiny and somewhat waxy in appearance.
Inflorescence: The flowering stem is shorter than the leaves during flowering, approximately 1/2 to 1 inch tall, and taller than the leaves in fruit.
Flowers: The sepals are up to 3/8 inch long, pale and linear; the petals are slightly shorter with an almost transparent linear petal with a thread-like base.
Fruit: is made up of several dry, papery, many-seeded, stalked pods that radiate horizontally from the terminal axis of the flower.

Habitat
Forms small to dense patches along river and creek corridors, although sometimes on shady N-facing slopes of Douglas-fir and redwood in deep duff on steep, rocky soils. Associated species include sword fern (*Polystichum munitum*), western trillium (*Trillium ovatum*), milk maids (*Cardamine californica*), redwood ivy (*Vancouveria planipetala*), western azalea (*Rhododendron occidentalis*), stream violet (*Viola glabella*), redwood sorrel (*Oxalis oregana*), and the mosses *Kindbergia oregana, Leucolepis ancanthoneuron* and *Porotrichum bigelovii*.

Recommendations
Plants with a California Rare Plant Rank of 4 are of limited distribution or infrequent throughout a broader area in California, and their status should be monitored regularly. Should the degree of endangerment or rarity of a California Rare Plant Rank 4 plant change, it will be transferred to a more appropriate rank by CNPS rare plant botanists. Some of the plants constituting California Rare Plant Rank 4 meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and few, if any, are eligible for state listing. Nevertheless, many of them are significant locally, and CNPS strongly recommends that CRPR 4 plants be evaluated for impact significance during preparation of environmental documents relating to CEQA.

This population of Oregon goldthread is part of the southern extension of the known range and thus should be considered locally rare. Locally rare plants are genetically adapted to tolerate conditions outside of the central range of the plant making them stronger and more broadly adapted to change. As a result, they are more likely to persist in the event of climate change and have the likelihood of supplanting less broadly adapted native species in the center of their range. This makes populations on the edge of their range of particular ecological significance (Lepig and White 2006). Observation suggests that it does not require or tolerate a disturbance regime.

Given this, where possible a minimum buffer of 25 feet should be considered to avoid direct impact. New occurrences of Oregon goldthread should be mapped and included into the TCF rare species databases as well as a CNDDB field form submitted.

Photo by Geri Hulse-Stephens

Bolander’s reed grass (*Calamagrostis bolanderi*) Poaceae CRPR 4.2 S4 G4

Known Range

The known range of the Bolander’s reed grass is restricted to sites from sea level to 500 m, near the coast, in Humboldt, Mendocino and Sonoma counties. It is a California endemic. According to the CNPS on-line inventory (8^{th} edition), it is “Possibly threatened by vehicles, logging, development, and grazing.” It is widespread across Big River, apparently less so on Salmon Creek forest.

Photo by Kerry Heise

Plant Description

Bolander’s reed grass is a perennial grass that grows from slender rhizomes. The 1-flowered spikelets with long awn attached at lemma base is characteristic of *Calamagrostis*; its rhizomatous habit and open inflorescences are distinctive for *C. bolanderi*. It blooms in late summer to early fall.

Stems are erect reaching a height of 3 to 4.5 feet, generally with 4 nodes. Leaves are flat and nearly smooth with blades 3-10 mm wide, evenly distributed along stems. Inflorescence is a more or less open panicle, 10 to 25 cm long, with spreading branches, the lower ones as much as 8 cm long, all arranged in whorls. Spikelets have smooth glumes, 3-4 mm long, with short stiff hairs on the keels. Lemmas are ± equal to the glumes with short stiff hairs throughout. The anthers are 2/3s the size of the lemma. The awn is attached near the base of the lemma, sometimes abruptly bent and extends beyond the lemma about 2 mm. The hairs at the base of the floret are short (±1 mm) and tufted.

Habitat

Found in a variety of forest settings but mostly under semi-open stands of Douglas-fir, tanoak, redwood with some shade. Often grows along seasonal road margins as well as abandoned skid trails. Common associates include *Bromus vulgaris, Clinopodium douglasii, Galium triflorum, Juncus effusus var. pacificus, Lysimachia latifolia, Oxalis oregana, Polygala californica, Polystichum munitum, Pteridium aquilinum subsp. pubescens, Viola sempervirens,* and *Whipplea modesta.*

Recommendations

Plants with a California Rare Plant Rank of 4 are of limited distribution or infrequent throughout a broader area in California, and their status should be monitored regularly. Should the degree of endangerment or rarity of a California Rare Plant Rank 4 plant change, it will be transferred to a more appropriate rank by CNPS rare plant botanists. Some of the plants constituting California Rare Plant Rank 4 meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and few, if any, are eligible for state listing. Nevertheless, many of them are significant locally, and CNPS strongly recommends that CRPR 4 plants be evaluated for impact significance during preparation of environmental documents relating to CEQA.

It persists primarily in sites that have been thinned or graded suggesting some disturbance is required for establishment. No actions are required except to continue mapping new occurrences of Bolander's reedgrass as they are discovered and submission of CNDDB field forms.

Monterey clover (*Trifolium trichocalyx*) Fabaceae
CRPR 1B.1 FE CE S1 G1

Known Range

Previously unknown beyond the Monterey Peninsula (USFWS 2009) this state and federally listed endangered species has since been documented at 23 sites across the western portion of the Garcia River Forest 28 miles to the south of the Big River occurrence. Significant from both a biogeographic and conservation perspective, these Mendocino County populations extend the range of the species approximately 200 mi (322 km) north of the Monterey Peninsula.

Monterey clover occurs at two locations, within .25 mile of each other, on seasonal Road 21020 which contours along a north facing slope of the upper East Branch Little North Fork Big River watershed. The primary population is situated along 275 feet of road surface area at 702 feet elevation (N39.33518, W123.63643). Another much smaller population occurs a short distance to the east on the outboard margin of the road at 666 feet elevation (N39.33784, W123.63544) a short distance to the east. The area is included in the Elf THP (Table 4).

Photo by Kerry Heise

Description

Monterey clover is an herbaceous annual and is extremely variable in form (Baldwin et al. 2012).

Stems: Plants are prostrate and spreading, often compact and occasionally producing one or two long prostrate stems up to 50cm long that become decumbent when supported by adjacent plants.

Leaves: Plants have cauline leaves with 5-10 mm leaflets that are oblanceolate to obovate. Stipules are toothed or lobed.
Inflorescence: Flowers are arranged in head-like clusters of 1-20 flowers subtended by a small, deeply-cut, irregularly toothed involucre that can be smooth or hairy.
Flowers: Calyces are hairy, 6-7 mm long with lobes generally longer than the tubes. Calyx lobes are bristle-tipped and sometimes slightly forked. Flowers are contained within the calyx or sometimes extend just beyond the tips of the lobes. Corollas are pale pink to lavender.
Fruit: Fruits are cylindrical and 5-7 mm. long containing up to 6 seeds.

Habitat

The area is situated within a shady, mesic redwood and Douglas fir forest. Adjacent and upslope from the primary site is a seasonal seep with Pacific rush (*Juncus effusus)* and giant horsetail (*Equisetum telmateia* ssp. *braunii)*. Associate species on the running surface include two other clovers, little hop clover (*Trifolium dubium)* and white-topped clover (*T. varigatum),* as well as hairy cat's ear (*Hypocharis radicata)*, miniature lotus (*Acmispon parviflora)* and *Gnaphalium purpureum*. Monocots include slender hair grass (*Deschampsia elongata)*, California brome (*Bromus carinatus),* and common rush (*Juncus patens)*. A suite of perennials co-occur with Monterey clover along the edges where cover is less dense. Here, associated perennials and biennials include California blackberry (*Rubus ursinus)*, Black-cap raspberry (*Rubus leucodermis),* Douglas iris *(Iris douglasiana),* bull thistle *(Cirsium vulgare),* nut sedge *(Cyperus eragrostis)*, and giant horsetail.

Recommendations

Monterey clover is highly resilient to some grading pressure and persists under regular disturbance. It is an extremely variable species in regards to yearly patterns of presence and abundance regardless of the level of disturbance. The following recommendations are developed following information gained from monitoring since 2011.

- Established permanent plot on Big River site should continue to be monitored a minimum of every 3 years.

- New *T. trichocalyx* occurrences should be documented as they are discovered and field forms sent to CNDDB as well as added to the TCF rare plant database.

- No grading restrictions other than following best management practices designed to minimize soil erosion during road maintenance activities.

- Schedules of grading activity should be maintained by TCF on a yearly basis so that more informed decisions can be made regarding optimal grading frequency to maintain population.

Santa Cruz clover (*Trifolium buckwestiorum*) Fabaceae CRPR 1B.1 S2 G2

Known Range

The known range of the *T. buckwestiorum* is restricted to Mendocino, Monterey, Santa Cruz and Sonoma counties showing a disjunct distribution pattern. Although it can dominate sites and become locally abundant in Mendocino County, it's distribution and habitat specificity is very narrow. Findings since the initial discovery in 2005 on the Garcia River Forest indicate it extends from the Buckeye Forest of northern Sonoma County northwards to Big River. It is most abundant and widespread on the Garcia River Forest.

Photo by Kerry Heise

At the northern end of its apparent range on Big River it occurs along the main road (22000) through Docker Hill THP paralleling Big River near the south end; where an estimated 500 – 750 plants occur along 50 meters of roadbed (Table 4). Only one site occurs at Salmon Creek above the road near the confluence of Little Salmon Creek and Hazel Creek consisting of two dense patches with up to 1,600 individuals (Table 5).

Description

Santa Cruz clover is an annual in the Pea Family (*Fabaceae*) that displays several growth habit phases. In more impoverished soils where moisture is limited to brief accumulations following spring storms the plant grows to about 2cm and develops sessile non-involucred heads of 1 or 2 flowers, followed by seed set before desiccation. If moisture availability is extended by cool temperatures, spring rains, or available ground water the plant gradually produces a well-developed involucre with conspicuous tooted lobes that subtend a head of a few to many flowers.

Stems: range from 2cm to more than 20cm. and are decumbent to ascending.
Leaves: occur along the stems and stipules have bristle-tipped teeth. Leaflets are .5 to 1.5 cm, round to elliptic and finely serrate.
Inflorescence: can range from a singular flower without an involucre to a head of flowers, 5 to many, nested in a bowl-shaped involucre that is irregularly toothed and cut.
Flowers: consist of a calyx tube 4-5mm, 10 veined with lobes smaller than the tube. Each lobe has 3 to 5 tiny lateral teeth ending in a 1-1.5 red bristle. The corolla is 6-7mm pale pink or white. *Seed*: 1 (2)

Habitat
At the Big River site, a shady section of roadway with pennyroyal (*Mentha pulegium*), English plantain (*Plantago lanceolatum*), little hop clover (*Trifolium dubium*), clustered clover (*T. glomeratum*), and white-topped clover (*T. variegatum*).

At the Salmon Creek site an opening dominated by exotic grasses adjacent to main road and surrounded by redwood and Douglas fir. Associated species include sweet vernal grass (*Anthoxanthum ordoratum*), velvet grass (*Holcus lanatus*), little hop clover (*Trifolium dubium*), variegated clover (*Trifolium variegatum),* common rush (*Juncus patens*), deervetch (*Acmispon parviflorus*), and hairy cat's ears (*Hypochaeris radicata*).

Recommendations
This is a disturbance adapted species and is very tolerant of grading and vehicular traffic associated with logging activities. In addition, regular grading appears to help distribute seed while reducing competition. In light of these findings we suggest that good road maintenance is beneficial to the long term viability of *T. buckwestiorum*. The following recommendations are provided for *T. buckwestiorum* across all sites on TCF parcels.

- No grading restrictions other than to follow best management practices designed to minimize soil erosion during road maintenance activities.

- New *T. buckwestiorum* occurrences should be documented as they are discovered and field forms sent to CNDDB as well as added to the TCF rare plant database.

- Schedules of grading activity should be maintained by TCF on a yearly basis so that more informed decisions can be made regarding rare plant management.

White-flowered Rein Orchid (*Piperia candida*) Orchidaceae **CRPR 1B.2 S3 G3**

Known Range
The known range of the white-flowered rein orchid in California extends from Santa Cruz and San Mateo counties northward into Sonoma, Mendocino, Humboldt, Trinity, Del Norte and Siskiyou counties. The range continues into Oregon and Washington

Description
P. candida is a perennial herb that reproduces primarily by underground tubers; production of seed is very rare. The white flowers are sparse to numerous, often on one side of the stem. The dorsal sepal has a green mid-vein. The white triangular shaped lip points downward. The spur is relatively short at only 2-3½ mm long. The flowers purportedly have a honey like fragrance. The basal leaves of mature *P. candida* typically emerge early following winter rains and wither by July or August when the plant produces a single flowering stem. Monitoring *P. candida* over the past decade has shown that individuals that flower in one year may not flower the next, and a

portion of the population may be completely dormant in any given year (Heise and Hulse-Stephens 2016).

Habitat

The white rein orchid can be found in coniferous and mixed evergreen forests primarily a short distance inland from the coast east to Hwy 101. At the Big River site several clusters of plants (up to 100 individuals) occur on west-facing slope in dense canopy of Doug fir, redwood, tanoak, and madrone. The understory is relatively open with blue huckleberry (*Vaccinium ovatum*), honeysuckle (*Lonicera hispidula*), sword fern (*Polystichum munitum*), and bracken fern (*Pteridium aquilinum* var. *pubescens*); common herbaceous species include star flower (*Lysimachia latifolia*), sweet scented bedstraw (*Galium triflorum)*, yerba de selva (*Whipplea modesta*), spotted coral root (*Corallorhiza maculata*), and western fescue (*Festuca occidentalis)*. Although these are typical associates within forest understories, roadside habitat, which is also quite common, can be quite exceptionally barren.

At the Salmon Creek site a single plant was found growing among light leaf litter and small woody debris under a semi-closed stand of redwood and grand fir. Associated species include *Whipplea modesta, Melica subulata, Toxicodendron diversilobum, Iris douglasiana, Sanicula crassicaulis, Vaccinium ovatum*, and a sparse cover of the moss *Kindbergia oregana*.

Photo by Kerry Heise

Recommendations

The distribution of *Piperia candida*, from observations on commercial timber lands in Mendocino County primarily along margins of skid trails and haul roads, suggests some level or pattern of disturbance is important in maintaining optimal habitat conditions. Local habitat conditions include partial to dense shade, thin soils with little to moderately deep leaf litter. Slash and other woody debris appear to limit establishment and success of *P. candida*. Accordingly, the following recommendations are presented:

1) A buffer (no harvest area) of at least 50 feet from all confirmed *P. candida* off-road occurrences should be maintained. All trees must be felled away from the circumscribed buffer. Any tractor work above such occurrences should avoid soil destabilization of the slope, additionally actions that could alter upslope hydrology should be avoided.

2) No grading restrictions for occurrences along permanent haul roads and skid trails, however, such occurrences should remain free of slash, woody debris, and cut logs.

3) New occurrences should be documented and CNDDB field forms submitted.

California sedge (*Carex californica*) Cyperaceae CRPR 2B.3 S2 G5

Known Range

From Outer Coast Ranges, Bay Area northward to Washington state. West of the Cascades in Oregon and Washington; disjunct in Idaho. California is southern end of its range. Although uncommon throughout its range it is not considered rare in Oregon and Washington. In Salmon Creek Forest one occurrence at south end of Albion Ridge, on south side of Albion Ridge road about 0.3 mile southeast of Middle Ridge road (Table 5).

Photo by Steve Matson

Habitat

In pygmy forest, meadows, swamps, and damp road banks in Mendocino County. Associated species include *Hesperocyparis pygmaea, Pinus contorta* subsp. *bolanderi, P. muricata, Sequoia sempervirens, Rhododendron macrophyllum, Vaccinium ovatum, Arctostaphylos nummularia* subsp. *mendocinoensis,* and *Gaultheria shallon.*

Other nearby locations where redwood and Bishop pine co-dominate in the tree layer with large shrub-dominated openings of *Arctostaphylos columbiana, Frangula californica, Gaultheria shallon, Morella californica, Rhododendron columbianum*, and *Vaccinium ovatum.* Herbaceous species include *Calamagrostis bolanderi, Luzula comosa var. elata,* and *Viola sempervirens.*

Description

A group 4 sedge (Stigmas 3; inflorescence bract sheath >= 6 mm) in the Jepson Manual. Plant rhizomatous, glabrous, 15-70cm tall, base of the plant reddish brown; the lower leaves reduced to bladeless sheaths. Inflorescence of spikelets >2, stigmas 3, fruit triangular. Perigynia strongly papillose, the scales reddish brown.

Recommendations

All of the plants constituting California Rare Plant Rank 2B meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and are eligible for state listing. Impacts to these species or their habitat must be analyzed during preparation of environmental documents relating to CEQA. Throughout its range in California the California sedge occurs primarily in pygmy cypress forest, itself a rare community type that supports other rare plant species such as the swamp harebell and Bolander’s reedgrass. 50’ buffers are the recommended distance to avoid impacting populations and the habitat they depend on.

Swamp harebell (*Campanula californica*) Campanulaceae CRPR IB.2 S3 G3

Known Range

A California endemic. Close to coast from Pt. Conception northwards to Oregon border. On the Salmon Creek Forest along Navarro Ridge; approx. 0.6 and 0.8 air mile southeast of Ketty Gulch, also pygmy woodland terrace between head of Little Salmon Creek and Big Salmon Creek.

Description

Perennial herb, hairs stiff, recurved, on stem angles, leaf margins, ovary ribs. *Stem*: clambering, 10--30 cm. *Leaf*: 10--20 mm, ovate, thin, crenate, petiole 0 or short. *Flower*: pedicel 1--20 mm; sepals spreading; corolla 8--15 mm, bell-shaped, pale blue, lobes reflexed; stamens 5 mm, base sparsely ciliate; ovary 2--3 mm, hemispheric, style +- 8 mm, white, distal 95% papillate. *Fruit*: spherical, weakly ribbed; pores basal (from Baldwin et al. 2012).

Habitat

Shady, moist to marshy areas, seeps, creek margins, roadside ditches, in redwood, redwood/Douglas fir, or pygmy cypress/Bishop pine forests. CNDDB record notes occurrence in the Salmon Creek Forest on flat marine terrace along with other rare species including *Veratrum fimbriatum* and *Calamagrostis bolanderi.* Forest type: redwood, Douglas-fir, bishop pine, pygmy cypress (not pygmy form) and plants surrounded by non-native grasses. Other sites nearby on moist ground under redwood/Bishop pine forest with *Carex obnupta, Rubus ursinus, Equisetum hymale, Lonicera hispidula, Stachys chamissonis, Struthiopteris spicant, Scirpus microcarpus.*

Recommendations

To ensure impacts such as uprooting and crushing of plants, soil compaction, and changes to local hydrology a 50 ft. buffer around swamp harebell occurrences is recommended. Swamp harebell is an obligate wetland species and thus very sensitive to changes in soil moisture and hydrology. Declines are evident in situations related to soil drying such as along roadsides subject to compaction, grading that has changed hydrology at the site scale, as well as seasonal drying related to periods of drought (Valentine et al. 2016). More directly, slash deposition heavy enough to obstruct light to the herbaceous layer, introduction and proliferation of invasive plants, and herbicide application are expected to have negative impacts (Sholars and Golec 2007). Marine conditions with more summer fog and cooler temperatures may ameliorate potential drying from thinning stands.

Fringed false hellebore (*Veratrum fimbriatum*) CRPR 4.3 S3 G3

Photo by John Doyen

Known Range

A California endemic species from coastal California, Sonoma and Mendocino County counties. Pygmy woodland terrace between head of Little Salmon Creek and Big Salmon Creek.

Description

A tall, coarse, perennial species, with leafy stems and thick rhizomes. *Leaf:* lanceolate; lower 20--50 cm, glabrous or sparsely hairy. *Inflorescence*: generally, 15--50 cm, tomentose; branches spreading; pedicels 6--12 mm. *Flower:* 6--10 mm; perianth parts diamond-shaped to ovate, white, glabrous, deeply fringed, glands 2, elliptic, yellow; stamens +- 1/2 perianth; ovary glabrous. *Fruit*: +- 8 mm, obovoid. *Seed:* +- 6 mm, +- margined (from Baldwin et al. 2012).

Habitat

Wet meadows of Coastal Scrub and North Coast coniferous forest, bogs and fens, meadows and seeps. CNDDB record notes occurrence in the Salmon Creek Forest on flat marine terrace of redwood, Douglas-fir, bishop pine, pygmy cypress, along with other rare species including *Campanula californica* and *Calamagrostis bolanderi.*

Recommendations

Plants with a California Rare Plant Rank of 4 are of limited distribution or infrequent throughout a broader area in California, and their status should be monitored regularly. Should the degree of endangerment or rarity of a California Rare Plant Rank 4 plant change, it will be transferred to a more appropriate rank by CNPS rare plant botanists. Some of the plants constituting California Rare Plant Rank 4 meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and few, if any, are eligible for state listing. Nevertheless, many of them are significant locally, and CNPS strongly recommends that CRPR 4 plants be evaluated for impact significance during preparation of environmental documents relating to CEQA.

Given this, where possible a minimum buffer of 25 feet should be considered to avoid direct impact. New occurrences of the fringed false hellebore should be mapped and included into the TCF rare species databases as well as a CNDDB field form submitted.

Pygmy cypress (*Hesperocyparis pygmaea*) Cupressaceae CRPR 1B.2 S1 G1

Known Range

California endemic. Southern North Coast Ranges (Mendocino, Sonoma counties). Distribution Outside California: reported from southwestern Oregon. In scattered areas at western end of Salmon Creek Forest, mostly on flat terraces south of Albion Ridge Road above Big Salmon Creek close to the Pacific Ocean.

Photo by Kerry Heise

Description

Habit: Shrub or tree, 1--2 m on sterile soil, 10--20(50) m on rich soil; with long whip-like ultimate shoot. *Stem:* bark fibrous, gray-brown; ultimate branches 0.9--1.1 mm diam, cylindric. *Leaf:* generally dark dull green, resin 0. *Seed Cone:* 12--27(35) mm, spheric to generally widely elliptic, tan aging gray; scales 6--10. Seed: 2.5--4.7(5.5) mm, not glaucous, dark red-brown to black, shiny or not; attachment scar inconspicuous. Elevation: 50--200(300) m. *Synonyms: Callitropsis pygmaea; Cupressus goveniana* subsp. *pygmaea; Cupressus pygmaea* (Baldwin et al. 2012).

Habitat

Confined to poorly drained, acidic, podzolic soils of uplifted marine terraces, where winter ponding frequently occurs. Here, trees are dwarfed, < 2m tall, and known as the Mendocino pygmy cypress woodland (Sawyer et al. 2009). The alliance intergrades with stands of redwood, Douglas-fir, and grand fir in deeper, richer soils. Pygmy cypress woodland is subdivided into Associations based on co-dominates with Bolander's beach pine (*Pinus contorta* subsp. *bolanderi*), Bishop pine (*P. muricata*), Western Labrador tea (*Rhododendron columbianum)*, or *Arctostaphyllos nummularia*. Other associated species within the broader Alliance include *Vaccinium ovatum, Gaultheria shallon, Rhododendron macrophyllum,* and *Xerophyllum tenax*.

Recommendations

This rare species along with the rare vegetation type that supports it (Mendocino pygmy cypress woodland, S1 G1) is of high conservation value. The Alliance is severely fragmented due to residential development, road building, off road vehicles, and indirect impacts from historic logging activities. In addition, past surveys on the Salmon Creek Forest have documented other rare species within the vegetation type (*Carex californica, Calamagrostis bolanderi*, *Pinus contorta* subsp. *bolanderi*), therefore sufficient buffers around this feature should be established prior to future development plans.

Bolander's beach pine (*Pinus contorta* subsp. *bolanderi*) Pinaceae
CRPR 1B.2   S2 G5

Photo by Dieter Wilken

Known Range
Bioregional Distribution is the North Coast (NCo), specifically Mendocino County. In scattered areas at western end of Salmon Creek Forest, mostly on flat terraces south of Albion Ridge Road above Big Salmon Creek close to the Pacific Ocean.

Description
Stem: mature bark scaly, thin; trunk generally < 2 m tall. *Leaf*: 2 per bundle, 2.5--8.6 cm; sheath persistent. *Seed Cone:* asymmetric, generally not opening, on stem many years; scale tip knobs angled, prickle < 6 mm

Habitat
Confined to poorly drained, acidic, podzolic soils of uplifted marine terraces, where winter ponding frequently occurs. At such sites trees are dwarfed and known as the Mendocino pygmy cypress woodland Alliance. Two Associations are described in Sawyer et al. (2009) that include Bolander's beach pine as a sub or co-dominant: *Hesperocyparis pygmaea/Pinus contorta* subsp. *bolanderi/Pinus muricata* and *Hesperocyparis pygmaea/Pinus contorta* subsp. *bolanderi/Rhododendron columbianum.*

Recommendations
Similar to pygmy cypress as the two species occur together. This rare species along with the rare vegetation type that supports it (Mendocino pygmy cypress woodland, S1 G1) is of high conservation value. The Alliance is severely fragmented due to residential development, road building, and indirect impacts from historic logging activities, as well as threatened by off road vehicles. In addition, past surveys on the Salmon Creek Forest have documented other rare species within the vegetation type (*Carex californica, Calamagrostis bolanderi*, *Hesperocyparis pygmaea)*, therefore sufficient buffers around this feature should be established prior to future development plans.

Leafy-stemmed mitrewort (*Mitellastra caulescens*) Saxifragaceae 4.2 S4 G5

Known Range and Habitat
From northwestern California, northwards to British Columbia; Montana. Largely a plant of shady moist mossy streambanks and terraces.

Description
Habit: Plant 1.5--4.5 dm; rhizome scaly; bulblets 0. Leaf: basal and 1--few cauline; petiole glabrous to +- hairy; blade 2--7 cm wide, +- round, lobes 3--7, teeth sharp. *Inflorescence*: blooming from tip to base; pedicel 2-8 mm. *Flower*: hypanthium 2.5--4 mm wide, saucer-shaped, +- fused to ovary; petals yellow-green, lobes 4--7, alternate, linear; stamens 5, alternate petals; filaments >> anthers, +- 2/3 calyx lobes; pistil 1, ovary > 1/2-inferior, chamber 1, placentas 2, parietal, styles 2, +- 0.2 mm, stigmas unlobed, headlike. *Fruit*: capsule, becoming widely dehiscent, forming splash cup. *Seed*: many, red-brown (to black), shiny.

Recommendations
Note: *Mitellastra caulescens* (previously *Mitella caulescens*) is easily mistaken for *Pectiantia ovalis* (previously *Mitella ovalis*) if care is not taken to determine presence of cauline leaves and direction of inflorescence blooming (tip to base in the former; base to tip in the latter).

Plants with a California Rare Plant Rank of 4 are of limited distribution or infrequent throughout a broader area in California, and their status should be monitored regularly. Should the degree of endangerment or rarity of a California Rare Plant Rank 4 plant change, it will be transferred to a more appropriate rank by CNPS rare plant botanists. Some of the plants constituting California Rare Plant Rank 4 meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and few, if any, are eligible for state listing. Nevertheless, many of them are significant locally, and CNPS strongly recommends that CRPR 4 plants be evaluated for impact significance during preparation of environmental documents relating to CEQA.

Where possible a minimum buffer of 25 feet should be considered to avoid direct impact. New occurrences of leafy-stemmed mitrewort should be mapped and included into the TCF rare species databases as well as a CNDDB field form submitted. Historic occurrences should be revisited to verify identity.

Redwood Lily (*Lilium rubescens*) Liliaceae CRPR 4.2 S3 G3

Known Range

California endemic. Northwestern California and Bay Area. Reported in Big River Forest, however no CNDDB record and no description of location available.

Description

Habit: Plant < 2 m, often glaucous; bulb +- erect-ovoid, scales unsegmented, longest 4--9 cm. *Leaf*: in 3--9 whorls, generally +- ascending, 3--13 cm, generally oblanceolate; margin generally wavy. *Inflorescence:* flowers 1--40, ascending to erect. *Flower*: funnel-shaped, fragrant; perianth parts 4.2--6.6 cm (inner wider, strongly oblanceolate), recurved in distal 33--50%, adaxially white, turning pink-purple, magenta spots minute, abaxially often +- red or +-purple; stamens held at same level as perianth, filaments +- parallel except distally, anthers 4--8 mm, pale yellow, pollen yellow; pistil 2.7--3.8 cm. *Fruit*: 2--3.7 cm, generally ribbed (Baldwin et al. 2012).

Photo by John Doyen

Habitat

Dry soils in chaparral, gaps in conifer forest, sometimes on serpentine.

Recommendations

Plants with a California Rare Plant Rank of 4 are of limited distribution or infrequent throughout a broader area in California, and their status should be monitored regularly. Should the degree of endangerment or rarity of a California Rare Plant Rank 4 plant change, it will be transferred to a more appropriate rank by CNPS rare plant botanists. Some of the plants constituting California Rare Plant Rank 4 meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and few, if any, are eligible for state listing. Nevertheless, many of them are significant locally, and CNPS strongly recommends that CRPR 4 plants be evaluated for impact significance during preparation of environmental documents relating to CEQA.

Where possible a minimum buffer of 25 feet should be considered to avoid direct impact. New occurrences of redwood lily should be mapped and included into the TCF rare species databases as well as a CNDDB field form submitted.

California pinefoot (*Pityopus californicus*) Ericaceae CRPR 4.2 S4 G4,5

Known Range
Bioregional distribution: NCo, KR, NCoRO, s SNH, CCo, SnFrB; Distribution Outside California: north to Washington. Reported from Salmon Creek Forest but no CNDDB record or location description available.

Description
Pityopus californicus is the smallest of the mycotrophic wildflowers in the Heath family. It ranges in height from 1to 10 centimeters. The entire plant is a pale creamy white. The leaves are crowded and scale-like on the flower stalk (peduncle). The inflorescence is a raceme of 2 to 11 flowers at the tip of the stem. Upon emerging from the ground, the flowers are pendant. As the anthers and stigma mature, the flowers are spreading to all most perpendicular to the stem. In 1950, noted California botanist, J.T. Howell noted that the odor of the mature plants resembled over-ripe Brie cheese and would be attractive to some animals. The fruit is a capsule. As the capsule matures, the flowers become erect. Once ripened, seed is released through slits that open from the tip to the base of the capsules. The plant is not persistent after seed dispersal (from USDA Forest Service).

Habitat:
Mesic mixed upland hardwood forest or conifer forest.

Recommendations
Plants with a California Rare Plant Rank of 4 are of limited distribution or infrequent throughout a broader area in California, and their status should be monitored regularly. Should the degree of endangerment or rarity of a California Rare Plant Rank 4 plant change, it will be transferred to a more appropriate rank by CNPS rare plant botanists. Some of the plants constituting California Rare Plant Rank 4 meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and few, if any, are eligible for state listing. Nevertheless, many of them are significant locally, and CNPS strongly recommends that CRPR 4 plants be evaluated for impact significance during preparation of environmental documents relating to CEQA.

Where possible a minimum buffer of 25 feet should be considered to avoid direct impact. New occurrences of California pinefoot should be mapped and included into the TCF rare species databases as well as a CNDDB field form submitted.

Methuselah's beard lichen (*Usnea longissima*) Parmeliaceae CRPR 4.2 S4 G4

Known Range
Northwestern California (Sonoma County northward) to Alaska; Montana, upper Midwest and New England states. Scattered location in the North Coast ranges often along rivers and streams.

Photo by Hayley Ross

Description
A pendant lichen that hangs from tree branches. It is a light yellow-green lichen with a central cord and short branches coming off of the central cord. In all *Usnea* species, the central cord is like an elastic band surrounded by a hard fungal cortex. *Usnea longissima* can be from 6 inches long up to 20 feet long (from USDA Forest Service).

Habitat
Old growth and mature Douglas fir/redwood forest in California, also on hardwoods. One documented site at Big River Forest with *Usnea* on 8 *Pseudotsuga menziesii* trees (Table 4). One site on Salmon Creek (Table 5) on n-facing slope of redwood/Doug-fir, with *Usnea* on *Sequoia. sempervirens, Pseudotsuga menziesii, Abies grandis,* and hardwoods of various size and age classes.

Recommendations
Plants with a California Rare Plant Rank of 4 are of limited distribution or infrequent throughout a broader area in California, and their status should be monitored regularly. Should the degree of endangerment or rarity of a California Rare Plant Rank 4 plant change, it will be transferred to a more appropriate rank by CNPS rare plant botanists. Some of the plants constituting California Rare Plant Rank 4 meet the definitions of the California Endangered Species Act of the California Fish and Game Code, and few, if any, are eligible for state listing. Nevertheless, many of them are significant locally, and CNPS strongly recommends that CRPR 4 plants be evaluated for impact significance during preparation of environmental documents relating to CEQA

Usnea longissima is now considered rare in the United States. Reasons for its rarity include pollution and loss of habitat. If possible, individual trees supporting Methuselah beard lichen should be protected. Additional discoveries should be documented and CNDDB records made.

Table 4. Rare plant occurrences on the Big River Forest, The Conservation Fund

SciName	ComName	Latitude	Longitude	THP
Calamagrostis bolanderi	Bolander's reedgrass	N39° 19.823'	W123° 39.167'	Kidwell
Calamagrostis bolanderi	Bolander's reedgrass	N39° 19.907'	W123° 39.166'	Kidwell
Calamagrostis bolanderi	Bolander's reedgrass	N39° 19.590'	W123° 38.399'	Kidwell
Calamagrostis bolanderi	Bolander's reedgrass	N39° 18.936'	W123° 38.636'	Picolotti
Calamagrostis bolanderi	Bolander's reedgrass	N39° 19.111'	W123° 39.338'	Picolotti
Calamagrostis bolanderi	Bolander's reedgrass	N39° 19.503'	W123° 39.916'	Picolotti
Calamagrostis bolanderi	Bolander's reedgrass	N39° 19.365'	W123° 39.350'	Picolotti
Calamagrostis bolanderi	Bolander's reedgrass	N39° 18.964'	W123° 39.281'	Picolotti
Calamagrostis bolanderi	Bolander's reedgrass	N39° 18.832'	W123° 39.175'	Picolotti
Calamagrostis bolanderi	Bolander's reedgrass	N39° 18.932'	W123° 37.602'	O
Calamagrostis bolanderi	Bolander's reedgrass	N39° 18.917'	W123° 37.604'	O
Calamagrostis bolanderi	Bolander's reedgrass	N39° 18.822'	W123° 37.734'	O
Calamagrostis bolanderi	Bolander's reedgrass	N39.33345	W123.64319	Elf
Calamagrostis bolanderi	Bolander's reedgrass	N39.33863	W123.63200	Elf
Calamagrostis bolanderi	Bolander's reedgrass	N39.33817	W123.63152	Elf
Calamagrostis bolanderi	Bolander's reedgrass	N39.34995	W123.60822	Jarvis
Calamagrostis bolanderi	Bolander's reedgrass	N39.34911	W123.60625	Jarvis
Calamagrostis bolanderi	Bolander's reedgrass	N39.34913	W123.60590	Jarvis
Coptis laciniata	Oregon goldthread	N39° 20.557'	W123° 40.294'	Little N. Fork
Coptis laciniata	Oregon goldthread	N39.34247	W123.67150	Little N. Fork
Coptis laciniata	Oregon goldthread	N39.33656	W123.65429	Little N. Fork
Coptis laciniata	Oregon goldthread	N39.34257	W123.67144	Changeling
Coptis laciniata	Oregon goldthread	N39.43373	W123.67295	Changeling
Coptis laciniata	Oregon goldthread	N39.31681	W123.62143	Ironing Board
Coptis laciniata	Oregon goldthread	N39.29369	W123.66854	Feldman Gulch
Hesperocyparis pigmaea	Pygmy cypress	N39.34626	W123.6663	Changeling
Lilium rubescens	Redwood lily	No CNDDB Records		?
Piperia candida	white-flowered rein orchid	N39.31719	W123.61218	Rabbit Ears
Piperia candida	white-flowered rein orchid	N39.31720	W123.61264	Rabbit Ears
Piperia candida	white-flowered rein orchid	N39.31649	W123.61296	Rabbit Ears
Piperia candida	white-flowered rein orchid	N39.31655	W123.61275	Rabbit Ears
Piperia candida	white-flowered rein orchid	N39.31661	W123.61270	Rabbit Ears
Piperia candida	white-flowered rein orchid	N39.31587	W123.61999	Ironing Board
Piperia candida	white-flowered rein orchid	N39.34234	W123.59496	Jarvis
Sidalcea malachroides	maple-leafed checkerbloom	N39° 19’ 02.8”	W123° 40’ 21.2"	Wheel Gulch
Sidalcea malachroides	maple-leafed checkerbloom	N39° 19’ 40.6”	W123° 40’ 28.6"	Wheel Gulch
Trifolium buckwestiorum	Santa Cruz clover	N39.30299	W123.58154	Docker Hill
Trifolium trichocalyx	Monterey clover	N39.33518	W123.63643	Elf
Trifolium trichocalyx	Monterey clover	N39.33784	W123.63544	Elf
Usnea longissima	Methusulah's beard lichen	N39.33230	W123.65257	S. of EBLNF

Table 5. Rare plant occurrences on the Salmon Creek Forest, The Conservation Fund

ScName	ComName	Latitude	Longitude	THP or Location
Calamagrostis bolanderi	Bolander's reedgrass	no cnddb		Mezner
Calamagrostis bolanderi	Bolander's reedgrass	39.19557	123.71041	south of Boyd Hill
Calamagrostis bolanderi	Bolander's reedgrass	39.20341	123.71227	Upper Salmon Cr.
Campanula californica	swamp harebell	39.19557	123.71041	south of Boyd Hill
Campanula californica	swamp harebell	39.20341	123.71227	Upper Salmon Cr.
Campanula californica	swamp harebell	39.20481	123.68481	Ketty Gulch
Campanula californica	swamp harebell	39.19247	123.68222	Navarro Ridge
Carex californica	California sedge	39.20492	123.70763	S. side Albion Ridge Road
Coptis laciniata	Oregon goldthread	39.22493	123.65810	Upper Hazel
Coptis laciniata	Oregon goldthread	39.22491	123.65765	Upper Hazel
Coptis laciniata	Oregon goldthread	39.19148	123.70093	West Hazel
Coptis laciniata	Oregon goldthread	39.19758	123.69662	West Hazel
Coptis laciniata	Oregon goldthread	39.20106	123.68467	West Hazel
Coptis laciniata	Oregon goldthread	39.20386	123.66873	West Hazel
Coptis laciniata	Oregon goldthread	39.20907	123.66768	West Hazel
Coptis laciniata	Oregon goldthread	39.21026	123.66734	West Hazel
Coptis laciniata	Oregon goldthread	39.21300	123.66760	West Hazel
Coptis laciniata	Oregon goldthread	39.22473	123.66302	West Hazel
Hesperocyparis pigmaea	Pygmy cypress	39.20492	123.70763	S. side Albion Ridge Road
Hesperocyparis pigmaea	Pygmy cypress	39.20341	123.71227	Upper Salmon Cr.
Hesperocyparis pigmaea	Pygmy cypress	39.19247	123.68222	Navarro Ridge
Mitellastra caulescens	leafy stemmed mitrewort	39.19279	123.69766	Saghart Gulch
Mitellastra caulescens	leafy stemmed mitrewort	no CNDDB		Mezner
Mitellastra caulescens	leafy stemmed mitrewort	no CNDDB		Upper Salmon Cr.
Pinus contorta subsp. *bolanderi*	Bolander's beach pine	39.20492	123.70763	S. side Albion Ridge Road
Piperia candida	white rein orchid	39.20627	123.66989	West Hazel
Pityopus californicus	California pinefoot	no CNDDB		?
Trifolium buckwestiorum	Santa Cruz clover	39.20627	123.66989	West Hazel
Usnea longissima	Methuseleh's beard lichen	39.19226	123.71829	Navarro Ridge Rd.
Veratrum fimbriatum	fringed false hellebore	39.20341	123.71227	Upper Salmon Cr.

INVASIVE PLANT OCCURENCES AND RECOMMENDATIONS

Between 2008 - 2018 Big River Forest gained 68 additional exotic species for a total of 156 while Salmon Creek Forest gained 23, for a total of 72 exotic species (Table 1). Of these, 23 are listed by California Invasive Plant Council (Cal-IPC), five of which are rated "High": jubata Grass (*Cortaderia jubata*), Scotch Broom (*Cytisus scoparius*), French Broom (*Genista monspessulana*), English Ivy (*Hedera helix*), and Himalayan blackberry (*Rubus ameniacus*), see Table 6 below. "High" Cal-IPC rated species have severe ecological impacts on physical processes, plant and animal communities and vegetation structure. Their biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Table 6. Exotic Plants with Cal-IPC Ratings of the Big River and Salmon Creek Properties. Note: List updated and revised in 2018. * new taxa added since 2008

Scientific name *new to list	Common name	Mixed Hardwood =MH Redwood/Doug-Fir =RD Grassland =G Riparian=R Roadcuts, Cliffs, Outcrops=RC Wet seep=WS S=scrub Road margins, disturbed ground= RM	Rating High=H Moderate =M Limited= L	Property Salmon Creek (SC Big River (BR) *new to site
**Agrostis stolonifera*	Creeping bent	G, WS	L	BR, SC
Anthoxanthum ordoratum	Sweet vernal grass	G, RC	L	SC, BR
Avena barbata	Wild oat	G, RC	M	SC, BR
Brassica rapa	Field mustard	G, RC	L	BR
Briza maxima	Rattlesnakegrass	G, RC	L	SC, BR
Bromus diandrus	Ripgut brome	MH, RD, G, RC	M	BR, *SC
Bromus hordeaceus	Soft brome	G	L	SC, BR
Carduus pycnocephalus	Italian thistle	MN, RD, G, RC, S	M	BR
**Centaurea melitensis*	tocalote	G, RC	M	BR
Cirsium arvense	Canada thistle	RD, R, G,	M	SC, BR
Cirsium vulgare	Bull thistle	R, WS	M	SC, BR
**Conium maculatum*	Poison hemlock	R	M	BR
**Cynosurus echinatus*	Hedgehog dogtail	G, RC, WS	M	SC, BR
Cortadaria jubata	Jubata grass	RD, RC	H	SC, BR
**Cytisus scoparius*	Scotch Broom	RD, RC	H	BR, SC
**Dactylis glomerata*	Orchard grass	WS	L	BR, SC
**Digitalis purpurea*	Foxglove	RD, WS	L	BR, SC
**Dipsacus fullonum*	Common teasel	G, WS	M	BR
**Dipsacus sativus*	Fuller's teasel	G, WS	M	BR
Erodium cicutarium	Redstem filaree	RC, G	L	BR
Festuca arundinacea	Tall fescue	G, *WS, *R	M	*BR, SC

Festuca myuros	Rattail fescue	RC, S	M	BR
**Festuca perennis*	Italian ryegrass	G, WS, R, MH	M	BR, SC
**Foeniculum vulgare*	Fennel	G, RC	M	BR
Genista monspessulana	French broom	MH, G, S	H	SC, BR
**Geranium dissectum*	Cutleaf geranium	G, WS	L	BR, SC
**Hedera helix*	English Ivy	RD, MH	H	BR
Holcus lanatus	velvet grass	G, WS	M	SC, BR
**Hordeum marinum*	Mediterranean barley	G, RC	M	BR
**Hypericum perforatum*	St. John's wort	MH, RD, G, S	L	BR
Hypochaeris glabra	Smooth cat's ear	MH, RC, S	L	BR
Hypochaeris radicata	Rough cat's ear	MH, RC, S	M	SC, BR
**Lythrum hyssopifolium*	Hyssop loosestrife	WS	M	BR, SC
Medicago polymorpha	California bur clover	RC, G	L	BR, *SC
Mentha pulegium	Penny royal	WS	M	SC, BR
Myosotis latifolia	forget-me-not	RD, R	L	BR
Parentucellia viscosa	Yellow glandweed,	G	L	BR
Phalaris aquatica	Harding grass	G	M	SC, BR
Plantago lanceolata	English plantain	RC, G	L	SC, BR
**Polypogon monspeliensis*	Rabbits foot grass	R, WS	L	BR, SC
Ranunculus repens	Creeping buttercup	RD, R	L	BR
**Rubus armeniacus*	Himalayan blackberry	R, WS	H	BR, SC
Rumex acetosella	Sheep sorrel	RD, G, R, WS	M	SC, BR
Rumex crispus	Curly dock	G, WS, R	L	BR, *SC
**Rytidosperma penicillatum*	Hairy oatgrass	G	L	BR, SC
Senecio glomeratus	Cutleaf burnweed	RD, S	M	BR, SC
Senecio jacobaea	Tansy ragwort	G, R	L	SC, BR
Silybum marianum	Blessed milkthistle	G, R	L	BR
**Stipa miliacea*	Smilo grass	R	L	BR
Torilis arvensis	Hedge parsley	MX, RD, RC	M	SC, BR
**Trifolium hirtum*	Rose clover	RM	L	BR, SC
**Verbascum thapsus*	Woolly mullein	G, RC	L	BR
**Vinca major*	periwinkle	R, WS	M	SC

High-these species have severe ecological impacts on physical processes, plant and animal communities and vegetation structure; Their biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate-these species have substantial and apparent but generally not severe_ ecological impacts on physical processes, plant and animal communities, and vegetation structures. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal through establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Limited- these species are invasive but their ecological impacts area minor on a statewide level or there was not enough information to justify a high score. Their reproductive biology and other attributes result tin low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but the species may be locally persistent and problematic.

The Big River - Salmon Creek Forest Invasive Plant Management Plan (BRSCFIPMP) was prepared by Geri Hulse-Stephens for The Conservation Fund in 2009. It states that the management goal for invasive plants is to reverse the spread of invasive species using mechanical means of control as the preferred method. The introduction and success of invasive species, especially jubata grass and French broom is an important factor influencing herbaceous composition on both the Big River and Salmon Creek Forests. Where adequate light and water combine with disturbed soils, infestations of both jubata grass and French broom have become established especially along open roads and at landings.

According to Blair et al, (2010) the impact of exotic species such and French broom and English ivy in the redwood forest understory is not fully known, but their spread in logging gaps may change hydrology, mycorrhizal composition, and interrupt regeneration of disturbance-dependent native species, possible leading to their extinction. Further, invasion of logging gaps by exotic species and the increase in exotic species richness in gaps of increasing size is likely due to increase in light availability.

French broom (*Genista monspessulana*) Control

French broom has been managed by hand and mechanical removal on portions of the Salmon Creek Forest but some mature and immature plants remain. The use of heavy equipment can cause significant disturbance that will bring about re-sprouting from the seed bank. Prior to timber harvest operations, mature plants should be removed by weed wrench or excavator, soil shaken loose from the roots and plants stacked for burning. Used in conjunction with hand removal of year-old plants an area can be left for one year after disturbance, before plants begin to flower, and returned to the following year for hand removal of all sprouts to reverse any infestation stimulated by soil disturbance.

Jubata grass (*Cortaderia jubata*) Control

Where flowering plants are disturbed the short-lived seed sprouts easily in loose soil. The BRSCFIPMP recommends that areas where flowering plants have been removed follow-up removal should take place within the next two years. Seedlings are easily removed by hand at 2 years of age and follow-up eradication efforts can be conducted accordingly. Plants would be excavated, as much soil shaken loose from them as possible and piled in an opening to decompose where they would not be disturbed. Root wads would be piled separately from slash piles. Some of the most difficult infestations to eliminate have been those where jubata grass was piled amongst slash and pushed down a hill. Excavated jubata grass plants have also been disposed of effectively by piling in deep shade.

BIG RIVER FOREST

The following are notable infestations, however, with the exception of English ivy, both French broom and jubata grass are widespread.

French broom (*Genista monspessulana*)

GEMO 1 - A large stand of French broom occurs along Road 24200, approaching Gate B7.
GEMO 2 - Three small occurrences of Scotch broom were observed on seasonal roads, Road 23885 and road 21100 on north and west-facing aspects at exposed sites.
GEMO 3 – Changeling THP, N39 20.705' W123 39.997'
GEMO 4 - N39 20.793' W123 40.218') Approximately 250 French broom plants about eight feet tall crowded by jubata grass over approximately 20 percent of the stand.
GEMO 5 - N39.31072, W123.58508 Both Scotch and French broom occur along the margins of the main road (#22000) above Two Log confluence for approximately 160 meters. This is a highly disturbed area adjacent to a prior patch of clear cut.
GEMO 6 – Elf THP, N39.34134, W123.62887 Interspersed along the ridge road at the northern boundary of the Elf THP. Densest infestations are at the eastern end of the road

English ivy (*Hedera helix*)

Covering an area of approximately 200 square feet adjacent to Road 21020 at N39 20.253', W123 37.601'

Jubata grass (*Cortaderia jubata*)

COJU 1 - N39 20.596 W123 39.795) A stand of jubata grass that grows on the slope above the road as high as 50 feet and extends along approximately 150 feet of the roadside
COJU 2 - N39.33392˚, W123.62505˚ Along Road 21100 at the north end of Ironing Board THP. The occurrence occupied the road shoulders and occasionally extended both above and below the road. The length of the infestation was approximately 100 meters.

SALMON CREEK FOREST

Jubata Grass (*Cortaderia jubata*)

COJU 1- 75-foot portion of old road where a stand of mature non-flowering plants were observed, located at N39 21.157 W123 64.075, elevation 779 feet.
COJU 2 - located on an approximate 200-foot stretch of unmaintained road and comprised of a stand of mature non-flowering plants, located at
N39 20.995 W123 64.153, elevation 891 feet.
COJU 3 - comprised of mass of mature, non-flowering plants in an area approximately 50 by 75 feet located at N3921.721 W123 65.347 elevation 984 feet.
COJU 4 - comprised of a stand of mid-aged to mature flowering plants, located at
N39 12.803 W 123 38.865.

GEMO 1 - The thick cover of broom covering approximately 30m of roadbed. N39.22575, W123.66708
GEMO 2 - was observed along the ridge top road, spreading in the vicinity of N3920.947 W123 64.465, elevation 976 feet.

Invasive Pathogens (Sudden Oak Death)
Outbreaks of Sudden Oak Death (SOD) caused by the pathogen *Phytopthora ramorum* have killed hundreds of thousands of native oak and tanoak trees in 15 coastal and near coastal counties in California since 1995 when it was first discovered. Intensive efforts to monitor the extent, pathology and control are underway by the California Oak Mortality Task Force and other research institutions. SOD BioBlitz's have been organized for the past several years and have greatly increased our knowledge of the extent and spread of SOD. Up to date materials related to research, treatment and diagnosis, management guidelines, and SOD education are available from the UC Berkeley Forest Pathology and Mycology Lab.
https://nature.berkeley.edu/garbelottowp/

As of 2018 no cure for Sudden Oak Death or other *P. ramorum*-associated diseases has been found, however a number of preventive measures that may protect plants are available (Swiecki 2013). A recent 2016 SOD BioBlitz to the western portion of Mendocino County mapped many infected bay trees just south of the Big River Forest, east of Comptche, although more coastal samples between the Navarro and Little Rivers were negative (SOD BioBlitz 2016).

Over the past few years forestry surveys on the Big River and Salmon Creek Properties have observed substantial tanoak mortality along both Big Salmon Creek and the mainstem of Big River (M. Thomson, Pers. Comm. Nov. 2018). In these situations SOD infected bay trees were present.

A list of regulated hosts and plants associated with Phytopthora ramorum is regularly updated and available on line at www.aphis.usda.gov/ppq/ispm/pramorum.

SOD hosts known to be on the TCF Properties are: (*added since 2008)
Acer macrophyllum, big leaf maple
Adiantum aleuticum, western maidenhair fern
Adiantum jordani, California maidenhair fern
**Aesculus californica,* California buckeye
Arbutus menziesii, madrone
Arctostaphylos manzanita, manzanita
Frangula californica (Rhamnus californica), California coffeeberry
Frangula purshiana (Rhamnus purshiana), cascara
**Heteromeles arbutifolia,* toyon

Lonicera hispidula, California honeysuckle
Maianthemum racemosum (Smilacina racemosa), false Solomon's seal
Notholithocarpus densiflorus, tan oak
Pseudotsuga menziesii var. menziesii and all nursery grown *P. menziesii*, Douglas-fir
**Quercus agrifolia,* coast live oak
**Quercus chrysolepis,* canyon live oak
**Quercus kelloggii*, black oak
**Quercus parvula* var. *shrevei* Shreve oak
Rhododendron macrophyllum, California rose bay
Rhododendron occidentale, western azalea
Rosa gymnocarpa, wood rose
Sequoia sempervirens, coast redwood
Lysimachia latifolia, western starflower
Umbellularia californica, California bay laurel
Vaccinium ovatum, evergreen huckleberry

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Appendix A: Query of rare taxa from 15 USGS quads which encompass Salmon Creek and Big River Forest parcels along with adjacent quads.

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 30 October 2018].

Note: Taxa in bold occur on the Salmon Creek and Big River Forests.

Scientific Name	Common Name	Family	CRPR	GRank	SRank	CESA	FESA	Bloom	Habitat
Abronia umbellata var. breviflora	pink sand-verbena	Nyctaginaceae	1B.1	G4G5T2	S2	None	None	Jun-Oct	Coastal dunes
Agrostis blasdalei	Blasdale's bent grass	Poaceae	1B.2	G2	S2	None	None	May-Jul	Coastal bluff scrub, Coastal dunes, Coastal prairie
Angelica lucida	sea-watch	Apiaceae	4.2	G5	S3	None	None	May-Sep	Coastal bluff scrub, Coastal dunes, Coastal scrub, Marshes and swamps (coastal salt)
Arctostaphylos nummularia ssp. mendocinoensis	pygmy manzanita	Ericaceae	1B.2	G3?T1	S1	None	None	Jan	Closed-cone coniferous forest (acidic sandy clay)
Astragalus agnicidus	Humboldt County milk-vetch	Fabaceae	1B.1	G2	S2	CE	None	Apr-Sep	Broadleafed upland forest, North Coast coniferous forest
Blennosperma nanum var. robustum	Point Reyes blennosperma	Asteraceae	1B.2	G4T2	S2	CR	None	Feb-Apr	Coastal prairie, Coastal scrub
Calamagrostis bolanderi	**Bolander's reed grass**	**Poaceae**	**4.2**	**G4**	**S4**	**None**	**None**	**May-Aug**	**Bogs and fens, Broadleafed upland forest, Closed-cone coniferous forest, Coastal scrub, Meadows and seeps (mesic), Marshes and swamps (freshwater), North Coast coniferous forest**

Calamagrostis crassiglumis	Thurber's reed grass	Poaceae	2B.1	G3Q	S2	None	None	May-Aug	Coastal scrub (mesic), Marshes and swamps (freshwater)
Calystegia purpurata ssp. saxicola	coastal bluff morning-glory	Convolvulaceae	1B.2	G4T2T3	S2S3	None	None	Apr-Sep	Coastal bluff scrub, Coastal dunes, Coastal scrub, North Coast coniferous forest
Campanula californica	**swamp harebell**	**Campanulaceae**	**1B.2**	**G3**	**S3**	**None**	**None**	**Jun-Oct**	**Bogs and fens, Closed-cone coniferous forest, Coastal prairie, Meadows and seeps, Marshes and swamps (freshwater), North Coast coniferous forest**
Carex californica	California sedge	Cyperaceae	2B.3	G5	S2	None	None	May-Aug	Bogs and fens, Closed-cone coniferous forest, Coastal prairie, Meadows and seeps, Marshes and swamps (margins)
Carex lenticularis var. limnophila	lagoon sedge	Cyperaceae	2B.2	G5T5	S1	None	None	Jun-Aug	Bogs and fens, Marshes and swamps, North Coast coniferous forest
Carex livida	livid sedge	Cyperaceae	2A	G5	SH	None	None	Jun	Bogs and fens
Carex lyngbyei	Lyngbye's sedge	Cyperaceae	2B.2	G5	S3	None	None	Apr-Aug	Marshes and swamps (brackish or freshwater)
Carex saliniformis	deceiving sedge	Cyperaceae	1B.2	G2	S2	None	None	Jun(Jul)	Coastal prairie, Coastal scrub, Meadows and seeps, Marshes and swamps (coastal salt)
Castilleja ambigua var. ambigua	johnny-nip	Orobanchaceae	4.2	G4T5	S4	None	None	Mar-Aug	Coastal bluff scrub, Coastal prairie, Coastal scrub, Marshes and swamps, Valley and foothill grassland, Vernal pools margins

Castilleja ambigua var. humboldtiensis	Humboldt Bay owl's-clover	Orobanchaceae	1B.2	G4T2	S2	None	None	Apr-Aug	Marshes and swamps (coastal salt)
Castilleja litoralis	Oregon coast paintbrush	Orobanchaceae	2B.2	G3	S3	None	None	Jun-Jul	Coastal bluff scrub, Coastal dunes, Coastal scrub
Castilleja mendocinensis	Mendocino Coast paintbrush	Orobanchaceae	1B.2	G2	S2	None	None	Apr-Aug	Coastal bluff scrub, Closed-cone coniferous forest, Coastal dunes, Coastal prairie, Coastal scrub
Ceanothus gloriosus var. exaltatus	glory brush	Rhamnaceae	4.3	G4T4	S4	None	None	Mar-Jun	Chaparral
Ceanothus gloriosus var. gloriosus	Point Reyes ceanothus	Rhamnaceae	4.3	G4T4	S4	None	None	Mar-May	Coastal bluff scrub, Closed-cone coniferous forest, Coastal dunes, Coastal scrub
Chorizanthe howellii	Howell's spineflower	Polygonaceae	1B.2	G1	S1	CT	FE	May-Jul	Coastal dunes, Coastal prairie, Coastal scrub
Chrysosplenium glechomifolium	Pacific golden saxifrage	Saxifragaceae	4.3	G5	S3	None	None	Feb-Jun	North Coast coniferous forest, Riparian forest
Clarkia amoena ssp. whitneyi	Whitney's farewell-to-spring	Onagraceae	1B.1	G5T1	S1	None	None	Jun-Aug	Coastal bluff scrub, Coastal scrub
Collinsia corymbosa	round-headed Chinese-houses	Plantaginaceae	1B.2	G1	S1	None	None	Apr-Jun	Coastal dunes
Coptis laciniata	**Oregon goldthread**	**Ranunculaceae**	**4.2**	**G4?**	**S3?**	**None**	**None**	**Mar-May**	**Meadows and seeps, North Coast coniferous forest (streambanks)**
Cornus canadensis	bunchberry	Cornaceae	2B.2	G5	S2	None	None	May-Jul	Bogs and fens, Meadows and seeps, North Coast coniferous forest
Cuscuta pacifica var. papillata	Mendocino dodder	Convolvulaceae	1B.2	G5T1	S1	None	None	Jul-Oct	Coastal dunes (interdune depressions)

Cypripedium montanum	mountain lady's-slipper	Orchidaceae	4.2	G4	S4	None	None	Mar-Aug	Broadleafed upland forest, Cismontane woodland, Lower montane coniferous forest, North Coast coniferous forest
Erigeron biolettii	streamside daisy	Asteraceae	3	G3?	S3?	None	None	Jun-Oct	Broadleafed upland forest, Cismontane woodland, North Coast coniferous forest
Erigeron supplex	supple daisy	Asteraceae	1B.2	G2	S2	None	None	May-Jul	Coastal bluff scrub, Coastal prairie
Erysimum concinnum	bluff wallflower	Brassicaceae	1B.2	G3	S2	None	None	Feb-Jul	Coastal bluff scrub, Coastal dunes, Coastal prairie
Erysimum menziesii	Menzies? wallflower	Brassicaceae	1B.1	G1	S1	CE	FE	Mar-Sep	Coastal dunes
Erythronium revolutum	coast fawn lily	Liliaceae	2B.2	G4G5	S3	None	None	Mar-Jul	Bogs and fens, Broadleafed upland forest, North Coast coniferous forest
Fissidens pauperculus	minute pocket moss	Fissidentaceae	1B.2	G3?	S2	None	None		North Coast coniferous forest (damp coastal soil)
Fritillaria roderickii	Roderick's fritillary	Liliaceae	1B.1	G1Q	S1	CE	None	Mar-May	Coastal bluff scrub, Coastal prairie, Valley and foothill grassland
Gilia capitata ssp. pacifica	Pacific gilia	Polemoniaceae	1B.2	G5T3	S2	None	None	Apr-Aug	Coastal bluff scrub, Chaparral (openings), Coastal prairie, Valley and foothill grassland
Gilia millefoliata	dark-eyed gilia	Polemoniaceae	1B.2	G2	S2	None	None	Apr-Jul	Coastal dunes
Hemizonia congesta ssp. congesta	congested-headed hayfield tarplant	Asteraceae	1B.2	G5T2	S2	None	None	Apr-Nov	Valley and foothill grassland
Hesperevax sparsiflora var. brevifolia	short-leaved evax	Asteraceae	1B.2	G4T3	S2	None	None	Mar-Jun	Coastal bluff scrub (sandy), Coastal dunes, Coastal prairie

Hesperocyparis pygmaea	**pygmy cypress**	**Cupressaceae**	**1B.2**	**G1**	**S1**	**None**	**None**		**Closed-cone coniferous forest (usually podzol-like soil)**
Hesperolinon adenophyllum	glandular western flax	Linaceae	1B.2	G2G3	S2S3	None	None	May-Aug	Chaparral, Cismontane woodland, Valley and foothill grassland
Horkelia marinensis	Point Reyes horkelia	Rosaceae	1B.2	G2	S2	None	None	May-Sep	Coastal dunes, Coastal prairie, Coastal scrub
Hosackia gracilis	harlequin lotus	Fabaceae	4.2	G3G4	S3	None	None	Mar-Jul	Broadleafed upland forest, Coastal bluff scrub, Closed-cone coniferous forest, Cismontane woodland, Coastal prairie, Coastal scrub, Meadows and seeps, Marshes and swamps, North Coast coniferous forest, Valley and foothill grassland
Juncus supiniformis	hair-leaved rush	Juncaceae	2B.2	G5	S1	None	None	Apr-May	Bogs and fens, Marshes and swamps (freshwater)
Kopsiopsis hookeri	small groundcone	Orobanchaceae	2B.3	G4?	S1S2	None	None	Apr-Aug	North Coast coniferous forest
Lasthenia californica ssp. bakeri	Baker's goldfields	Asteraceae	1B.2	G3T1	S1	None	None	Apr-Oct	Closed-cone coniferous forest (openings), Coastal scrub, Meadows and seeps, Marshes and swamps
Lasthenia californica ssp. macrantha	perennial goldfields	Asteraceae	1B.2	G3T2	S2	None	None	Jan-Nov	Coastal bluff scrub, Coastal dunes, Coastal scrub
Lathyrus palustris	marsh pea	Fabaceae	2B.2	G5	S2	None	None	Mar-Aug	Bogs and fens, Coastal prairie, Coastal scrub, Lower montane coniferous forest, Marshes and swamps, North Coast coniferous forest

Lilium maritimum	coast lily	Liliaceae	1B.1	G2	S2	None	None	May-Aug	Broadleafed upland forest, Closed-cone coniferous forest, Coastal prairie, Coastal scrub, Marshes and swamps (freshwater), North Coast coniferous forest
Lilium rubescens	**redwood lily**	**Liliaceae**	**4.2**	**G3**	**S3**	**None**	**None**	**Apr-Aug**	**Broadleafed upland forest, Chaparral, Lower montane coniferous forest, North Coast coniferous forest, Upper montane coniferous forest**
Listera cordata	heart-leaved twayblade	Orchidaceae	4.2	G5	S4	None	None	Feb-Jul	Bogs and fens, Lower montane coniferous forest, North Coast coniferous forest
Lycopodium clavatum	running-pine	Lycopodiaceae	4.1	G5	S3	None	None	Jun-Aug	Lower montane coniferous forest (mesic), Marshes and swamps, North Coast coniferous forest (mesic)
Microseris borealis	northern microseris	Asteraceae	2B.1	G5	S1	None	None	Jun-Sep	Bogs and fens, Lower montane coniferous forest, Meadows and seeps
Mitellastra caulescens	**leafy-stemmed mitrewort**	**Saxifragaceae**	**4.2**	**G5**	**S4**	**None**	**None**	**Apr-Oct**	**Broadleafed upland forest, Lower montane coniferous forest, Meadows and seeps, North Coast coniferous forest**
Packera bolanderi var. bolanderi	seacoast ragwort	Asteraceae	2B.2	G4T4	S2S3	None	None	Apr-Aug	Coastal scrub, North Coast coniferous forest
Phacelia insularis var. continentis	North Coast phacelia	Hydrophyllaceae	1B.2	G2T2	S2	None	None	Mar-May	Coastal bluff scrub, Coastal dunes

Pinus contorta ssp. bolanderi	**Bolander's beach pine**	**Pinaceae**	**1B.2**	**G5T2**	**S2**	**None**	**None**		**Closed-cone coniferous forest (podzol-like soil)**
Piperia candida	**white-flowered rein orchid**	**Orchidaceae**	**1B.2**	**G3**	**S3**	**None**	**None**	**May-Sep**	**Broadleafed upland forest, Lower montane coniferous forest, North Coast coniferous forest**
Pityopus californicus	**California pinefoot**	**Ericaceae**	**4.2**	**G4G5**	**S4**	**None**	**None**	**May-Aug**	**Broadleafed upland forest, Lower montane coniferous forest, North Coast coniferous forest, Upper montane coniferous forest**
Pleuropogon hooverianus	North Coast semaphore grass	Poaceae	1B.1	G2	S2	CT	None	Apr-Jun	Broadleafed upland forest, Meadows and seeps, North Coast coniferous forest
Pleuropogon refractus	nodding semaphore grass	Poaceae	4.2	G4	S4	None	None	Apr-Aug	Lower montane coniferous forest, Meadows and seeps, North Coast coniferous forest, Riparian forest
Puccinellia pumila	dwarf alkali grass	Poaceae	2B.2	G4?	SH	None	None	Jul	Marshes and swamps (coastal salt)
Ramalina thrausta	angel's hair lichen	Ramalinaceae	2B.1	G5	S2?	None	None		North Coast coniferous forest
Rhynchospora alba	white beaked-rush	Cyperaceae	2B.2	G5	S2	None	None	Jun-Aug	Bogs and fens, Meadows and seeps, Marshes and swamps (freshwater)
Sanguisorba officinalis	great burnet	Rosaceae	2B.2	G5?	S2	None	None	Jul-Oct	Bogs and fens, Broadleafed upland forest, Meadows and seeps, Marshes and swamps, North Coast coniferous forest, Riparian forest
Sidalcea calycosa ssp. rhizomata	Point Reyes checkerbloom	Malvaceae	1B.2	G5T2	S2	None	None	Apr-Sep	Marshes and swamps (freshwater, near coast)

Sidalcea malachroides	**maple-leaved checkerbloom**	**Malvaceae**	**4.2**	**G3**	**S3**	**None**	**None**	**Apr-Aug**	**Broadleafed upland forest, Coastal prairie, Coastal scrub, North Coast coniferous forest, Riparian woodland**
Sidalcea malviflora ssp. patula	Siskiyou checkerbloom	Malvaceae	1B.2	G5T2	S2	None	None	May-Aug	Coastal bluff scrub, Coastal prairie, North Coast coniferous forest
Sidalcea malviflora ssp. purpurea	purple-stemmed checkerbloom	Malvaceae	1B.2	G5T1	S1	None	None	May-Jun	Broadleafed upland forest, Coastal prairie
Tiarella trifoliata var. trifoliata	trifoliate laceflower	Saxifragaceae	3.2	G5T5	S2S3	None	None	Jun-Aug	Lower montane coniferous forest, North Coast coniferous forest
Trifolium buckwestiorum	**Santa Cruz clover**	**Fabaceae**	**1B.1**	**G2**	**S2**	**None**	**None**	**Apr-Oct**	**Broadleafed upland forest, Cismontane woodland, Coastal prairie**
Trifolium trichocalyx	**Monterey clover**	**Fabaceae**	**1B.1**	**G1**	**S1**	**CE**	**FE**	**Apr-Jun**	**Closed-cone coniferous forest (sandy, openings, burned areas)**
Triquetrella californica	coastal triquetrella	Pottiaceae	1B.2	G2	S2	None	None		Coastal bluff scrub, Coastal scrub
Usnea longissima	**Methuselah's beard lichen**	**Parmeliaceae**	**4.2**	**G4**	**S4**	**None**	**None**		**Broadleafed upland forest, North Coast coniferous forest**
Veratrum fimbriatum	**fringed false-hellebore**	**Melanthiaceae**	**4.3**	**G3**	**S3**	**None**	**None**	**Jul-Sep**	**Bogs and fens, Coastal scrub, Meadows and seeps, North Coast coniferous forest**
Viburnum ellipticum	oval-leaved viburnum	Adoxaceae	2B.3	G4G5	S3?	None	None	May-Jun	Chaparral, Cismontane woodland, Lower montane coniferous forest
Viola palustris	alpine marsh violet	Violaceae	2B.2	G5	S1S2	None	None	Mar-Aug	Bogs and fens (coastal), Coastal scrub (mesic)

Vascular Plants of the Big River Forest, The Conservation Fund, Mendocino County, CA
Updated: Nov. 20, 2018
Nomenclature and taxonomy follow the Jepson Manual, Higher Plants of California, 2nd ed. 2012 and Jepson Flora Project (eds.) 2018. Jepson eFlora, http://ucjeps.berkeley.edu/eflora/, accessed on Oct. 1, 2018.
Total taxa = 541, Families = 89, Exotics = 158 (29%)
Rare species in Bold

Family	Scientific Name	Common Name	Exotic
LYCOPHYTES - Spike Mosses, Club Mosses, Quillworts			
Selaginellaceae - Spike-Moss family			
	Selaginella wallacei		
FERNS			
Athyriaceae - Lady Fern Family			
	Athyrium filix-femina var. cyclosorum	lady fern	
Azollaceae - Mosquito-fern Family			
	Azolla filiculoides	mosquito fern	
Blechnaceae -Deer Fern Family			
	Struthiopteris spicant (Blechnum s.)	deer fern	
	Woodwardia fimbriata	giant chain fern	
Cystopteridaceae - Fragile Fern Family			
	Cystopteris fragilis	fragile fern	
Dennstaedtiaceae - Bracken Fern Family			
	Pteridium aquilinum var. pubescens	bracken fern	
Dryopteridaceae -Wood Fern Family			
	Dryopteris arguta	wood fern	
	Dryopteris expansa	wood fern	
	Polystichum californicum	California sword fern	
	Polystichum imbricans ssp. imbricans		
	Polystichum munitum	western swordf fern	
Equisetaceae - Horsetail Family			
	Equisetum arvense	common horsetail	
	Equisetum hyemale ssp. affine	common scouring rush	
	Equisetum laevigatum	smooth scouring rush	
	Equisetum telmateia ssp. braunii	giant horsetail	
Polypodiaceae - Polypody Family			
	Polypodium calirhiza	nested polypody	
	Polypodium glycyrrhiza	licorice fern	
	Polypodium scouleri	leather leaf fern	
Pteridaceae - Brake Fern Family			
	Adiantum aleuticum	five-finger fern	
	Adiantum capillus-veneris	Venus' hair fern	

	Adiantum jordanii		
	Pentagramma triangularis ssp. *triangularis*	goldenback fern	
GYMNOSPERMS - Conifers			
Cupressaceae - Cypress Family			
	Cupressus lawsoniana	Port Orford cedar	
	Hesperocyparis macrocarpa	Monterey cypress	x
	Sequoia sempervirens	coast redwood	
Pinaceae - Pine Family			
	Abies grandis	grand fir	
	Pinus radiata	Monterey pine	x
	Pseudotsuga menziesii	Douglas fir	
	Tsuga heterophylla	western hemlock	
Taxaceae - Yew Family			
	Torreya californica	California nut-meg	
MAGNOLIIDS			
Aristolochiaceae - Pipevine Family			
	Asarum caudatum	wild-ginger	
Lauraceae - Laurel Family			
	Umbellularia californica	California bay	
EUDICOTS			
Adoxaceae - Muskroot Family			
	Sambucus nigra subsp. *caerulea (Sambucus mexicana)*	blue elderberry	
	Sambucus racemosa	red elderberry	
Anacardiaceae - Sumac Family			
	Toxicodendron diversilobum	poison oak	
Apiaceae - Carrot Family			
	Conium maculatum	poison hemlock	x
	Daucus carota		x
	Daucus pusillus	rattlesnake weed	
	Foeniculum vulgare	fennel	x
	Heracleum maximum (Heracleum lanatum)	cow parsnip	
	Lomatium macrocarpum		
	Oenanthe sarmentosa		
	Osmorhiza berteroi (O. chilensis)	sweet cicley	
	Perideridia kelloggii	yampah	
	Sanicula bipinnatifida	purple sanicle	
	Sanicula crassicaulis	gamble weed	
	Sanicula laciniata		
	Torilis arvensis	Japanese hedge parsley	x
	Torilis nodosa	knotted hedge parsley	x
	Yabea microcarpa	hedge parsley	
Araliaceae - Ginsing Family			

	Aralia californica	elk clover	
	Hedera helix	English ivy	x*
Asteraceae - Aster Family			
	Achillea millefolium	yarrow	
	Adenocaulon bicolor	trail plant, silver arrow	
	Agoseris grandiflora	grand mountain dandelion	
	Agoseris heterophylla		
	Anisocarpus madioides (Madia madioides)	woodland tarweed	
	Anaphalis margaritacea	pearly everlasting	
	Arnica discoidea		
	Artemisia douglasiana	mugwort	
	Artemisia suksdorfii	coastal mugwort	
	Baccharis glutinosa (B. douglasii)	marsh baccharis	
	Baccharis pilularis	Coyote Brush	
	Bellis perennis		x
	Carduus pycnocephalus	Italian thistle	x*
	Centaurea melitensis	Napa thistle, tocalote	x*
	Chrysanthemum segetum	corn chrysanthemum	x
	Cirsium arvense		x
	Cirsium brevistylum		
	Cirsium occidentale var. venustum	Venus thistle	
	Cirsium vulgare	bull thistle	x
	Crepis capillaris	smooth hawksbeard	x
	Erigeron canadensis (Conyza c.)	horseweed	x
	Erigeron foliosus var. *mendocinus*		
	Eriophyllum lanatum var. achilleoides	common wooly sunflower	
	Euchiton gimnocephalus (Gnaphalium collinum)	creeping cudweed	
	Euchiton sphaericus (Gnaphalium japonicum)		x
	Eurybia radulina (Aster radulinus)	broad-leafed aster	
	Gamochaeta ustulata (Gnaphalium purpureum)	featherweed	
	Helenium puberulum	rosilla, sneezeweed	
	Hemizonella minima (Madia minima)	small tarweed	
	Hieracium albiflorum	Hawkweed	
	Hypochaeris glabra	Smooth Cat's Ear	x
	Hypochaeris radicata	hairy cat's ear	x
	Lactuca saligna	willow lettuce	x
	Lactuca virosa	wild lettuce	x
	Leontodon saxatilis subsp. *saxatilis (L. taraxacoides)*	hairy hawkbit	x
	Leucanthemum vulgare	ox-eye daisy	x
	Logfia filaginoides (Filago californica)	California cottonrose	
	Logfia gallica (Filago gallica)	daggerleaf cottonrose	x
	Madia exigua	litter tarweed	

	Madia gracilis	gumweed, slender tarweed	
	Madia sativa	coast tarweed	
	Matricaria discoidea	pineapple weed	
	Micropus californicus	slender cottonweed	
	Petasites frigidus var. *palmatus*	coltsfoot	
	Pseudognaphalium californicum	California cudweed	
	Pseudognaphalium luteo-album	cudweed	x
	Pseudognaphalium ramosissimum	everlasting	
	Pseudognaphalium stramineum		
	Psilocarphus brevissimus var. brevissimus	dwarf woolly-heads	
	Senecio glomeratus (Erechitites g.)		x
	Senecio jacobaea	tansy ragwort	x
	Senecio minimus (Erechitites m.)	coastal burnweed	x
	Senecio vulgaris	common ragwort	x
	Silybum marianum	milk vetch	x
	Soliva sessilis		x
	Sonchus asper	prickly sow thistle	x
	Sonchus oleraceus	common sow thistle	x
	Symphyotrichum chilense (Aster chilensis)	American aster	
	Taraxacum officionale	California dandelion	x
	Tolpis barbata		x
	Xanthium strumarium	cocklebur	
Berberidaceae - Barberry Family			
	Achlys californica	vanilla leaf	
	Berberis nervosa	barberry	
	Vancouveria planipetala	redwood ivy	
Betulaceae - Birch Family			
	Alnus rhombifolia	white alder	
	Alnus rubra	red alder	
	Corylus cornuta subsp. californica	hazelnut	
Boraginaceae - Borage Family			
	Cryptantha torreyana	Torrey's cryptantha	
	Cynglossum grande	hound's tongue	
	Heliotropium curassavicum	salt heliotrope	
	Hydrophyllum tenuipes	Pacific waterleaf	
	Myosotis discolor	blue scorpion grass	x
	Myosotis latifolia	forget-me-not	
	Nemophila heterophylla		
	Nemophila parviflora		
	Nemophila pedunculata		
	Phacelia bolanderi		
	Plagiobothrys bracteatus		

	Romanzoffia californica		
Brassicaceae- Mustard Family			
	Barbarea orthoceras	winter cress	
	Brassica rapa	field mustard	
	Cardamine californica	milk maids	x
	Cardamine oligosperma		
	Hirschfeldia incana	short-pod mustard	x
	Raphanus raphanistrum	jointed charlock	x
	Rorippa curvisiliqua		
	Turritis glabra (Arabis g.)	tower mustard	
Campanulaceae - Bluebell Family			
	Asyneuma prenanthoides (Campanula p.)	California harebell	
	Heterocodon rariflorum		
Caprifoliaceae - Honeysuckle Family			
	Lonicera hispidula	honeysuckle	
	Symphoricarpos albus var. *laevigatus*	snowberry	
	Symphoricarpos mollis	creeping snowberry	
Caryophyllaceae - Pink Family			
	Cerastium arvense	field chickweed	
	Cerastium fontanum subsp. vulgare	common mouse-eared chickweed	x
	Cerastium glomeratum	mouse-ear chickweed	x
	Moenchia erecta	upright chickweed	x
	Petrorhagia dubia		x
	Polycarpon tretraphyllum	four-leaved allseed	x
	Sagina apetela	dwarf pearl-wort	
	Sagina decumbens subsp. occidentalis	pearlwort	
	Silene gallica	windmill Pink	x
	Silene laciniata subsp. californica	Indian Pink	
	Spergularia rubra	sand-spurrey	x
	Stellaria borealis subsp. sitchana	Sitka willow	
	Stellaria crispa		
	Stellaria longipes subsp. longipes	Goldie's starwort	
	Stellaria media	common chickweed	x
	Stellaria nitens	shining chick-weed	
Celastraceae - Staff Tree Family			
	Euonymus occidentalis var. *occidentalis*	western burning bush	
Chenopodiaceae - Goosefoot Family			
	Chenopodium chenopodioides		x
	Dysphania ambrosioides (Chenopodium a.)	Mexican tea	x
	Dysphania bothrys (Chenopodium b.)	Jerusalem oak	x
	Dysphania chilensis	Chilean worm seed	x

Convolvulaceae - Morning-Glory Family			
	Calystegia purpurata subsp. purpurata		
	Convolvulus arvense	common bindweed	x
Cornaceae - Dogwood Family			
	Cornus nuttallii	mountain dogwood	
	Cornus sericea subsp. *sericea*	western dogwood	
Crassulaceae - Stonecrop Family			
	Crassula connata	sand pygmy-weed	
	Crassula tillaea		
Datiscaceae - Datisca Family			
	Datisca glomerata	Durango Root	
Dipsacaceae - Teasel Family			
	Dipsacus fullonum	Fuller's teasel	x
	Dipsacus sativus	wild teasel	x
Ericaceae - Heath Family			
	Allotropa virgata	sugar stick	
	Arbutus menziesii	madrone	
	Arctostaphylos columbiana	Pacific manzanita	
	Arctostaphylos glandulosa subsp. glandulosa		
	Arctostaphylos manzanita subsp. glaucescens	common manzanita	
	Arctostaphylos manzanita subsp. manzanita	common manzanita	
	Chimaphila menziesii	little prince's pine	
	Chimaphila umbellata	pipsissewa	
	Gaultheria shallon	salal	
	Hemitomes congestum	gnome plant	
	Pyrola picta	white-veined wintergreen	
	Rhododendron macrophyllum	California rosebay	
	Rhododendron occidentale	western azalea	
	Vaccinium ovatum	California huckleberry	
	Vaccinium parvifolium	red huckleberry	
Euphorbiaceae - Spurge Family			
	Croton setigerus (Eremocarpus s.)	turkey mullein	
	Euphorbia crenulata	Chinese cups	x
Fabaceae - Pea Family			
	Acmispon americanus (Lotus purshianus)	Spanish lotus	
	Acmispon brachycarpus (Lotus humistratus)	deervetch	
	Acmispon glaber (Lotus scoparius)	California broom	
	Acmispon parviflorus (Lotus micranthus)	deervetch	
	Cytisus scoparius	Scotch broom	x
	Genista monspessulana	French Broom	x*
	Hosackia rosea (Lotus aboriginus)		
	Lathyrus angulatus		x

	Lathyrus jepsonii var californicus		
	Lathyrus polyphyllus		
	Lathyrus latifolius	perennial sweet pea	x
	Lathyrus sulphureus		
	Lathyrus torreyi		
	Lathyrus vestitus var. vestitus	hillside pea	
	Lotus angustissimus	slender lotus	x
	Lotus corniculatus	birdfoot trefoil	x
	Lotus tenuis		x
	Lupinus arboreus		
	Lupinus bicolor	miniature lupine	
	Lupinus rivularis		
	Medicago polymorpha	California burclover	x
	Melilotus albus	white sweetclover	x
	Trifolium barbigerum var barbigerum		
	Trifolium bifidum var bifidum	pinole clover	
	Trifolium bifidum var decipiens		
	Trifolium buckwestiorum	**Santa Cruz clover**	
	Trifolium campestre	hop cover	x
	Trifolium cernuum		
	Trifolium ciliolatum		
	Trifolium depauperatum	balloon clover	
	Trifolium dubium	little hop clover	x
	Trifolium glomeratum	clustered clover	x
	Trifolium gracilentum	pinpoint clover	
	Trifolium hirtum	rose clover	x
	Trifolium microcephalum	small head clover	
	Trifolium microdon	thimble clover	
	Trifolium oliganthum	few-flowered clover	
	Trifolium repens	white clover	x
	Trifolium striatum		x
	Trifolium subterraneum	subterranean Clover	x
	Trifolium trichocalyx	**Monterey clover**	
	Trifolium varigatum	varigated clover	
	Trifolium willdenovii	tomcat clover	
	Vicia americana	American vetch	
	Vicia gigantea		
	Vicia hirsuta		x
	Vicia lathyroides	spring pea vetch	x
	Vicia sativa ssp nigra	narrow-leaved vetch	x
	Vicia sativa ssp sativa	spring vetch	x
	Vicia tetrasperma		x

Fagaceae - Beech Family			
	Chrysolepis chrysophylla var. chrysophylla	chinquapin	
	Notholithocarpus densiflorus var. densiflorus	tan oak	
	Quercus chrysolepis	canyon live oak	
	Quercus kelloggii	black oak	
Gentianaceae - Gentian Family			
	Cicendia quadrangularis		
	Zeltnera venusta	California centaury	
Geraniaceae - Geranium Family			
	Erodium botrys	broadleaf filaree	x
	Erodium cicutarium	red-stemmed filaree	x
	Geranium dissectum	cut-leaf geranium	x
	Geranium molle	dove-foot geranium	x
Grossulariaceae - Gooseberry Family			
	Ribes menzisii	canyon gooseberry	
	Ribes sanguineum var. glutinosum	red-flowering currant	
Hypericaceae - St. John's Wort Family			
	Hypericum anagalloides	tinker's penny	
	Hypericum perforatum	Klamath weed	x*
Lamiaceae - Mint Family			
	Clinopodium douglasii (Satureja d.)	yerba buena	
	Melissa officinalis	bee balm	
	Mentha arvensis	field mint	x
	Mentha canadensis	American cornmint	
	Mentha pulegium	penny royal	x*
	Prunella vulgaris var. lanceolata	self-heal	
	Prunella vulgaris var. vulgaris		x
	Stachys ajugoides	hedge nettle	
	Stachys rigida subsp. *quercetorum*	hedge nettle	
	Stachys chamissonis	coast hedge nettle	
	Trichostema lanceolatum	vinegar weed	
Linaceae - Flax Family			
	Linum bienne	common flax	x
Lythraceae - Loosestrife Family	Loosestrife Family		
	Lythrum hyssopifolium	loosestrife	x
Malvaceae - Mallow Family			
	***Sidalcea malachroides* CRPR 4.2**	**maple-leafed checkerbloom**	**x**
Montiaceae - Montia Family			
	Calandrinia menziesii	red maids	
	Claytonia parviflora subsp. parviflora	streamside spring beauty	

	Claytonia perfoliata subsp. mexicana		
	Claytonia perfoliata subsp. perfoliata	miner's lettuce	
	Claytonia rubra subsp. *rubra*	redstemmed spring beauty	
	Claytonia sibirica	candy flower	
	Montia siberica		
	Montia fontana	water chickweed	
Myricaceae- Wax Mytrle Family			
	Morella californica (Myrica california)	California wax myrtle	
Myrsinaceae - Myrsine Family			
	Lysimachia arvensis (Anagallis arvensis)	scarlet pimpernel	x
	Lysimachia latifolia (Trientalis latifolia)	star flower	
Nymphaeaceae - Waterlily Family			
	Nuphar polysepala (Nuphar lutea subsp. polysepala)	yellow pond lily	
Oleaceae - Olive Family			
	Fraxinus latifolia	Oregon ash	
Onagraceae - Evening Primrose Family			
	Epilobium brachycarpum		
	Epilobium ciliatum ssp. ciliatum	Northern willow herb	
	Epilobium densiflorum		
	Epilobium minutum		
Orobanchaceae - Broomrape Family			
	Parentucellia viscosa		x
	Pedicularis densiflora	Indian warrior	
	Triphysaria pusilla		
	Triphysaria versicolor ssp. versicolor		
Oxalidaceae- Oxalis Family			
	Oxalis oregana	redwood sorrel	
Papaveraceae - Poppy Family			
	Dicentra formosa	bleeding heart	
	Eschscholzia californica	California poppy	
Philadelphaceae - Mock Orange Family			
	Whipplea modesta	yerba de selva, modesty	
Phrymaceae - Lopseed Family			
	Mimulus aurantiacus	sticky monkey-flower	
	Mimulus cardinalis	scarlet monkey flower	
	Mimulus guttatus	common monkeyflower	
	Mimulus moschatus	musk monkeyflower	
	Mimulus pilosus	false monkeyflower	
Plantaginaceae - Plantain Family			
	Callitriche heterophylla var. bolanderi	Bolander's Water-Starwort	
	Callitriche marginata		
	Digitalis purpurea	foxglove	x

	Gratiola ebracteata	bractless hedge-hyssop	
	Plantago lanceolata	English plantain	x
	Plantago major	common plantain	x
	Plantago subnuda	naked plantain	
	Synthyris reniformis	snow queen	
	Veronica americana	American brooklime	
	Veronica anagallis-aquatica	water speedwell	x
	Veronica arvensis	common speedwell	x
	Veronica peregrina ssp. xalapensis	purslane speedwell	
	Veronica persica	Persian speedwell	x
	Veronica scutellata	marsh speedwell	
Polemoniaceae - Phlox Family			
	Collomia heterophylla	varied-leaf collomia	
	Leptosiphon bicolor (Linanthus b.)	bicolored linanthus	
	Navarretia squarrosa	skunkweed	
Polygalaceae - Milkwort Family			
	Polygala californica	California milkwort	
Polygonaceae - Buckwheat Family			
	Persicaria amphibia (Polygonum amphibium var. emersum)	water smartweed	
	Persicaria hydropiper (Polygonum hydropiper)	waterpepper	x
	Persicaria hydropiperoides (Polygonum hydropiperoides)	small false waterpepper	
	Persicaria lapathifolia (Polygonum lapathifolium)	willow weed	
	Persicaria punctata (Polygonum punctatum)	water smartweed	
	Polygonum aviculare subsp. *depressum*	common smartweed	x
	Rumex acetosella	sheep sorrel	x
	Rumex conglomeratus	clustered dock	x
	Rumex crispus	curly dock	x
	Rumex obtusifolius	bitter dock	x
	Rumex transitorius (R. salicifolius)	willow dock	
Ranunculaceae - Buttercup Family			
	Actaea rubra	red baneberry	
	Anemone deltoidia	windflower	
	Aquilegia formosa	columbine	
	Coptis laciniata	**goldthreads**	
	Delphinium nudicaule	red larkspur	
	Ranunculus californicus	California buttercup	
	Ranunculus hebecarpus		
	Ranunculus occidentalis	western buttercup	
	Ranunculus parviflorus		x
	Ranunculus repens	creeping buttercup	x
	Ranunculus uncinatus	woodland buttercup	
Resedaceae - Mignonette Family			

	Reseda luteola	Dyer's rocket	x
Rhamnaceae - Buckthorn Family			
	Ceanothus foliosus var. foliosus		
	Ceanothus thyrsiflorus		
	Ceanothus velutinus	tobacco brush	
	Frangula californica (Rhamnus californica)	California coffeeberry	
	Frangula purshiana (Rhamnus purshiana)	cascara	
Rosaceae - Rose Family			
	Aphanes occidentalis	western ladies mantle	
	Cotoneaster pannosa		x
	Drymocallis glandulosa var. glandulosa (Potentilla g.)	sticky cinquefoil	
	Fragaria vesca	woodstrawberry	
	Heteromeles arbutifolia	toyon	
	Holodiscus discolor	ocean spray	
	Horkelia californica var. *californica*		
	Horkelia californica var. *elata*		
	Malus pumila	apple	x
	Prunus domesticum	plum	x
	Pyrus communis	common pear	x
	Rosa gymnocarpa	wood rose	
	Rubus armeniacus (R. discolor)	Himalayan blackberry	x
	Rubus leucodermis	western raspberry	
	Rubus parviflorus	thimbleberry	
	Rubus ursinus	California blackberry	
Rubiaceae - Madder Family			
	Galium aparine	goose grass	x
	Galium californicum ssp. californicum	California bedstraw	
	Galium muricatum	Humboldt bedstraw	
	Galium parisiense	wall bedstraw	x
	Galium porrigens var. porrigens	climbing bedstraw	
	Galium triflorum	sweet-scented bedstraw	
	Sherardia arvensis	field madder	x
Salicaceae - Willow Family			
	Salix exigua var. hindsii	narrow-leaf willow	
	Salix laevigata	red willow	
	Salix lasiolepis	arroyo willow	
	Salix lasiandra	Pacific willow	
	Salix scouleriana	Scouler's willow	
	Salix sitchensis	Sitka willow	
Sapindaceae - Soapberry Family			
	Acer macrophyllum	big leaf maple	
	Aesculus californica	California buckeye	

Saxifragaceae - Saxifrage Family			
	Boykinia occidentalis		
	Heuchera micrantha	alum root	
	Pectiantia ovalis = Mitella ovalis	Bishop's cup	
	Saxifraga mertensiana	Merten's saxifrage	
	Tellima grandiflora	fringe cups	
	Tiarella trifoliata var. unifoliata	lace flower	
Scrophulariaceae - Figwort Family			
	Scrophularia californica	California figwort	
	Verbascum thapsus	woolly mullein	x
Solanaceae - Nightshade Family			
	Solanum americanum		
Urticaceae - Nettle Family			
	Urtica dioica subsp. gracilis	American stinging nettle	
Verbenaceae - Vervain Family			
	Verbena lasiostachys var. lasiostachys		
Violaceae - Violet Family			
	Viola glabella	stream violet	
	Viola ocellata	western heart's ease	
	Viola sempervirens	evergreen violet	
MONOCOTS			
Agavaceae - Century Plant Family			
	Chlorogalum pomeridianum	soaproot	
Alismataceae – Water Plantain Family			
	Alisma trivale (A. plantago-aquatica)	water plantain	
Alliaceae - Onion Family			
	Allium neopolitanum	Naple's garlic	x
	Allium unifolium		
Araceae - Arum Family			
	Lemna minuta		
	Lemna minor	duckweed	
Cyperaceae - Sedge Family			
	Bolboschoenus maritimus subsp. *paludosus*		
	Carex amplifolia	big-leaf sedge	
	Carex bolanderi	Bolander's sedge	
	Carex echinata subsp. *phyllomanica*	star sedge	
	Carex exsiccata (C. vesicaria var. major)	inflated sedge	
	Carex globosa	round-fruited sedge	
	Carex gynodynama	wonder-woman sedge	
	Carex harfordii	Harford's sedge	
	Carex hendersonii	timber sedge	
	Carex leptopoda	slender-foot sedge	

	Carex nudata	torrent sedge	
	Carex obnupta	slough sedge	
	Carex subfusca	rusty brome sedge	
	Carex tumulicola	foothill sedge	
	Carex vesicaria	inflated sedge	
	Cyperus eragrostis	nutsedge	
	Eleocharis macrostachya	spikerush	
	Isolepis carinata (Scirpus koilolepis)		
	Scirpus microcarpus	panicled bulrush	
Iridaceae - Iris Family			
	Iris douglasiana	Douglas Iris	
	Sisyrinchium bellum	blue-eyed grass	
Juncaceae - Rush Family			
	Juncus articulatus	jointed rush	
	Juncus bolanderi	Bolander's rush	
	Juncus bufonius var. bufonius	toad rush	
	Juncus bufonius var. occidentalis	dwarf toad rush	
	Juncus capitatus	dwarf rush	x
	Juncus covillei	Coville's rush	
	Juncus dubius	mariposa rush	
	Juncus effusus var. pacificus	Pacific rush	
	Juncus ensifolius	dagger rush	
	Juncus occidentalis	western rush	
	Juncus patens	common rush	
	Juncus phaeocephalus	brown-headed rush	
	Juncus tenuis	slender rush	
	Juncus xiphioides	iris leaved rush	
	Luzula comosa	wood rush	
	Luzula parviflora subsp. *parviflora*	woodrush	
Liliaceae - Lily Family			
	Calochortus tolmei	pussy ears	
	Clintonia andrewsiana	clintonia	
	Fritillaria affinis	checker lily	
	Lilium pardalinum	leopard lily	
	Lilium rubescens **CRPR 4.2**	**redwood lily**	
	Prosartes hookeri (Disporum hookeri)	Hooker's fairybell	
	Prosartes smithii (Disporum smithii)	Smith's fairybell	
	Scoliopus bigelovii	fetid adders tongue	
Melanthiaceae - False-Hellebore Family			
	Toxicoscordion fremontii (Zigadenus fremontii)	death camus	
	Trillium ovatum	western trillium	
	Xerophyllum tenax	bear-grass	

Orchidaceae - Orchid family			
	Calypso bulbosa	calypso orchid	
	Cephalanthera austiniae	phantom orchid	
	Corallorhiza maculata	spotted coralroot	
	Corallorhiza mertensiana	western coralroot	
	Corallorhiza striata	striped coralroot	
	Epipactis gigantea	streamside orchid	
	Goodyera oblongifolia	rattlesnake-plantain	
	Piperia candida	**white rein orchid**	
	Piperia elongata	wood rein orchid	
	Piperia transversa	flat spurred piperia	
Poaceae - Grass Family			
	Agrostis exarata		
	Agrostis gigantea	redtop	x
	Agrostis pallens	dune bent grass	
	Agrostis stolonifera	redtop	x*
	Aira caryophyllea	silver European hairgrass	x
	Aira praecox		x
	Alopecurus pratensis	meadow foxtail	x
	Anthoxanthum aristatum	annual vernal grass	x
	Anthoxanthum occidentale (Hierochloe occidentalis)	sweet grass	
	Anthoxanthum ordoratum	sweet vernal grass	x
	Avena barbata	slender wild oat	x
	Avena fatua	wild oats	x
	Briza maxima	big quaking grass	x
	Briza minor	little quaking grass	x
	Bromus arenarius	Australian chess	x
	Bromus carinatus var. carinatus	California brome	
	Bromus diandrus	ripgut brome	x
	Bromus hordeaceus	soft chess	x
	Bromus laevipes	woodland brome	
	Bromus sterilis	poverty brome	x
	Bromus tectorum	cheatgrass brome	x
	Bromus vulgaris		
	Calamagrostis bolanderi	**Bolander's Reedgrass**	
	Calamagrostis rubescens	pine grass	
	Cortaderia jubata	Jubata Grass	x*
	Cynodon dactylon	Bermuda grass	x
	Cynosurus cristatus	crested dogtail	x
	Cynosurus echinatus	hedgehog dogtail	x
	Dactylis glomerata	orchard grass	x
	Danthonia californica	California oatgrass	

	Deschampsia danthonioides	annual hairgrass	
	Deschampsia elongata	slender hairgrass	
	Distichlis spicata	salt grass	
	Echinochloa crus-galli	barnyard grass	x
	Elymus glaucus ssp. glaucus	blue wildrye	
	Elymus triticoides	beardless wildrye	
	Festuca arundinacea	tall Fescue	x
	Festuca bromoides	brome fescue	x
	Festuca californica	California Fescue	
	Festuca elmeri	Elmer's fescue	
	Festuca microstachys		
	Festuca myuros	sixs weeks rattail fescue	x
	Festuca occidentalis	western fescue	
	Festuca perennis (Lolium multiflorum, L. perenne)	Italian ryegrass	x
	Festuca rubra	red Fescue	
	Festuca subulata		
	Festuca subuliflora		
	Gastridium phleoides (G. ventricosum)	nit grass	x
	Glyceria elata	fowl mannagrass	
	Glyceria xoccidentalis	western mannagrass	
	Holcus lanatus	common velvet grass	x
	Hordeum brachyantherum ssp. brachyantherum	meadow barley	
	Hordeum jubatum subsp. jubatum	foxtail barley	x
	Hordeum marinum ssp. gussoneanum	Mediterranean barley	x
	Hordeum vulgare		x
	Melica harfordii		
	Melica subulata	Alaskan Oniongrass	
	Melica torreyana	Torrey's melic	
	Muhlenbergia mexicana	Mexican muhly	
	Paspalum dilatatum	dallis grass	x
	Phalaris aquatica	harding grass	x
	Phalaris californica	California canary grass	
	Poa annua	annual bluegrass	x
	Poa kellogii	Kellogg's bluegrass	
	Poa nemoralis	wood bluegrass	x
	Poa pratensis	Kentucky bluegrass	x
	Poa secunda ssp. secunda	One-sided bluegrass	
	Poa trivialis	rough bluegrass	x
	Polypogon australis	Chilean beardgrass	x
	Polypogon interruptus	ditch beard grass	x
	Polypogon monspeliensis	annual beard grass	x
	Rytidosperma penicillatum (Danthonia pilosa)	hairy oatgrass	x

	Setaria viridis	setaria	x
	Stipa miliacea (Piptatherum miliaceum)	smilo grass	x
	Torreyochloa pallida var. paciflora	pale false mannagrass	
	Trisetum canescens	smooth trisetum	
Potamogetonaceae - Pondweed Family			
	Potamogeton natans	floating-leaved pond weed	
Ruscaceae - Buthcher's-Broom Family			
	Maianthemum racemosum (Smilacina racemosa)	branched false solomon's seal	
	Maianthemum stellatum (Smilacina stellata)	star false solomon's seal	
Themidaceae - Brodiaea Family			
	Brodiaea elegans subsp. elegans	harvest brodiaea	
	Dichelostemma capitatum ssp.capitatum	blue dicks	
	Dichelostemma ida-maia	fire cracker flower	
	Triteleia laxa	Ithuriel's spear	
Typhaceae - Cattail Family			
	Sparganium emersum	bur-reed	
	Typha latifolia	broad-leaf cattail	

Survey Dates (Since 2008) Note: in 2008 KLH and GHS surveyed N. Hwy 20, Blind Gulch, and Tunzi THPs.
GHS, Z. Akulova-Barlow (ZAB) 4/13, 4/13, 5/20, 5/29, 6/15, 6/16, 2009 (Wheel Gulch THP). GHS, ZAB 4/30, 5/20, 7/17, 2009. KLH, GHS 5/13, 6/21, 7/1, 2010 (Coombs Gulch THP). GHS, ZAB 7/1, 8/8, 8/13, 8/18, 2009. KLH, GHS 4/28, 5/20, 6/15, 2010 (Kidwell THP). KLH, GHS 5/18, 5/21, 7/23, 2010 (Little NF THP). GHS, ZAB 8/14, 8/18, 2009. GHS, ZAB, 8/14, 8/18, 2009. KLH, GHS 4/22, 4/27, 5/20, 5/21, 6/14, 6/15, 2010 (Picolotii THP). KLH, GHS, 5/13, 6/22, 6/24, 2010 (Shaftsky THP). KLH and GHS 4/22, 4/27, 4/28, 5/18. 5/20, 5/21, 6/14, 6/15, 7/23, 8/8, 8/13. 8/14, 8/18, 2010; 4/14, 5/27,6/6, 6/17, 2011; 4/20, 5/22, 6/7, 2012 (EBLNF THP) KLH and GHS 4/28/4/29. 5/2, 5/4, 5/5, 5/12 6/17, 6/29, 6/30, 7/11, 8/9, 8/17, 2011 (Elephant Seal and O THPs). KLH and GHS 4/23, 4/25, 5/21, 7/30, 2013 (Changeling THP). KLH and GHS 5/5, 5/6, 5/17, 5/27, 6/17, 6/21, 7/13, 7/15, 2016 (Docker Hill and Ironing Board THPs). KLH and GHS 5/4, 5/5, 5/12, 6/17, 6/29, 6/30, 2011; 4/25, 6/26, 6/27, 2012; 7/15, 8/18, 9/2, 9/3, 2015; 3/15, 3/29, 5/27, 6/17, 2016 (Rabbit Ears). KLH 4/9, 4/21, 5/1, 5/11, 5/26, 6/8, 7/12. 2017 (Rabbit Ears Amend.) KLH 4/15, 5/1, 5/8, 5/26, 6/6, 7/12, 8/15, 9/21, 2017 (Elf THP). KLH 5/9, 5/10, 5/30, 6/13, 2018 (Jarvis THP).

Appendix C: Vascular Plants of the Salmon Creek Forest, TCF, Mendocino County, CA

Nomenclature and taxonomy follow the Jepson Manual, Higher Plants of California, 2nd ed. 2012 and

Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/eflora/ accessed 10/8/2018.

Zika, P., Wilson, B., and J. Kirschner. 2015. The Luzula comosa complex (Luzula Sect. Luzula, Juncaceae) in western N. America. Phylotaxa 192 (4): 201-229.

Surveys between 2008-2018 conducted by Kerry Heise and Geri Hulse-Stephens

Survey dates since 2008: March 12, 27, May 21, July 2 of 2015 (K. Heise and G. Hulse-Stephens); April 14, 20, May 5, 4, June 1, July 14, Aug 15, of 2017 (K. Heise)

Rare plants in bold

Total taxa = 289; Families = 70; Exotics = 72 (25%)

Family	*Scientific Name*	Common Name	Exotic
FERNS			
Athyriaceae - *Lady Fern Family*			
	Athyrium filix-femina	lady fern	
Blechnaceae -Deer Fern Family			
	Struthiopteris spicant (Blechnum s.)	deer fern	
	Woodwardia fimbriata	giant chain fern	
Dennstaedtiaceae - Bracken Fern Family			
	Pteridium aquilinum var. pubescens	bracken fern	
Dryopteridaceae -Wood Fern Family			
	Dryopteris expansa	wood fern	
	Polystichum munitum	western sword fern	
Equisetaceae - Horsetail Family			
	Equisetum hymale subsp. *affine*	common scouring rush	
	Equisetum telmateia subsp. *braunii*	giant horsetail	
Pteridaceae - Brake Fern Family			
	Adiantum aleuticum	five-finger fern	
	Pentagramma triangularis subsp. *triangularis*	goldenback fern	
Polypodiaceae - Polypody Family			
	Polypodium glycyrrhiza	licorice fern	
GYMNOSPERMS			
Cupressaceae - Cypress Family			
	***Hesperocyparis pygmaea* CRPR 1B.2**	**pygmy cypress**	
	Sequoia sempervirens	coast redwood	
Pinaceae - Pine Family			
	Abies grandis	grand fir	
	***Pinus contorta* subsp. *bolanderi* CRPR 1B.2**	**Bolander's pine**	
	Pinus muricata	Bishop pine	

	Pseudotsuga menziesii	Douglas fir	
	Tsuga heterophylla	western hemlock	
Taxaceae - Yew Family			
	Torreya californica	California nutmeg	
MAGNOLIIDS			
Lauraceae - Laurel Family			
	Umbellularia californica	California bay	
EUDICOTS			
Adoxaceae - Muskroot Family			
	Sambucus nigra subsp. *caerulea (S. mexicana)*	blue elderberry	
	Sambucus racemosa	red elderberry	
Anacardiaceae - Sumac Family			
	Toxicodendron diversilobum	poison oak	
Apiaceae - Carrot Family			
	Angelica genuflexa		
	Daucus pusillus	rattlesnake weed	
	Oenanthe sarmentosa	ditch carrot	
	Osmorhiza berteroi	sweet cicley	
	Sanicula bipinnata	poison sanicle	
	Sanicula crassicaulis	gamble weed	
	Scandix pecten-veneris	Venus' needle	x
	Torilis arvensis	Japanese hedge parsley	x
	Torilis nodosus	knotted hedge-parsley	x
	Yabea microcarpa	hedge parsley	
Apocynaceae - Dogbane Family			
	Vinca major	greater periwinkle	x
Araliaceae - Ginseng Family			
	Aralia californica	elk clover	
Aristolochiaceae - Pipevine Family			
	Asarum caudatum	wild-ginger	
Asteraceae - Aster Family			
	Adenocaulon bicolor	trail plant	
	Anaphalis margaritacea	pearly everlasting	
	Anisocarpus madioides (Madia madioides)	woodland tarweed	
	Baccharis glutinosa (B. douglasii)	marsh baccharis	
	Baccharis pilularis	coyote brush	
	Bellis perennis	English daisy	x
	Cirsium arvense	Canada thistle	
	Cirsium vulgare	bull thistle	x
	Crepis vesicaria subsp. *taraxacifolia*		

	Erigeron canadensis	horseweed	
	Eriophyllum lanatum var. *arachnoideum*	common wooly sunflower	
	Euchiton sphaericus (Gnaphalium japonicum)	star cudweed	x
	Gamochaeta ustulata (Gnaphalium purpureum)		x
	Hieracium albiflorum	hawkweed	
	Hypochaeris radicata	hairy cat's ear	x
	Lasthenia minor	coastal gold fields	
	Leucanthemum vulgare	ox eye daisy	x
	Logfia gallica	daggerleaf cottonrose	x
	Madia exigua	small tarweed	
	Madia gracilis	gumweed	
	Madia sativa	coast tarweed	
	Petasites frigidus var. *palmatus*	coltsfoot	
	Pseudognaphalium luteoalbum		x
	Pseudognaphalium stramineum		
	Psilocarphus brevissimus var. *brevissimus*	dwarf woolyheads	
	Senecio glomeratus (Erechitites glomerata)	cut-leaf coast fireweed	x
	Senecio minimus (Erechtites minima)	fireweed	x
	Senecio jacobaea	tansy ragwort	x
	Senecio sylvaticus	woodland ragwort	x
	Sonchus asper	prickly sow thistle	x
	Sonchus oleraceus	common sow thistle	x
	Soliva sessilis		x
	Taraxacum officionale	California dandelion	x
Berberidaceae - Barberry Family			
	Achlys californica	vanilla leaf	
	Berberis aquifolium	barberry	
	Berberis nervosa	barberry	
	Vancouveria planipetala	redwood ivy	
Betulaceae - Birch Family			
	Alnus rubra	red alder	
	Corylus cornuta subsp. californica	hazelnut	
Boraginaceae - Borage Family			
	Cynglossum grande	hound's tongue	
	Nemophila parviflora	tiny flowered nemophila	
	Nemophila pedunculata		
	Myosotis discolor	changing forget-me-not	x
	Plagiobothrys sp.	popcorn flower	
Brassicaceae- Mustard Family			

	Cardamine californica	milk maids	
	Cardamine oligosperma		
	Nasturtium officionale (Rorippa nasturtium-aquaticum)	water cress	
Campanulaceae - Bluebell Family			
	Asyneuma prenanthoides (C. prenanthoides)	California harebell	
	***Campanula californica* CRPR 1B.2**	**swamp harebell**	
Caprifoliaceae - Honeysuckle Family			
	Lonicera hispidula var. *vacillans*	honeysuckle	
	Symphoricarpos mollis	creeping snowberry	
Caryophyllaceae - Pink Family			
	Cerastium glomeratum	mouse-ear chickweed	x
	Stellaria crispa		
	Stellaria media	common chickweed	x
	Stellaria nitens	shining chickweed	
Celastraceae - Staff-Tree Family			
	Euonymus occidentalis	western burning bush	
Convolvulaceae - Morning Glory Family			
	Calystegia purpurata subsp. *purpurata*		
Cucurbitaceae - Gourd Family			
	Marah oregana	coast manroot	
Ericaceae - Heath Family			
	Arbutus menziesii	madrone	
	Arctostaphylos canescens subsp. *canescens*	hoary manzanita	
	Arctostaphylos columbiana	Columbia manzanita	
	Arctostaphylos nummularia subsp. *nummularia*	shiny leaf manzanita	
	Chimaphila menziesii	little prince's pine	
	Gaultheria shallon	salal	
	***Pityopus californicus* CRPR 4.2**	**California pinefoot**	
	Pyrola picta	white-veined wintergreen	
	Rhododendron columbianum (Ledum glandulosum)	western Labrador tea	
	Rhododendron macrophyllum	California rose-bay	
	Rhododendron occidentale	western azalea	
	Vaccinium ovatum	California huckleberry	
	Vaccinium parvifolium	red huckleberry	
Fabaceae - Pea Family			
	Acmispon americanus (Lotus purshianus)	Spanish lotus	
	Acmispon parviflorus (Lotus micranthus)	deer vetch	

	Cytisus scoparius	Scotch broom	x*
	Genista monspessulana	French broom	x*
	Lathyrus latifolius	perennial sweet pea	x
	Lathyrus torreyi	redwood or Torrey's pea	
	Lathyrus vestitus	hillside pea	
	Lotus corniculatus	birdfoot trefoil	x
	Lupinus bicolor	minature lupine	
	Lupinus rivularis		
	Medicago polymorpha	bur clover	x
	Trifolium bifidum var. *bifidum*	pinole clover	
	Trifolium buckwestiorum **CRPR 1B.1**	**Santa Cruz clover**	
	Trifolium cernuum	nodding clover	x
	Trifolium dubium	shamrock clover	x
	Trifolium gracilentum	pinpoint clover	
	Trifolium hirtum	rose clover	x
	Trifolium microcephalum	small head clover	
	Trifolium microdon	thimble clover	
	Trifolium striatum	knotted clover	x
	Trifolium subterraneum	subterranean Clover	x
	Trifolium varigatum	varigated clover	
	Trifolium willdenovii	tomcat clover	
	Vicia hirsuta	hairy vetch	x
	Vicia sativa subsp. *sativa*	spring vetch	x
Fagaceae - Beech Family			
	Chrysolepis chrysophylla	chinquapin	
	Notholithocarpus densiflorus var. *densiflorus*	tan oak	
Gentianaceae - Gentian Family			
	Zeltnera venusta (Centarium v.)	California centaury	
Geraniaceae - Geranium Family			
	Geranium dissectum	cut-leaf geranium	x
	Geranium molle	dove foot	x
Grossulariaceae - Gooseberry Family			
	Ribes divaricatum var. *pubiflorum*	straggle bush	
Hypericaceae - St. John's Wort Family			
	Hypericum anagalloides	tinker's penny	
Lamiaceae - Mint Family			
	Clinopodium douglasii (Satureja d.)	yerba buena	
	Mentha pulegium	penny royal	x*
	Prunella vulgaris var. lanceolata	self-heal	
	Prunella vulgaris var. vulgaris	self-heal	x
	Stachys chamissonis	coast hedge nettle	

	*Stachys rigida*var. *rigida*	hedge nettle	
Linaceae - Flax Family			
	Linum bienne	common flax	x
Lythraceae - Loosestrife Famly			
	Lythrum hyssopifolia	hyssop loosestrife	x
Montiaceae - Montia Family			
	Claytonia perfoliata	miner's lettuce	
	Montia fontana	water chickweed	
	Montia siberica	candy flower	
Myricaceae- Wax Mytrle Family			
	Morella californica (Myrica california)	California wax myrtle	
Myrsinaceae - Myrsine Family			
	Lysimachia arvensis (Anagallis arvensis)	scarlet pimpernel	x
	Lysimachia latifolia (Trientalis latifolia)	star flower	
Onagraceae - Evening primrose Family			
	Epilobium ciliatum subsp. *ciliatum*	Northern willow herb	
Orobanchaceae - Broom rape Family			
	Triphysaria pusilla	dwarf owl's clover	
Oxalidaceae- Oxalis Family			
	Oxalis oregana	redwood sorrel	
	Oxalis pilosa	hairy wood-sorrel	
Papaveraceae - Poppy Family			
	Dicentra formosa	bleeding heart	
Philadelphaceae - Mock Orange Family			
	Whipplea modesta	modesty	
Phrymaceae - Lopseed Family			
	Mimulus aurantiacus	sticky monkey-flower	
	Mimulus moschatus	musk monkeyflower	
Plantaginaceae - Plantain Family			
	Callitriche heterophylla	water starwart	
	Callitriche marginata	winged water starwart	
	Digitalis purpurea	foxglove	x
	Plantago lanceolata	English plantain	x
	Plantago major	common plaintain	
	Synthyris reniformis	snow queen	
	Veronica americana	American brooklime	
Polemoniaceae - Phlox Family			
	Collomia heterophylla	variable leaf collomia	
	Leptosiphon minimus	tiny leptosiphon	
	Navarretia squarrosa	skunkweed	

Polygalaceae - Milkwort Family			
	Polygala californica	California milkwort	
Polygonaceae - Buckwheat Family			
	Rumex acetosella	sheep sorrel	x
	Rumex crispus	curly dock	x
Ranunculaceae - Buttercup Family			
	Actaea rubra	baneberry	
	Anemone grayi	Gray's anemone	
	Aquilegia formosa	columbine	
	Coptis laciniata **CRPR 4.2**	**Oregon goldthread**	
	Ranunculus californicus	California buttercup	
	Ranunculus uncinatus	hooked fruit buttercup	
Rhamnaceae - Buckthorn Family			
	Ceanothus thyrsiflorus	blue blossum	
	Frangula californica (Rhamnus californica)	California coffeeberry	
	Frangula purshiana (Rhamnus purshiana)	cascara	
Rosaceae - Rose Family			
	Aphanes occidentalis	western ladies mantle	
	Cotoneaster pannosa		x
	Drymocallis glandulosa var. *glandulosa*	sticky cinquefoil	
	Fragaria vesca	wood strawberry	
	Rosa gymnocarpa	wood rose	
	Rubus armeniacus (R. discolor)	Himalayan blackberry	x
	Rubus leucodermis	western raspberry	
	Rubus parviflorus	thimbleberry	
	Rubus spectabilis	salmon berry	
	Rubus ursinus	California blackberry	
Rubiaceae - Madder Family			
	Galium aparine	goose grass	x
	Galium muricatum	Humboldt bedstraw	
	Galium parisiense	wall bedstraw	x
	Galium triflorum	sweet-scented bedstraw	
	Sherardia arvensis	field madder	x
Salicaceae - Willow Family			
	Salix lasiandra var. *lasiandra (Salix lucida)*	Pacific willow	
	Salix scouleriana	Scouler's willow	
	Salix sitchensis	Sitka willow	
Sapindaceae - Soapberry Family			
	Acer macrophyllum	big leaf maple	
Saxifragaceae - Saxifrage Family			
	Boykinia occidentalis	boykinia	

	Heuchera micrantha	alum root	
	Mitellastra caulescens **CRPR 4.2**	leafy stemmed mitre-wort	
	Pectiantia ovalis (Mitella ovalis)	coastal mitrewort	
	Tellima grandiflora	fringe cups	
	Tiarella trifoliata var. unifoliata	lace flower	
	Tolmiea diplomenziesii	pig-a-back plant	
Scrophulariaceae - Figwort Family			
	Scrophularia californica	California figwort	
Solanaceae - Nightshade Family			
	Solanum americanum	small-flowered nightshade	
	Solanum xantii	chaparral nightshade	
Urticaceae - Nettle Family			
	Urtica dioica subsp. *gracilis*	American stinging nettle	
Violaceae - Violet Family			
	Viola glabella	stream violet	
	Viola sempervirens	evergreen violet	
MONOCOTS			
Cyperaceae - Sedge Family			
	Carex californica **CRPR 2B.3**	California sedge	
	Carex globosa	round-fruited sedge	
	Carex gynodynama	wonder woman sedge	
	Carex harfordii	Harford's sedge	
	Carex hendersonii	timber sedge	
	Carex leptopoda	slender-footed sedge	
	Carex obnupta	slough sedge	
	Carex rossii	Ross' sedge	
	Carex tumulicola	foothill sedge	
	Cyperus eragrostis	tall flatsedge	
	Cyperus strigosus	false nutsedge	
	Eleocharis macrostachya	spike rush	
	Scirpus microcarpus	panicled bulrush	
Iridaceae - Iris Family			
	Iris douglasiana	Douglas iris	
	Sisyrinchium bellum	blue-eyed grass	
Juncaceae - Rush Family			
	Juncus bufonius var. *bufonius*	toad rush	
	Juncus effusus var. *pacificus*	Pacific rush	
	Juncus ensifolius	dagger-leaf rush	
	Juncus patens	common rush	

	Luzula comosa var. laxa	wood rush	
Liliaceae - Lily Family			
	Clintonia andrewsiana	clintonia	
	Prosartes hookeri (Disporum hookeri)	Hooker's fairybell	
	Scoliopus bigelovii	fetid adders tongue	
Melanthiaceae - False-Hellebore Family			
	Toxicoscordion fremontii (Zigadenus f.)	death camus	
	Trillium ovatum	western trillium	
	Veratrum fimbriatum **CRPR 4.3**	**fringed false hellebore**	
Orchidaceae - Orchid family			
	Calypso bulbosa	calypso orchid	
	Corallorhiza maculata	spotted coralroot	
	Corallorhiza mertensiana	Merten's coralroot	
	Goodyera oblongifolia	rattlesnake plantain	
	Listera banksiana	Northwest twayblade	
	Piperia candida **CRPR 1B.2**	**white flowered piperia**	
Poaceae - Grass Family			
	Agrostis gigantea	redtop	x
	Agrostis pallens	deune bent grass	
	Agrostis stolonifera	creeping bent	x
	Aira caryophyllea	silver European hairgrass	x
	Anthoxanthum occidentale (Hierochloe o.)	sweet grass	
	Anthoxanthum ordoratum	sweet vernal grass	x
	Avena barbata	slender wild oat	x
	Briza maxima	big quaking grass	x
	Briza minor	little quaking grass	x
	Bromus diandrus	ripgut brome	x
	Bromus carinatus var. carinatus	California brome	
	Bromus hordeaceus	soft chess	x
	Bromus orcuttianus	Orcutt's brome	
	Bromus vulgaris	Columbia brome	
	Calamagrostis bolanderi **CRPR 4.2**	**Bolander's reedgrass**	
	Cortaderia jubata	jubata grass	x
	Cynosurus echinatus	hedgehog dogtail	x
	Dactylis glomerata	orchard grass	x
	Danthonia californica	California oatgrass	
	Deschampsia elongata	slender hairgrass	
	Elymus glaucus subsp. glaucus	blue wildrye	
	Festuca arundinacea	tall fescue	x

	Festuca bromoides	brome fescue	x
	Festuca idahoensis	Idahoe fescue	
	Festuca occidentalis	western fescue	
	Festuca octaflora	six weeks grass	
	Festuca perennis (Lolium multiflorum)	perennial ryegrass	x
	Festuca subulata	bearded fescue	
	Festuca subuliflora	crinkle awn fescue	
	Gastridium phleoides	nit grass	x
	Glyceria elata	fowl mannagrass	
	Holcus lanatus	common velvet grass	x
	Melica subulata	Alaskan oniongrass	
	Phalaris arundinacea	reed canary grass	
	Phalaris californica	California canary grass	
	Poa annua	annual blue grass	x
	Poa kelloggii	Kellogg's blue grass	
	Polypogon australis	Chilean beardgrass	x
	Polypogon monspeliensis	annual beard grass	x
	Rytidosperma penicillatum (Danthonia pilosa)	hairy oatgrass	x
	Trisetum canescens	smooth trisetum	
Ruscaceae - Butcher's-Broom Family			
	Maianthemum racemosum (Smilacina racemosa)	branched false solomon's seal	
	Maianthemum stellatum (Smilacina stellata)	star false solomon's seal	

Appendix D: Bryophytes and Lichens of Big River (BR) and Salmon Creek (SC) River Forests, TCF
Nomenclature largely follows:
For Mosses: Norris D.H. and J.R. Shevock. 2004. Contrb. toward a bryoflora of CA: I. A Specimen-Based Catalogue of Mosses. Madrono 51(1): 1-131. II. A Key to the Mosses. Madrono 51 (2) 133-269
P. Wilson (ed.) [2018] California Moss eFlora, http://ucjeps.berkeley.edu/CA_moss_eflora/inde1.html
For Liverworts: Doyle W.T. and R.E. Stotler. 2006. Contributions toward a bryoflora of California III. Keys and Annotated Species Catalogue for Liverworts and Hornworts. Madrono 53: 89-197.
For Lichens: Brodo I.M., S.D. Sharnoff, and S. Sharnoff. 2001. Lichens of N. America. Yale Univ. Press.
S. Sharnoff. 2014. A Field Guide to California Lichens. Yale Univ. Press.
Esslinger, T. E. 2016. A cumulative checklist for the lichen-forming, lichenicolous, and allied fungi of the continental United States and Canada. North Dakota State University, Version 22: http://www.ndsu.edu/pubweb/~esslinge/chcklst/chcklst7.htm, [accessed Jan 1, 2018] Fargo, ND.
Survey Dates: 2008 - 2018 (same as vascular plants (Appendices B & C)

Big River mosses=63, liverworts=15, llchens=34; Salmon Creek mosses=45, liverworts=11, lichens=9

MOSSES	Habitat	BR	SC
AULACOMNIACEAE			
Aulacomnium androgynum	On rotten logs and old stumps	x	x
BARTRAMIACEAE			
Anacolia menziesii	moist soil of old road bed, rock face	x	
Bartramia stricta	on soil in sunny opening	x	
Philonotis capillaris	moist soil on roadbed, costa long-excurrent	x	x
Philonotis fontana	moist soil along road, costa hardly excurrent	x	
BRACHYTHECIACEAE			
Amblystegium serpens	wet, seep across dirt road	x	
Brachythecium frigidum	On moist banks next to creek	x	x
Brachythecium velutinum	shady dry drainage		x
Brachythecium starkei	moist soil, edge of trail		x
Homalothecium nuttallii	On hardwood bark and rock	x	x
Homalothecium pinnatifidum		x	
Isothecium cristatum	On old fallen logs	x	x
Isothecium spiculiferum	On wax myrtle trunk		x
Isothecium stoloniferum	On shaded logs and boulders	x	
Kindbergia oregana	On shaded duff and tree bases and logs, old roadbeds	x	x
Kindbergia praelonga	On moist to wet logs, rock along streams, stem lvs decurrent	x	x
Scleropodium cespitans	Mats of creeping stems with julaceous ± pinnate branches. On litter, soil, tree bases.	x	x
Scleropodium obtusifolium	On boulders in streams or seasonal streamlets	x	x

Scleropodium touretii	Mats of prostrate, weakly julaceous stems and ascending tips. Soil and rock away from seasonal streams	x	x
BRYACEAE			
Bryum canariense (Rosulabryum c.)	moist soil		x
Bryum capillare (Rosulabryum c.)	sunny habitat, soil over rock, similar to R. torquescens but tubers not scarlet	x	x
Bryum gemmiparum (Imbribryum g.)	On wet rock in streambed, no hairpoints	x	
Bryum torquescens (Rosulabryum t.)	soil, rock, litter, tree truncks, rotten wood. Scarlet tuberss. Hair points conspicuous	x	x
BUXBAUMIACEAE			
Buxbaumia piperi	On damp soil and rotten logs	x	
CRYPHAEACEAE			
Dendroalsia abietina	On red alder, oak bark, tanoak	x	x
DICRANACEAE			
Dicranella howei	On moist mineral soil banks; seta 5-8mm reddish, lvs 2mm; sporophyte arcuate.	x	
Dicranum fuscescens	On shaded rotten log; stems tomentose below	x	x
Dicranum howellii	shaded wood; stems rhizoid matted	x	
Orthodicranum tauricum	On shaded logs and tree bases; lf tips broken	x	x
DITRICHACEAE			
Ceratodon purpureus	On bare soil in sunny sites	x	
Ditrichum ambiguum	On shaded soil of roadbanks; erect sporophyte, seta reddish.	x	x
Ditrichum schimperi	Bare soil and roadbeds; erect sporophyte; seta yellow, 10-30mm.		x
Pleuridium acuminatum		x	
FISSIDENTACEAE			
Fissidens bryoides	Semiaquatic, moist habitats. All leaf margins bordered; many leaf pairs	x	x
Fissidens crispus	Seasonally moist soil, roadbanks, trails. All leaf margins bordered; up to 20 lf pairs	x	x
Fissidens grandifrons	springs, seeps, creeks, usually calcareous		x
FONTINALACEAE			
Fontinalis neomexicana	aquatic, submersed in pond	x	

FUNARIACEAE			
Funaria hygrometrica	On sunny soil on road edge	x	x
GRIMMIACEAE			
Codriophorus varius (Racomitrium varium)	On rock, moist or dry	x	
Grimmia laevigata	on shady rock	x	
Grimmia lisae	On rocks at high water line	x	
HYPNACEAE			
Hypnum circinale	On shaded conifer bases; mats of downward facing stems, pale green; more coastal	x	x
Hypnum subimponens	On shaded rock and logs; mats with pinnately branched stems	x	
Pseudotaxiphyllum elegans	On damp soil and duff in shade, shiney complanate stems with paraphyllia	x	x
LEPTODONTACEAE			
Alsia californica	Shaded branch of Torreya californica	x	x
LESKEACEAE			
Claopodium whippleanum	On bare soil in sun or shade	x	x
LEUCOBRYACEAE			
Campylopus introflexus	exotic species of clayey roadbeds	x	x
LEUCODONTACEAE			
Pterogonium gracile	Rock and hardwood trunks, bay bark; lvs serrate above; double costa to mid leaf	x	
MNIACEAE			
Epipterygium tozeri	On moist bare soil with other mosses	x	x
Leucolepis acanthoneuron	On moist soil along stream	x	x
Rhizomnium glabrescens	moist to wet soil along stream, lvs entire	x	x
Plagiomnium insigne	wet, sandy floodplain bottoms; plants prostrate	x	x
Plagiomnium venustum	On decaying humus, and roadbed; plants erect; longer teeth	x	x
Pohlia wahlenbergii	On shaded wet soil	x	
NECKERACEAE			
Bryolawtonia vancouveriensis	On trunk of bay trees, complanate stems	x	
Metaneckera menziesii	on red alder trunks; costa present	x	

Neckera douglasii	Epiphytic on California nutmeg, red alder; costa absent	x	
Porotrichum bigelovii	On wet shaded rock along streams. Lvs ~ 3mm	x	x
ORTHODONTIACEAE			
Orthodontium gracile	dense, silky, yellow-green tufts of erect stems; on *Sequoia* bark		x
ORTHOTRICHACEAE			
Orthotrichum bolanderi	soil of roadcut		x
Orthotrichum consimile	hardwood bark		x
Orthotrichum lyelii	on bark of tanoak, Quercus, Doug fir	x	x
Orthotrichum rivulare	old wood of bridge just above waterline	x	
Orthotrichum tenellum	bark of tanoak	x	
PLAGIOTHECIACEAE			
Plagiothecium laetum	tree trunks, occasionally rock; complanate light greens stems; costa absent	x	
POLYTRICHACEAE			
Atrichum selwynii	On bare mineral soil, roadcuts	x	x
Polytrichastrum alpinum	On shady rock face	x	
Polytrichum juniperinum	On bare or humusy soil; leaf with reddish apex	x	x
POTTIACEAE			
Didymodon vinealis	On soil or rock, sun or shade	x	x
Timmiella crassinervis	On bare soil in sun or shade	x	x
RHABDOWEISIACEAE			
Amphidium californicum	In shaded underhangs of outcrops	x	
SELIGERIACEAE			
Dicranoweisia cirrata	dead wood of fallen logs	x	x
LIVERWORTS			
ANEURACEAE			
Aneura pinguis	Water splashed rock along stream, & shaded seeps	x	x
AYTONIACEAE			
Asterella bolanderi	On moist mossy bank	x	x

CALYPOGEIACEAE			
Calypogeia sp.	On damp shaded soil	x	x
CEPHALOZIACEAE			
Cephalozia bicuspidata	On shaded soil and humus	x	x
CEPHALOZIELLACEAE			
Cephaloziella divaricata	On soil over rock	x	
CONOCEPHALACEAE			
Conocephalum conicum	moist stream banks	x	x
FRULLANIACEAE			
Frullania nisquallensis	Epiphytic on red alder	x	x
Jungermannia rubra	On moist bare soil banks	x	
GEOCALYCACEAE			
Chiloscyphus polyanthos	submerged in creek on rock	x	
JUNGERMANNIACEAE			
Jungermannia rubra	On moist shaded soil	x	
LEPIDOZIACEAE			
Lepidozia reptans (micky mouse hands)	On shaded base of Redwood	x	x
MARCHANTIACEAE			
Marchantia polymorpha	on moist soil near water	x	x
PORELLACEAE			
Porella navicularis	On shaded hardwood bark	x	x
SCAPANIACEAE			
Lophozia sp.	with Scapania	x	
Scapania bolanderi	on shady roadcuts and stream banks	x	x
TARGIONIACEAE			
Targionia hypophylla	on soil bank	x	x
HORNWORTS			

ANTHOCEROTACEAE			
Anthoceros sp	On moist to wet bare soil	x	x
LICHENS			
Cladonia caricosa	On soil	x	
Cladonia cenotea	roadbanks with mosses and litter	x	
Cladonia coniocraea	On shaded soil banks	x	
Cladonia fimbriata		x	
Cladonia furcata	On shaded soil and old wood	x	x
Cladonia py1idata		x	
Cladonia squamosa	old redwood stumps, soil over rocks	x	
Cladonia transcendens	weathered stump near coast	x	
Cladonia verruculosa		x	
Collema nigrescens	on low branch of Baccharis pilularis and Salix sitchensis		x
Hypogymnia apinnata	conifer branches	x	
Hypogymnia enteromorpha	Doug fir branches	x	x
Hypogymnia imshaugii	bark and wood	x	x
Leptogium palmatum (L. corniculatum)	On shaded soil banks	x	x
Leptogium gelatinosum	on road	x	
Leptogium lichenoides		x	
Leptogium platynum	Moist soil of old roadbed	x	
Lobaria linita	on soil on road	x	
Lobaria oregana	Mostly coniferous trees	*x*	
Lobaria polmonaria	alder trunks, Doug fir branches	x	x
Parmelia sulcata	on red alder	x	
Parmotrema arnoldii	On hardwood bark	x	
Peltigera malacea		x	
Peltigera membranacea	on soil, litter	x	x
Peltigera neopolydactyla	moist soil edge or road	x	x
Pilophorus acicularis	On shaded soil banks	x	
Platismatia herrei	on doug fir bark, isidiate margin	x	
Platismatia stenophylla	doug fir bark	x	
Pseudocyphellaria anthraspis	Epiphytic on hardwoods	x	
Ramalina farinacea	conifer and hardwood	x	
Sticta limbata		x	
Tuckermannopsis orbata	On conifer branches	x	
Usnea arizonica	Epiphytic	x	
Usnea filipendula	Epiphytic on conifers; on Salix near coast	x	
Usnea longissima	Methusulah's beard	x	x

Appendix E. The CNPS Ranking System

California Rare Plant Rank 1A: Plants Presumed Extirpated in California and Either Rare or Extinct Elsewhere. Plants with a California Rare Plant Rank of 1A are presumed extirpated or extinct because they have not been seen or collected in the wild in California for many years. A plant is extinct if it no longer occurs anywhere. A plant that is extirpated from California has been eliminated from California, but may still occur elsewhere in its range. All of the plants constituting California Rare Plant Rank 1A meet the definitions of the California Endangered Species Act of the California Department of Fish and Game Code, and are eligible for state listing. Should these taxa be rediscovered, and impacts proposed to individuals or their habitat, they must be analyzed during preparation of environmental documents relating to the California Environmental Quality Act (CEQA), or those considered to be functionally equivalent to CEQA, as they meet the definition of Rare or Endangered under CEQA Guidelines §15125 (c) and/or §15380.

California Rare Plant Rank 1B: Plants Rare, Threatened, or Endangered in California and Elsewhere. Plants with a California Rare Plant Rank of 1B are rare throughout their range with the majority of them endemic to California. Most of the plants that are ranked 1B have declined significantly over the last century. California Rare Plant Rank 1B plants constitute the majority of taxa in the CNPS *Inventory*, with more than 1,000 plants assigned to this category of rarity. All of the plants constituting California Rare Plant Rank 1B meet the definitions of the California Endangered Species Act of the California Department of Fish and Game Code, and are eligible for state listing. Impacts to these species or their habitat must be analyzed during preparation of environmental documents relating to CEQA, or those considered to be functionally equivalent to CEQA, as they meet the definition of Rare or Endangered under CEQA Guidelines §15125 (c) and/or §15380.

California Rare Plant Rank 2A: Plants Presumed Extirpated in California, But Common Elsewhere. Plants with a California Rare Plant Rank of 2A are presumed extirpated because they have not been observed or documented in California for many years. This list only includes plants that are presumed extirpated in California, but more common elsewhere in their range. All of the plants constituting California Rare Plant Rank 2A meet the definitions of the California Endangered Species Act of the California Department of Fish and Game Code, and are eligible for state listing. Should these species be rediscovered, any impacts proposed to individuals or their habitat must be analyzed during preparation of environmental documents relating to CEQA, or those considered to be functionally equivalent to CEQA, as they meet the definition of Rare or Endangered under CEQA Guidelines §15125 (c) and/or §15380.

California Rare Plant Rank 2B: Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere. Except for being common beyond the boundaries of California, plants with a California Rare Plant Rank of 2B would have been ranked 1B. From the federal perspective, plants common in other states or countries are not eligible for consideration under the provisions of the Federal Endangered Species Act. With California Rare Plant Rank 2B, we recognize the importance of protecting the geographic range of widespread species. In this way we protect the diversity of our own state's flora and help maintain evolutionary processes and genetic diversity within species. All of the plants constituting California Rare Plant Rank 2B meet the definitions of the California Endangered Species Act of the California Department of Fish and Game Code, and are eligible for state listing. Impacts to these species or their habitat must be analyzed during preparation of environmental documents relating to CEQA, or those considered to be functionally equivalent to CEQA, as they meet the definition of Rare or Endangered under CEQA Guidelines §15125 (c) and/or §15380.

California Rare Plant Rank 3: Plants About Which More Information is Needed - A Review List
Plants with a California Rare Plant Rank of 3 are united by one common theme - we lack the necessary information to assign them to one of the other ranks or to reject them. Nearly all of the plants constituting California Rare Plant Rank 3 are taxonomically problematic. For each California Rare Plant Rank 3 plant we have provided the known information and indicated in the "Notes" section of the CNPS *Inventory* record where assistance is needed. Data regarding distribution, endangerment, ecology, and taxonomic validity are welcomed and can be submitted by emailing the Rare Plant Program at rareplants@cnps.org. Many of the plants constituting California Rare Plant Rank 3 meet the definitions of the California Endangered Species Act of the California Department of Fish and Game Code, and are eligible for state listing. Impacts to these species or their habitat should be analyzed during preparation of environmental documents relating to CEQA, or those considered to be functionally equivalent to CEQA, as they may meet the definition of Rare or Endangered under CEQA Guidelines §15125 (c) and/or §15380.

California Rare Plant Rank 4: Plants of Limited Distribution - A Watch List
Plants with a California Rare Plant Rank of 4 are of limited distribution or infrequent throughout a broader area in California, and their status should be monitored regularly. Should the degree of endangerment or rarity of a California Rare Plant Rank 4 plant change, we will transfer it to a more appropriate rank. Some of the plants constituting California Rare Plant Rank 4 meet the definitions of the California Endangered Species Act of the California Department of Fish and Game Code, and few, if any, are eligible for state listing. Nevertheless, many of them are significant locally, and we strongly recommend that California Rare Plant Rank 4 plants be evaluated for impact significance during preparation of environmental documents relating to CEQA, or those considered to be functionally equivalent to CEQA, based on CEQA Guidelines §15125 (c) and/or §15380. This may be particularly appropriate for: The type locality of a California Rare Plant Rank 4 plant, Populations at the periphery of a species' range, Areas where the taxon is especially uncommon, Areas where the taxon has sustained heavy losses, or Populations exhibiting unusual morphology or occurring on unusual substrates.

Threat Ranks
0.1-Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
0.2-Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
0.3-Not very threatened in California (less than 20% of occurrences threatened / low degree and immediacy of threat or no current threats known)
Notes:
The above Threat Rank guidelines only represent a starting point in the assessment of threat level. Other factors, such as habitat vulnerability and specificity, distribution, and condition of occurrences, are also considered in setting the Threat Rank.
Many of the Threat Ranks have not been reassessed since the time they were first designated after implementation of the Rare Plant Status Review Process, and therefore may not represent the current level of threats associated with a given taxon.
The Threat Ranks do not designate a change of environmental protections. For instance a CRPR 1B.3 plant has the same environmental protections as a CRPR 1B.1 plant, and it is mandatory that both be fully considered during preparation of environmental documents relating to CEQA.

State and Federal Status

For each taxon with official status under the California Endangered Species Act (CESA), the Federal Endangered Species Act (FESA), and/or the Native Plant Protection Act (NPPA), the plant's status is presented. Our definitions conform to those found in California state law and federal regulations.

Global Ranking

The *global rank* (G-rank) is a reflection of the overall status of an element throughout its global range. Both Global and State ranks represent a letter+number score that reflects a combination of Rarity, Threat and Trend factors, with weighting being heavier on Rarity than the other two.

Species or Natural Community Level

G1 = Critically Imperiled — At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

G2 = Imperiled — At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

G3 = Vulnerable — At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

G4 = Apparently Secure — Uncommon but not rare; some cause for long-term concern due to declines or other factors.

G5 = Demonstrably Secure — Common; widespread and abundant.

Note: Subspecies receive a T-rank attached to the G-rank. With the subspecies, the G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of just the subspecies or variety. For example: *Chorizanthe robusta* var. *hartwegii*. This plant is ranked G2T1. The G-rank refers to the whole species range i.e., *Chorizanthe robusta.* The T-rank refers only to the global condition of var. *hartwegii*.

State Ranking

The *state rank* (S-rank) is assigned much the same way as the global rank, but state ranks refer to the imperilment status only within California's state boundaries.

S1 = Critically Imperiled — Critically imperiled in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2 = Imperiled — Imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3 = Vulnerable — Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 = Apparently Secure — Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 = Secure — Common, widespread, and abundant in the state.

Note: Other considerations used when ranking a species or natural community include the pattern of distribution of the element on the landscape, fragmentation of the population/stands, and historical extent as compared to its modern range. It is important to take a bird's eye or aerial view when ranking sensitive elements rather than simply counting element occurrences. Uncertainty about the rank of an element is expressed in two major ways: By expressing the ranks as a range of values: e.g., S2S3 means the rank is somewhere between S2 and S3. By adding a ? to the rank: e.g., S2? This represents more certainty than S2S3, but less certainty than S2.

Other symbols:
GH - All sites are historical; the element has not been seen for at least 20 years, but suitable habitat still exists (SH = All California sites are historical).
GX - All sites are extirpated; this element is extinct in the wild (SX = All California sites are extirpated).
GXC - Extinct in the wild; exists in cultivation.
G1Q - The element is very rare, but there are taxonomic questions associated with it.
T - Rank applies to a subspecies or variety.

APPENDIX D

NORTHERN SPOTTED OWL

The spotted owl is a medium sized owl, about 20 inches long with an average wingspan of 40 inches. Spotted owls have large dark eyes, lack ear tufts and the legs and feet are fully feathered. Spotted owl's diet generally consist of rodents and small birds, with a smaller component of other various animals such as insects, bats and lizards (Forsman 1984). Spotted owls hunt for food, or forage, by perching and swooping on prey items. The spotted owl's range occurs from southern British Columbia to the southern part of the Sierra Madre Occidental and Oriental mountains. The spotted owl is comprised of 3 subspecies within this range. The Mexican spotted owl's range is the largest occurring from the southern Rocky Mountains in Colorado; the Colorado Plateau in southern Utah; southward through Arizona, New Mexico, and far western Texas; in Mexico through the Sierra Madre Occidental and Oriental mountains and the southern end of the Mexican Plateaus range. The California spotted owl occurs throughout the Sierra Nevada mountain range in addition to the coastal mountain ranges of southern California north to the San Francisco peninsula. The Northern spotted owl range is north of the San Francisco peninsula throughout the coastal and inland ranges of California and throughout the coastal and Cascade mountain ranges of Oregon and Washington to southern British Columbia. The redwood region accounts for only about 9% of the northern spotted owl's range. The northern spotted owl (hereafter referred to as NSO) was listed as a threatened species under the Endangered Species Act (ESA) in 1990 as concern mounted over the continuing loss of habitat that NSO's appeared to require for survival and reproductive success (Federal register 1990). Subsequently, in August 2016 the NSO was listed as threatened under the California Endangered Species Act. As part of the ESA listing it was required by landowners within the range of the NSO to survey for their presence if any kind of habitat altering activities were proposed. The United States Fish and Wildlife Service (USFWS) is in charge of administering and consulting with species protected under the ESA. The USFWS developed a protocol for surveying for NSOs in 1991 and revised it in 1992. Subsequently, in 2011 the USFWS developed an updated protocol that was primarily intended to address the presence of barred owls. Additional minor revisions to the protocol were made in 2012.

Northern Spotted Owl Survey Procedures

Northern spotted owl surveys are currently required to be conducted in conformance with the 2012 revision of the 2011 USFWS NSO survey protocol. The USFWS NSO survey protocol requires landowners within the range of the northern spotted owl to survey areas for NSO presence if any "habitat altering, or significant disturbance" project is proposed. The method of surveying for presence requires covering the project area with survey stations that are spaced approximately ¼ - ½ mile apart. Each survey station is "called" for 10 minutes using a digital calling device that plays recorded NSO vocalizations. Survey stations are called between sunset and sunrise and the permitted survey season is March 1-August 31. The protocol requires 6 survey visits per year to the project area for two years prior to commencing project operations. If NSO are detected during nighttime surveys, daytime follow-up surveys are conducted in order to determine if there is a NSO territory in the area of the detection. If NSO are found during daytime surveys, they are offered mice and the fate of these mice is recorded in order to determine reproductive status (whether a NSO territory is nesting or not).

Habitat Requirements and Regulations

When the NSO was listed under the ESA in 1990 it was generally believed that they required large tracts of old growth or late seral stage forests for survival and reproductive success (Thomas et al 1990). This was primarily a result of interpreting habitat conditions that existed around nest sites, at. At the time little was known about the habitat that was used or needed for foraging (LaHaye et al, 1999). Recent studies have shown that NSOs require a mixture of forest conditions for reproductive success and long-term survival (Franklin, 2000 and Irwin et al, 2000). Generally, NSOs require nesting habitat that consists of well stocked, mixed-conifer dominated, and dense canopy stands, which are often close distances to year-round water and riparian habitat (Irwin et al. 2007) These stands can be of varying ages but what is important is retained structure from older stands (Forsman et al. 1984, Solis and Guitierrez 1990, Ripple et al. 1991, Lehmkuhl and Raphael 1993, Hunter et al. 1995, Meyer et al. 1998). Features including branch deformities, cavities, mistletoe clumps, broken tops, debris platforms, old squirrel, vole and raptor nests provide nesting possibilities within such stands (Blakesley et al. 1992 and Thome et al. 1998). Also, factors such as north facing slopes provide cooler temperatures during the breeding season and areas on the lower 1/3 of slopes also seem to provide refuge from adverse environmental conditions (Irwin et al. 2007). NSOs can utilize a wide range of prey species across their range however, in the redwood region the main prey item is the dusky-footed woodrat (Ambrose, 1991 and Mendocino Redwood Company, 1989, 2001 unpublished),. In the redwood region dusky-footed woodrats occur in high densities in early successional stages "brushy-stage" clearcuts and in the ecotones between late and early successional forests (Franklin et al. 2000). The distance relationship between stand conditions used by NSO's for nesting and foraging may well determine whether NSOs will occupy a site and/or have reproductive success. It is presumed that if NSOs have to travel great distances between nest sites and foraging locations it may result in poor reproductive success or exclusion of NSOs from an area altogether (Franklin et al. 2000 and Irwin et al. 2007).

The USFWS defines NSO habitat as the following:
Nesting/roosting habitat: ≥60% canopy cover of trees ≥11" DBH (diameter at breast height) and ≥ 100 square feet of basal area of trees ≥11" DBH
Foraging habitat: ≥40% canopy cover of trees ≥11" DBH and ≥ 75 square feet of basal area of trees ≥11" DBH
Non-suitable Habitat: ≤40% canopy cover of trees ≥11" DBH and ≤75 square feet of basal area of trees ≥11" DBH

The Big River and Salmon Creek Forests are composed of stand structures with high variability due to differences in harvest history. Timber stands range from 30 to 100 years old. The dominant tree species are Douglas-fir, redwood, western hemlock, and grand fir and there is a substantial component of mixed hardwood species, primarily tanoak. Although no late seral stage stands are present on the property, there are some stand types that contain elements of late-seral forest characteristics. Using the USFWS habitat definitions, the majority of the property is most likely foraging habitat, with scattered patches of nesting/roosting habitat focused primarily along riparian areas and northern spotted owl activity centers.

NSO take avoidance for Timber Harvest Plans on the Big River and Salmon Creek Forests will most likely be demonstrated through 14 CCR 919.9(e) of the California Forest Practice rules which requires the plan submitter to consult with the USFWS. The Arcata, California office of the USFWS has prepared a set of guidelines that landowners within the coast redwood region must follow in order to assure that the take of NSO through timber operations does not occur. The March 15, 2011 version of the Northern Spotted Owl Take Avoidance Analysis and Guidance for the California Coast Forest District ("Attachment A") outlines habitat protection measures and operational restrictions that are applied to known NSO sites. Revisions to the "Attachment A" guidelines are commonly made every few years. Protection measures are focused around each NSO territory's activity center. Each territory's activity center is generally that territory's most recent nest site or the most recent roost location if no nest site is known. Under the "Attachment A" guidelines, a 100 acre core area polygon composed of the best available suitable habitat (preferably nesting/roosting) is delineated contiguous with each territory's activity center. Generally speaking, timber harvest is prohibited within each NSO territory's core area. Additionally, within 0.7 mi of each NSO activity center at least 500 acres of suitable NSO habitat (nesting/roosting or foraging) and at least 200 acres of this habitat must be nesting/roosting habitat.

Silvicultural Objectives and Habitat Development

TCF's principal silvicultural objectives are to grow large high-quality trees, increase structural complexity and natural diversity and establish a high level of sustainable timber production through selective (individual tree and group selection) harvests. These measures should maximize volume and value growth within the constraints of an unevenage management philosophy and develop and maintain important late-seral habitat characteristics for wildlife and non-timber forest vegetation. "Crop tree" target diameters are 30 to 36 inches for redwood and 22 to 28 inches for Douglas-fir. Forest management will seek to ensure that late-seral ecological functions and processes are present within a managed forest. Ultimately, these measures are intended to develop stands that have high canopy closure, some large mature trees, and a high degree of structural diversity, which should ensure that NSO nesting/roosting habitat is maintained and developed through time. Additionally, active timber management that creates some canopy gaps and stimulates understory vegetation growth will ensure that high quality foraging habitat is present.

Big River Forest and Salmon Creek Forest NSO Survey Summary

Historically, NSO surveys on the Forests have been somewhat inconsistent. Throughout the 1990's-mid 2000's surveys were conducted on a timber harvest plan specific basis and little effort was made to monitor known NSO territories for occupancy and reproductive status. Since acquiring the property, TCF has implemented a more intensive survey design. A network of 200+ survey stations was installed across the Big River and Salmon Creek and the entire ownership was surveyed annually from 2009-2014. Surveys from 2015-2018 were pared back to a project specific scale with approximately 75% of the ownership surveyed during each of these years. Site visits to all recently occupied NSO activity centers were also conducted from 2009-2018 to determine reproductive status and assess occupancy trends.

The California Natural Diversity Database (CNDDB) currently lists 7 NSO activity centers located on the Big River Forest, and 7 NSO activity centers on the Salmon Creek Forest. Several of these sites are no longer occupied by NSO and recent years' surveys generally find 8-10 occupied NSO activity centers across the two Forests. Additionally, there are several NSO activity centers located immediately outside TCF ownership that are routinely detected during surveys.

Additional Threats to NSO's

Aside from the habitat issues associated with NSO reproduction and survival, there is a more ominous threat to NSOs emerging, which is the invasion of the barred owl into the range of the NSO. Barred owls are in the same genus as NSOs and occupy a similar niche, competing for many of the same prey resources and nesting sites. Antagonistic behavior between barred owls and NSO is well documented throughout the Pacific northwest (Courtney et al. 2004, Olson et al. 2005). Barred owls are displacing NSOs (Kelly et al. 2003) as well as suppressing the calling behavior of NSOs, which can make NSO survey efforts increasingly difficult and possibly ineffective (Crozier et al. 2006). In the last decade, the number of barred owls in Mendocino county has steadily increased. Barred owls are routinely detected during spotted owl surveys on the Big River and Salmon Creek Forests and the range across the property where barred owls are detected appears to have expanded since ownership wide surveys were initiated in 2009. Barred owls appear likely to be impacting NSO detection probabilities and occupancy trends at several sites throughout the Big River and Salmon Creek Forests. At this point, barred owl specific surveys have yet to conducted on the Big River or Salmon Creek Forests, though they may be conducted at a future time. In other portions of the redwood region, experimental barred owl removal trials have been partially successful at allowing NSO to re-occupy sites where they were previously displaced (Diller et al. 2012). Recent studies also suggest that management activities, such as the creation of 15-25 acre patches of early seral hardwoods in close proximity to known barred owl nests and preferential removal of redwood during thinning in young stands, may provide habitat conditions that NSO are better adapted to exploit than barred owls (Irwin et al. 2013). Barred owl management activities may be considered if NSO displacement continues to become problematic and if permitting opportunities exist.

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APPENDIX E

Big River and Salmon Creek Forests Inventory of Completed Roadwork

				Site Treatments			Site Types					Road Miles	
Forest	**Project**	**Completion Year**	**Total Sites**	**Road Drainage Improvement**	**New Culvert**	**Decomm**	**Landslides**	**Stream Crossings**	**Other**	**Culverts**	**Cubic yards of Sediment Savings**	**Improved**	**Decomm**
Big River	Jarvis Camp THP	2007	7	7	2	0	2	5	0	3	242	2	
Big River	River Bends THP	2007	12	5	1	0	4	8	0	7	125	2	
Big River	North of 20 THP	2008	44	35	3	0	8	28	8	15	350	7.75	
Big River	Coombs Gulch THP	2009	25	19	0	0	6	19	0	17	385	4	
Big River	Laguna Pass THP	2009	28	21	7	1	9	17	2	12	946	5	0.5
Big River	Wheel Gulch THP	2009	32	19	8	0	14	18	0	10	3863	6	2
Big River	Piccolotti THP	2012	31	18	13	0	0	28	3	27	270	5	
Big River	Elephant Seal THP	2013	5	4	1	0	1	4	0	2	635	3.5	
Big River	Laguna 11 THP	2013	23	21	8	0	1	22	0	19	3757	4	
Big River	Lower N Fork Big River THP	2013	56	56	16	0	5	39	12	29	10917	9.25	0.3
Big River	Changeling THP	2015	16	15	1	0	9	7	0	2	160	2.11	
Big River	Lower N Fork Big River THP	2015	27	20	11	0	10	13	4	13	2764	6	
Big River	Feldman Gulch THP	2016	28	26	5	0	0	28	0	15	2469	3	0.5
Big River	Ironing Board THP	2018	39	34	3	4	13	25	1	21	5762	4	0.5
Big River	Rabbit Ears THP	2018	22	22	4	0	4	17	1	8	2150	3.5	0.2
Salmon Creek	Lower Salmon Creek THP	2007	26	25	7	0	3	16	7	9	1135	4.25	
Salmon Creek	Mendocino Lightening Complex	2008	17	0	0	17	1	16	0	0	203	0	3
Salmon Creek	Pullen Gulch THP	2008	10	9	0	0	2	5	3	0	96	4.3	
Salmon Creek	N Navarro Ridge THP	2015	22	13	0	2	5	10	8	0	237	1	0.3
Salmon Creek	Upper Hazel THP	2016	26	18	8	0	3	20	3	10	1412	2.3	
	TOTALS		**496**	**387**	**98**	**24**	**100**	**345**	**52**	**219**	**37878**	**78.96**	**7.3**

Salmon Creek Sediment Source Assessment, Pacific Watershed Associates
Big River Sediment Source Assessment, Elias Steinbuck and Christopher Blencowe

APPENDIX F

BIG RIVER AQUATIC MANAGEMENT PLAN

CAMPBELL TIMBERLAND MANAGEMENT, LLC

Big River Aquatics Management Plan

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1 Overview of Properties

The Big River and Salmon Creek watersheds have unique ecological factors that affect each stream network differently from the standpoint of fishery production. The two watersheds have differing thermal regimes, landscape management histories, and discharge characteristics, which suggest separate treatment strategies to guide aquatic restoration including increasing salmonid production. The purpose of the following watershed overview is to address factors affecting The Conservation Fund's ownership within each watershed from a fishery standpoint.

1.1 Overview

The Big River component of The Conservation Fund (TCF) ownership primarily comprises the Middle Subbasin of the Big River Watershed as described by North Coast Watershed Assessment Program (2006) (Figure 1-2). The Property also contains several larger tributaries to Big River and (to a lesser extent) the Noyo that have significant value to fisheries. There are pronounced differences between stream conditions within the tributaries and the mainstem, and consequently will be addressed separately. The aquatic management plan for Big River relies on synthesis of information derived from the 2006 North Coast Watershed Assessment Program (NCWAP) assessment (Downie et al 2006), data from Campbell Timberland Management (CTM, unpublished), Georgia Pacific (GP), and Klamath Resource Information System (KRIS) Big River (2003).

Because salmonids are often considered an indicator of watershed and ecosystem health, this section is predominantly focused on information and management recommendations relevant to salmonid habitat and populations.

Big River

Big River drains an approximately 180-square mile watershed located in the northern California Coastal Range in western Mendocino County (Figure 1-1). The river enters the Pacific Ocean approximately ten miles south of Fort Bragg and extends 24 miles to the east. The Big River Basin drains east to west and borders on the Noyo and Caspar basins to the north and the Albion and Navarro basins to the south. Much of the watershed is presently managed for timber production; nearly ten percent of the watershed is owned and managed by The Conservation Fund (TCF), hereafter referred to as the Property.

For analysis and organization, the Big River NCWAP divided the basin into three subbasins (Coast, Middle, Inland) (Figure 1-2). The Property encompasses most of the Middle and a smaller fraction of the Coast subbasins. For brevity, the overview discussion will focus primarily on Middle Subbasin attributes. For more detail on the entire Big River watershed, refer to NCWAP *Big River Basin Assessment* (2006).

Vegetation in the Coast and Middle Subbasins is primarily conifer forest comprised of coast redwood (*Sequoia sempervirens*) and Douglas fir (*Pseudotsuga menziesii*). The primary constituents of the riparian canopy are coast redwood, Douglas-fir, red alder (*Alnus rubra*) and willow (*Salix* Spp.), all of which is nearly continuous throughout the stream network. Streambed gradient is generally low ($\leq 2\%$) throughout the mainstem reaches. The regional climate is characterized as Mediterranean with wet, mild winters and dry summers. Rainfall averages 55-65 inches annually.

The entire watershed including the Middle and Coast Subbasins support runs of coho salmon and steelhead trout (see Section 1.2.2 for species description). Chinook have been reported occasionally, but presently there are no significant runs (Downie et al 2006). Historical anecdotes indicate that Big River supported significant populations of coho and steelhead with an associated recreational and local commercial fishery. By the 1950s agency reports indicated that the populations were depleted and in serious decline. Since that initial disclosure, stream enhancement and restoration efforts have been ongoing throughout the watershed. However, no research on overall watershed salmonid abundance has been conducted, and it is assumed that the salmonid populations are static and have not changed notably since the 1950s (Downie et al 2006).

The Property contains approximately eleven miles of mainstem Big River and 13 miles of tributaries with habitat attributes conducive to salmonid production. For this analysis of stream and habitat conditions in the Property subbasins, the perennial fish bearing streams are considered separately from the mainstem reach due to differential instream thermal regimes. The summer water temperatures in the mainstem are unsuitable for rearing salmonids, whereas most of the perennial tributaries are within suitable thresholds.

1.1.1 Location and Watercourse Description

The Middle and Coast subbasins of Big River are located in Mendocino County California, drain approximately 32,000 acres (Figure 1-2), and are tributary to the Pacific Ocean. Elevations range from sea level at the mouth of the creek to approximately 210 feet at the confluence of the North Fork Big River (Middle Subbasin Boundary). The mouth of Big River is located at 39° 18.114’ N Latitude and 123° 47.542’ W Longitude. Instream conditions such as discharge, thermal properties, and gradient typify many of the characteristics commonly associated with coastal Northern California watersheds. Discharge rates, which are not influenced by snow pack, vary significantly between summer and winter flows. Instream daily average temperatures in the perennial tributaries range from 17° C (63º F) in summer to 7° C (45º F) in winter, and daily average mainstem summer water temperatures are often over 20° (68º F) (GP unpublished, CTM unpublished) (KRIS Big River 2003). Although summer stream temperatures are moderated by the watershed’s close proximity to the coastal marine climatic conditions, the summer thermal regime on the mainstem within the Property is mainly driven by the influx of streamflow from the hot interior reaches. Within the Property boundaries, Big River mainstem is predominantly a low gradient, moderately entrenched F-4 Rosgen channel type[1] characterized by high pool development and low velocity discharge. Two Log Creek, the primary fish-bearing tributary on the Property is predominantly a B-4 channel type, which is characterized by a riffle-dominated channel and infrequently spaced pools. The larger perennial tributaries within the Property confines have suitable habitat conditions for salmonid production. Conversely, the mainstem has limited value for salmonids due to excessive stream temperatures during the summer rearing period.

[1] Rosgen channel types include 42 distinct channel classes, primarily based on gradient and dominant substrate characteristics. Various quantitative metrics help to classify channels, although it is not uncommon for specific metrics to vary among several classes.

1.1.1.1 Maps

Figure 1-1. Fishery Overview of TCF Big River Ownership with Coho and Steelhead ESUs.

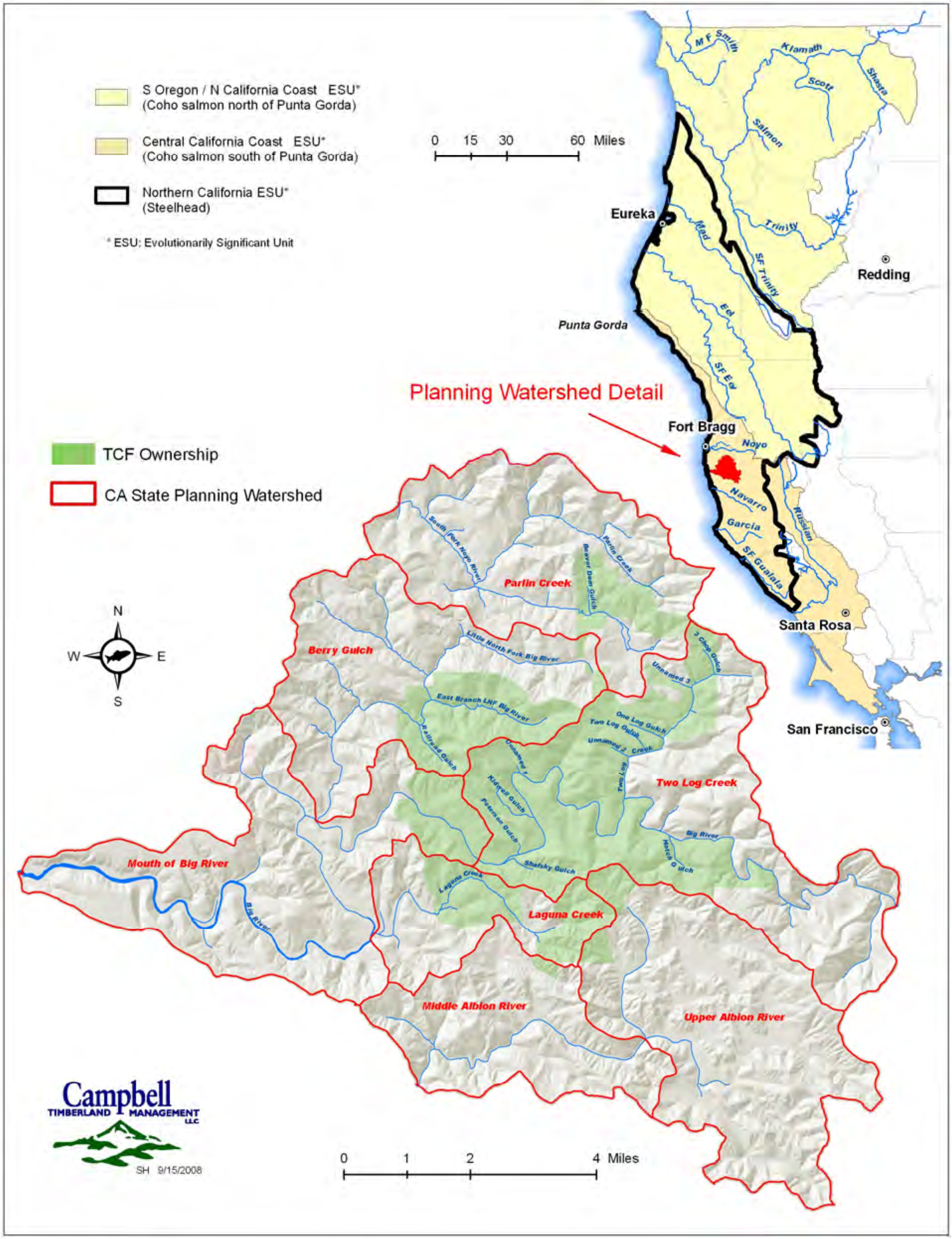
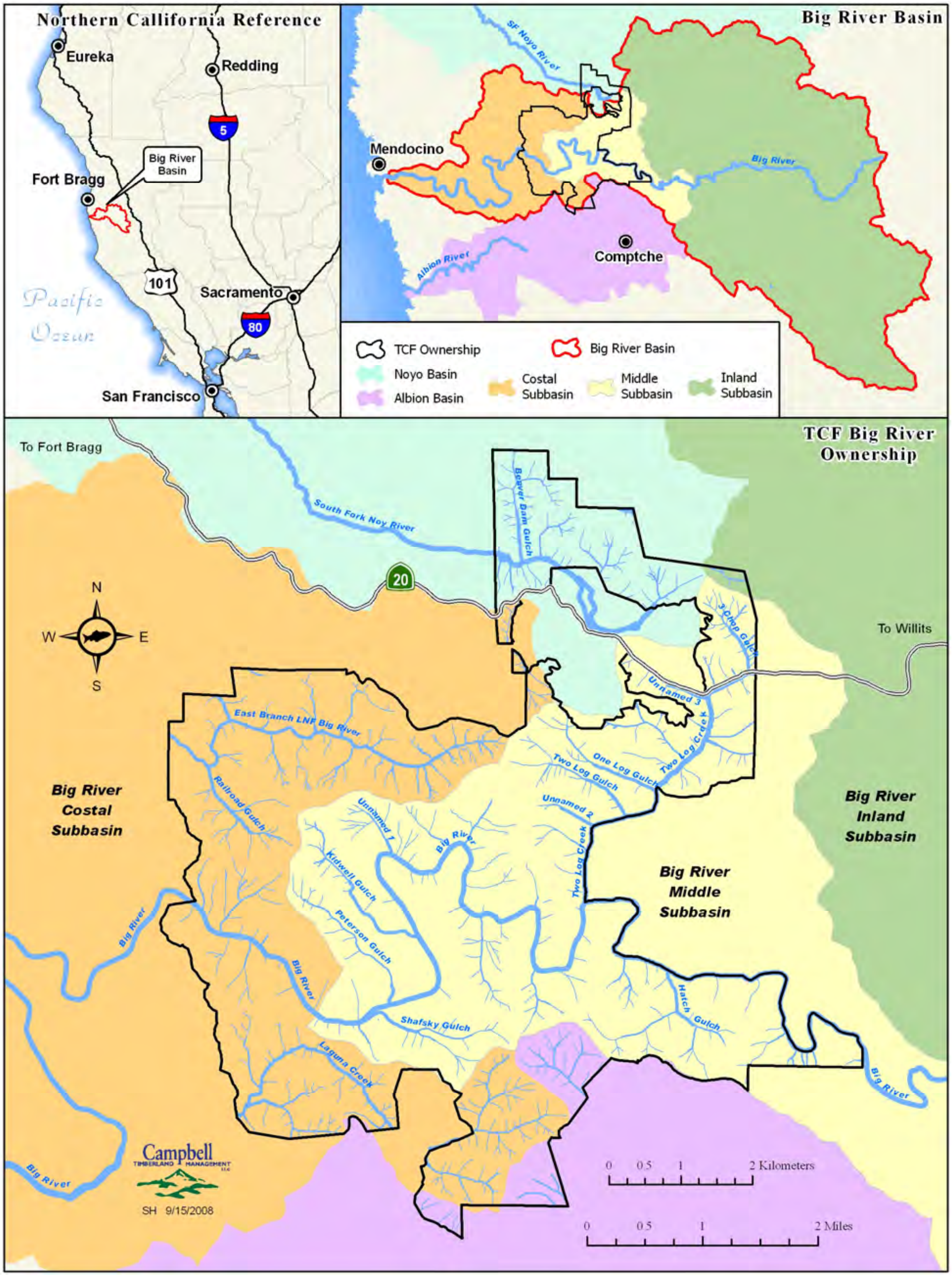


Figure 1-2. Location of NCWAP (2006) Subbasin Study Regions in Relation to Property.



1.1.2 Context

Aquatic conditions in Big River, like many watersheds in the region, are presently more influenced by recovery processes from past management practices than by present practices. Therefore, in order to prescribe management practices that improve aquatic conditions and promote fish production, Section 1.1.2.1 provides a brief description of the past land use history of the Big River watershed from a fishery perspective.

1.1.2.1 History

Before the European settlement of the Mendocino area and subsequent logging operations in the basin, Big River likely hosted three species of anadromous Pacific salmonids: coho, steelhead, and possibly to a lesser extent Chinook salmon. Other species of salmonids likely "strayed" into the watershed on an infrequent basis but did not constitute recurring spawning populations. Presently the watershed still supports coho and steelhead in reduced numbers compared to presumed prehistoric populations, and based on studies conducted in the nearby Noyo basin (Gallagher and Wright 2007), a small population of Chinook salmon may persist in Big River. However, their presence is undocumented.

The watershed history of Big River has been generally well documented (Downie et al 2006; Warick and Wilcox 1981). From the perspective of aquatic ecology and fisheries on the Property, it is unnecessary to review the modern history of anthropogenic disturbance across the basin, but only to outline a few key points. The Big River Basin has been listed as a temperature and sediment impaired waterbody, and as such considerable literature has been generated regarding stream conditions (GMA 2001, Downie et al 2006) and their historical context.

Logging began in the watershed in the 1850s, and management for timber harvesting presently continues. The infrastructure of the early logging era, which ran from approximately 1850 to 1945, consisted of a large mill and an associated mill town (Mendocino) located at the river mouth. A rail line was constructed throughout the estuary and lower basin to facilitate log transport to the mill. The rail network essentially terminated in Laguna Gulch and the East Branch of the Little North Fork. Beyond the lower areas serviced by the rail line, logs were moved to the mill by the use of hydrologic force in the practice known as splash dam logging. For this transport method, logs were stored in the active stream channel throughout the summer (or longer) until the onset of winter rains or "freshets." In order to store enough hydrologic potential to move the logs, a series of dams were constructed throughout the aquatic network (Figure 1-7). When the stored capacity and stream flow was sufficient, the dams were sequentially tripped to allow a whitewater torrent to mobilize the logs down-channel, eventually arriving at the mill. Because log jams and snags would delay log transport (sometimes for years), they were removed from the channel by crews throughout the summer months. This method of transport was employed throughout the upper basin and all major tributaries. The history of this practice in Big River is well documented by W. F. Jackson in *Big River was Dammed* (1991). During this era, timber was generally dragged downslope with cables powered by "steam donkeys" or oxen, either directly to the mainstem channel or by gulch running tramways that brought logs to the channel.

The end of World War II (1945) initiated the era of tractor logging in this and most other watersheds in the region. Tractor technology, which had been perfected during the war, was used to pull logs downslope to landings and road systems commonly based within the active fluvial network. By the 1980s replacement of the fluvial-based road networks by upslope road systems began and resultantly timber was cable-yarded to upslope landings. Presently, about half of most industrial logging operations in the watershed are cable-yarded, with tractor logging comprising the remainder (Downie et al 2006).

As tractor-logging operations increased across the northern California landscape, it became apparent that the practice of removing logging waste by pushing it with heavy equipment into the river was creating barriers to spawning salmon migration (Figures 1-3 and 1-4). Resource agencies responded by mandating the removal of logging debris from the river at the end of operations, which was usually accomplished with heavy equipment. Declines in anadromous Pacific salmonid populations were thought to result primarily from their lack of access to spawning habitat posed by logging debris. This perception, now generally believed only one of many factors affecting fish stocks, initiated the era of log removal from stream systems throughout the North Coast. From the late 1950s to the early 1990s, crews employed by State and County agencies routinely removed large woody debris (LWD) from stream networks throughout northern California – a practice that, as described below, resulted in additional problems. A map of the wood removal areas and additional information can be viewed on the KRIS Big River website (http://www.krisweb.com/krisbigriver/krisdb/html/krisweb/index.htm).

The practice of splash dam logging likely contributed to the decline of anadromous Pacific salmonids in the watershed due to channel homogenization. Log quantities by the tens of thousands, stored throughout the fluvial network over-summer (Figure 1-5), were annually sluiced through the larger channels, essentially scouring the channel of most complexity and roughness elements (Figure 1-6). Whatever obstructions to log passage that remained were systematically blasted from the channel by crews during summer low flows. The net result is a U-shaped channel with little heterogeneity. Aquatic habitat complexity is a well-known stream condition affecting anadromous salmonids during their freshwater phase, as well as many other aquatic organisms.

In addition to channel simplification, it's likely that splash dam log drives also widened and decreased the depth of the overall channel, consequently increasing the probability of additional solar radiation to the stream channel and thereby increasing stream temperatures. Excessive water temperature is another well-known factor affecting anadromous salmonids.

The initial tractor logging era (1945-1980) and the associated fluvial-based road network delivered deleterious quantities of sediments to the Big River planning watersheds (GMA 2001). Multiple facets of these operations caused sediment delivery to the fluvial network and have been well documented (Burns 1970). Tractors operated on steep slopes, throughout upslope watercourses, and yarded timber downslope to landings, increasing soil erosion. Road networks, streamside landings, and watercourse crossings often failed further inundating the network with sediment. Excessive sediment loads are deleterious to salmonids through many pathways (Burns 1970; Kondolf 2000): sediment can limit survival-to-emergence (STE) of juveniles from the redds (Trappel and Bjornn 1983); decrease aquatic insect production; decrease sub-surface water flows (thereby increasing stream temperature); decrease habitat complexity by burying structural components; and limit foraging opportunities for fish during winter due to the associated turbidity during high flows (Sigler et al 1984). The known effects of excessive sediment bedload in the channel clearly contributed to the decline of salmonids and trout throughout the watershed, and modern timber harvest practices have adapted in response.

The mandate to remove LWD from streams either by timber operators at the end of operations with heavy equipment, or by stream clearance crews, also contributed to anadromous salmonid declines in the watershed. Instream structure especially in the form of LWD has many beneficial attributes for aquatic species (Bjornn and Reiser 1991). The loss of lotic habitat complexity from stream clearance activities, splash damming, and burial from excessive bedload clearly impacted salmonid populations, and the legacy effects continue today.

1.1.2.2 Historic Photographs

Figure 1-3. Typical Northern California Stream Condition After Historic Logging Operations (GP Unpublished).

Figure 1-4. Typical Barrier To Fish Passage From Historic Logging Operations (GP Unpublished).

Figure 1-5. Logs Stored In Stream Channels Awaiting Winter Flows (The Robert J. Lee Photographic Collection Of The Mendocino County Historical Society).

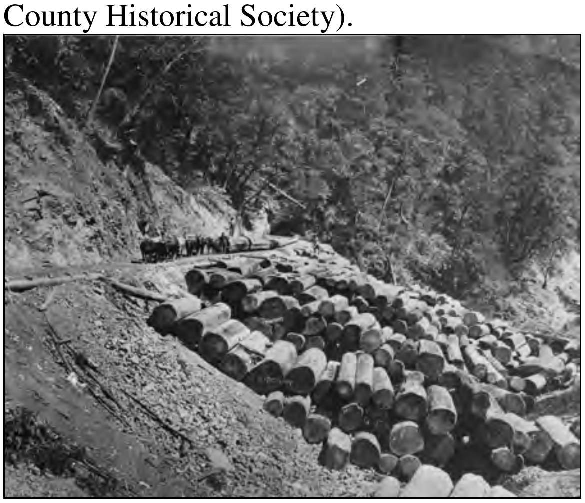
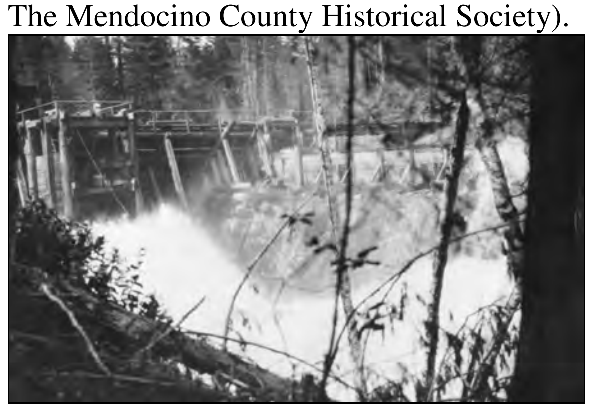


Figure 1-6. Log Drive In Big River, Circa 1924 (The Robert J. Lee Photographic Collection Of The Mendocino County Historical Society).

Figure 1-7. Big River Splash Dam (The Robert J. Lee Photographic Collection Of The Mendocino County Historical Society).



1.2 Ecological Conditions

This section describes habitat types, riparian communities, and aquatic species of special concern found on the Property.

1.2.1 Species Occurrences and Habitat Types

1.2.1.1 Riparian Communities

The riparian corridor on mainstem Big River and its Class I perennial tributaries, show substantial dense, riparian habitat. Migratory Neotropical birds are expected to be more abundant in these areas. The smaller tributary streams are often intermittent and do not show substantial riparian tree development.

Table 1-1, below, is a summary of the total miles of class I, II, and III streams found in each State Planning Watershed contained within the Big River ownership (Figure 1-8). Calculations are based on data collected by CTM (2001, unpublished).

Table 1-1. Summary Of Total Stream Miles By Classification Within State Planning Watersheds Located On Tcf Ownership, Big River.

Planning Watershed	Predominant Stream	Total Acres	Acres of Ownership in Watershed	Percent of Ownership in Watershed	Class I (total mi) on TCF Big River	Class II (total mi) on TCF Big River	Class III (total mi) on TCF Big River
1113.300402	Berry Gulch	7,999	1,996	17.0	4.3	4.7	13.6
1113.300302	Chamberlain Creek	7,868	37	0.3	0.2	0.2	0.3
1113.300401	Laguna Creek	3,246	1,421	12.1	2.7	4.2	12.2
1113.400001	Middle Albion River	4,878	65	0.6	0	0.1	0.8
1113.300403	Mouth of Big River	9,548	951	8.1	1.6	1.5	4.9
1113.200302	Parlin Creek	7,578	871	7.4	1.4	3.0	7.1
1113.300406	Two Log Creek	11,432	5,982	51.1	18.6	12.3	32.9
1113.400006	Upper Albion River	8,739	383	3.3	0	2.2	2.2
Total	**-**	**-**	**11,707**	**100**	**28.8**	**28.2**	**74.0**

1.2.1.2 Rivers

Big River Mainstem

The Property encompasses approximately nine percent of the Big River watershed (Figures 1-1, 1-2) and 11.9 miles of the mainstem river. Temperature monitoring conducted by GP in 1994-1999, CTM in 2000-2005, and TCF in 2006-2007 (all unpublished) (Figures 2-3, 2-4) indicate that stream temperatures during summer months are not within suitable ranges for coho and steelhead, according to the *NCWAP Big River Middle Subbasin Profile and Synthesis* (Downie et al 2006). However, snorkel surveys conducted by Big Rivers Stewards in 2006 and 2007 indicate that juvenile salmonids of both species persist in the mainstem in small numbers (Matt Coleman, Big River Stewards Coordinator, Mendocino Land Trust, pers. comm. 2008). Stream habitat surveys conducted by GP in 1996 and CDFG in 2002 suggest that the mainstem contained fair to poor habitat conditions for salmonids. Shade canopy values were below target values, with only 33 % closed canopy (in 2002); however, on fourth order watercourses such as Mainstem Big River target values do not apply (Downie et al 2006)[2]. Spawning habitat quality was rated as suitable (Downie et al 2006). Pool habitat by depth was rated as good in 2002, with 93% of the pools having optimal depth for the stream order. CDF&G protocol states that ideally 40% of instream habitat (by length) should be in pool habitat. In Big River, CDFG surveyors (2002) found 45% of the stream in pool habitat, indicating suitable pool frequency. Pool shelter was during that survey was found to be low with a rating of 45. Eighty is considered an optimal rating for shelter in pool habitat (Flossi 1998). Low shelter values may result from Large Organic Debris (LOD) and Large Woody Debris (LWD) scarceness as discussed in Section 1.1.2.1

Upper South Fork Noyo River (SFNR)

This fork of the Noyo River located in the Parlin Creek Planning Watershed is a well-known producer of coho and steelhead (Gallagher and Wright 2007). Instream habitat is generally well shaded, pools are frequent and deep, and the summer water temperatures are suitable for rearing salmonids. However, TCF has little influence on fishery conditions in the stream due to limited ownership adjacent to the watercourse (Figure 1-2) (Table 1-2).

1.2.1.3 Perennial Streams

Portions of approximately 14 streams and small creeks within the Big River ownership are considered class I stream habitat, displayed on a map in Figure 1-8. A class I stream classification denotes potential habitat for salmonid species exists, and that the presence of salmon is not required for this classification.

Table 1-2, below is a summary of the total miles of class I, II, and III streams found in the selected class I sub watersheds, contained within the Big River ownership. Calculations are based on data collected by CTM (2001, unpublished).

Table 1-2. Summary Of Total Stream Miles By Classification Within The Class I Habitat Sub Watersheds Located On TCF Ownership, Big River.

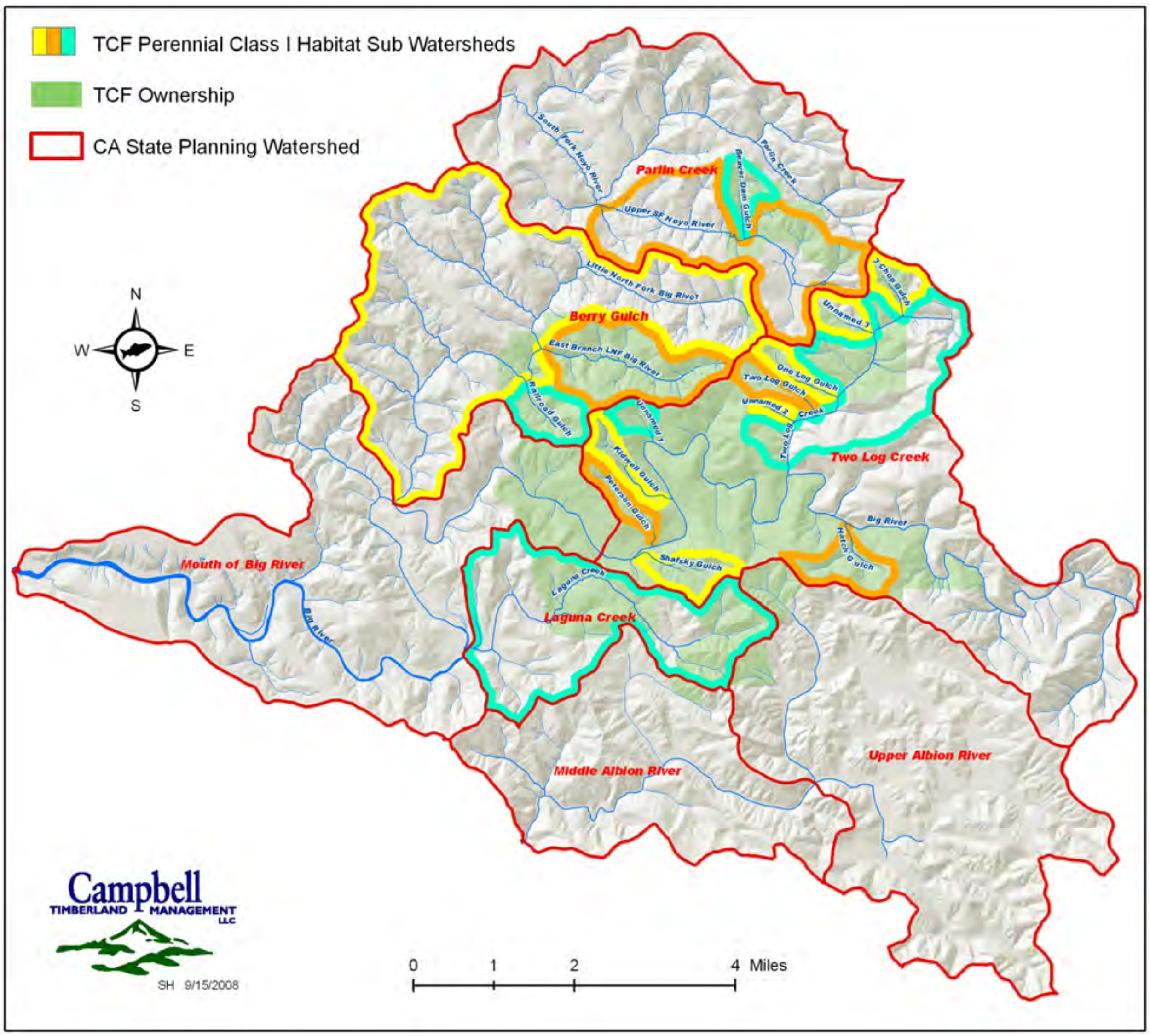
Sub Watershed Name	**Total Acres**	**Acres of Ownership in Sub Watershed**	**Percent of Ownership in Sub Watershed**	**Class I** (total mi) on TCF Big River	**Class II** (total mi) on TCF Big River	**Class III** (total mi) on TCF Big River
Hatch Gulch	442	441	3.8	0.6	1.1	2.7
Kidwell Gulch	281	281	2.4	0.9	0.9	1.0
Laguna Creek	3,242	1,421	12.1	2.7	4.3	12.2
Little North Fork Big River*	6,429	1,996	17.1	4.3	4.1	13.6
Peterson Gulch	255	255	2.2	0.2	1.0	1.4
Shafsky Gulch	361	358	3.1	0.6	0.7	2.2
South Fork Noyo River**	2,591	805	6.9	1.2	3.0	6.9
Two Log Gulch***	3,057	1,659	14.2	5.9	4.5	11.5
Unnamed 1	163	163	1.4	0.1	0.3	1.6

[2] Typically, larger, high order channels are too wide to expect adequate shading from tree canopy due to maximum tree heights.

Sub Watershed Name	Total Acres	Acres of Ownership in Sub Watershed	Percent of Ownership in Sub Watershed	Class I (total mi) on TCF Big River	Class II (total mi) on TCF Big River	Class III (total mi) on TCF Big River
Subtotal	**-**	**7,379**	**63**	**16.5**	**19.9**	**53.1**
Remainder of Big River mainstem		3,777	95	11.9	5.8	17.5
All other minor drainages		551	5	0.4	2.5	3.4
Total	**-**	**11,707**	**100**	**28.8**	**28.2**	**74.0**

* Includes class I perennial tributaries: East Branch Little North Fork Big River, and Railroad Gulch
** Includes class I perennial tributary: Beaver Dam Gulch
*** Includes class I perennial tributaries: 3 Chop Gulch, One Log Gulch, Unnamed 2, and Unnamed 3

Figure 1-8. Map Of Perennial Class I Habitat Sub Watersheds On TCF Ownership, Big River.



The following short narratives are provided for all Class I tributaries. They are listed in watershed position, beginning with the most downstream tributary within the ownership.

3 Chop Gulch (Ayn Creek)

Also known as Ayn Creek, this fish-bearing watercourse presently contains a barrier to anadromous fish migration. A “shotgun culvert” under the State Highway 20 crossing extends out from the bank and is elevated above the receiving plunge pool surface, preventing adult migration. Resident trout have been observed in the subbasin (Downie et al 2006).

Beaver Dam Gulch

This small watercourse is tributary to the South Fork of the Noyo (SFN). It contains less than a mile of Class I habitat (Table 1-2). A 2005 stream survey associated with a Timber Harvest Plan (THP- 1 – 98- MEN) found optimal habitat conditions for salmonids. Coho and steelhead have been observed throughout the SFN (Gallagher and Wright 2007).

East Branch of Little North Fork Big River (EBLNF Big River).

A 2002 habitat inventory survey by CDFG of this subbasin indicates that while the amount pool habitat is sufficient, depth characteristics may be deficient (pools are too shallow). However, this is a small first order tributary and depth thresholds may not apply. The survey also indicates that canopy and shelter values are suitable, but spawning conditions (based on embeddedness values) are unsuitable (Downie et al 2006). In 2002 a failed stream crossing was removed in the upper end of the gulch to allow fish migration (see Section 2.1.1.3). Instream temperatures are fully suitable, and coho and steelhead consistently inhabit this gulch (Downie et al 2006).

Hatch Gulch

Juvenile coho and steelhead have been frequently observed in this small first order stream. Limited temperature monitoring indicates fully suitable temperatures for salmonids (Downie et al 2006). Habitat inventory surveys from 1996 (GP) indicate that canopy cover was fully suitable, shelter values are suitable, pool depth and frequency are unsuitable, and spawning conditions based on summer cobble observations are fully unsuitable. As a small first order stream, pool frequency and depth targets are not applicable, and embeddedness observations during summer may not correlate to spawning quality in winter (see Section 2.1.1.1).

Kidwell Gulch

Kidwell is another small first order gulch with restricted fisheries values due to limited flow potential. The results of surveys conducted in 2002 by CDFG suggest that spawning and pool habitat is deficient, but that canopy values are suitable. The target thresholds are likely not valid for this small subbasin.

Laguna Creek

The lower reaches of this creek, managed by California Department of Parks and Recreation, are predominately wetland marsh. The control point for the impounded marsh pond is composed of large redwood logs that may form a barrier to fish passage from the mainstem in some form. Limited temperature monitoring by GP indicates fully suitable temperatures for both coho and steelhead, but only juvenile steelhead have been observed. Considering the multiple barriers to fish passage presented by the marsh, there is a high probably that Laguna is populated solely by resident rainbow trout (GP 1996). Similar to other small, first order streams tributary to Big

River, stream target conditions are likely not relevant. The lower reaches have more ecological value as a wetland than the upper reaches do as salmonid habitat.

Little North Fork Big River (LNFBR)

The LNFBR is a productive fish-bearing stream where coho and steelhead have been reliably reported since the 1950s. Shelter values, canopy values, pool frequency and depth, are optimal for salmonids (Downie et al 2006). CDFG (Downie et al 2006) reports poor spawning conditions from cobble embeddedness observed during summer surveys (see section 2.1.1.1). From a management standpoint, TCF owns only a minor reach of this stream, totaling less than two miles (Figure 1-2), suggesting there is limited impact from TCF management activities on aquatic conditions in the stream.

One Log Gulch

This very small gulch is not likely to contribute to fish production in the watershed. Because of its size, habitat inventories have not been conducted. Foresters employed by CTM classified a small segment as fish bearing based on the possibility of suitable habitat, not on actual fish observations.

Peterson Gulch

Similar to the other small, un-surveyed gulches on the Property, this gulch offers an exceedingly small amount of habitat for fish (Table 1-2). It probably provides more fisheries value as a cooling influence and feed producer for fish in the mainstem.

Railroad Gulch

This gulch, located in the Berry Gulch Planning Watershed (Figure 1-2), is not the same as another surveyed gulch with the same name, located in the Mouth of Big River planning Watershed. This watercourse is also limited for fish production due to size. A small amount of the stream was classified by CTM as fish bearing based on the possibility of fish habitation.

Shafsky Gulch

This gulch has minimal drainage area and has not been surveyed, likely due to its small influence on overall fish production. Foresters for CTM determined that about a half mile of the lower drainage should be considered fish bearing based on habitat conditions.

Two Log Creek

Although this sub watershed is a perennial stream, tributary to the mainstem, there are other Class I streams tributary to the Creek. It contains 2.8 miles of fish-bearing habitat and is the most significant tributary to Big River on the Property, with consistent historical documentation of coho and steelhead. Stream temperatures within the subbasin are generally suitable for salmonids (Figure 2-5) except for a short period in 2006 when the entire region experienced a heat spell. A survey in 2002 found spawning conditions suitable, but shelter conditions and pool depth deficient (Downie et al 2006). In 2004 a stream enhancement project was implemented by CTM throughout the subbasin (see Section 2.1.1.2): 30 LWD structures were placed at sites to enhance fish production. As a consequence, shelter values and pool frequency/depth may have increased since the 2002 survey.

Two Log Gulch

This small un-surveyed gulch, tributary to Two Log Creek, has limited value for direct fish production. Foresters employed by CTM classified a small segment (Table 1- 2) of the stream as fish bearing based on potential habitat, not fish presence.

Unnamed 1, 2, and 3 Gulches

These three gulches most likely directly support few if any fish. They have not been surveyed; habitat was classified as fish bearing by foresters working for CTM based on the possibility that they might support a small number of steelhead.

1.2.2 Special Status Animal Species

1.2.2.1 Coho Salmon

Coho have been definitively observed throughout Big River and most of its tributaries (Downie et al 2006) (GP 1996). The coho salmon (*Oncorhynchus kisutch*) was listed as federally threatened on December 2, 1996 within the Central California Coast Evolutionary Significant Unit (ESU) and was state and federally listed as endangered in 2005. This ESU includes all naturally spawned populations of coho salmon in coastal streams south of the Mattole River in Humboldt County to the San Lorenzo River in Santa Cruz County. Coho salmon are anadromous salmonids that require migration access to streams, cold, clean, well oxygenated water, and that prefer the cover of overhanging vegetation, undercut banks, submerged vegetation, rocks, and logs and deep, slow-moving water. Coho typically initiate upstream migration between late October and mid-February. Preferred mean weekly average temperatures (MWATs) found in the literature for coho range from 10 to 17.5° C (55-63.5° F). Redds are laid in gravel that range in size from 1.3 to 10.2 cm. in diameter and intergravel mortality begins to occur when fine sediments exceed 13 percent of the substrate composition within the redd egg pocket (note that redd construction involves a winnowing process that clears the egg pocket of most fine material). After emergence from gravels, juvenile coho spend the rest of the year in the freshwater environment. This makes coho reliant on over-summer and over-wintering habitats within rivers and streams, engendering susceptibility to impacts from degraded freshwater habitat. Favored summer habitat is deep coldwater pools often formed by the presence of large woody debris and sufficient cover. Winter habitat includes low velocity stream habitats (alcoves, backwaters, side channels and floodplains) where juveniles can weather high winter flows. The majority of coho juveniles migrate to the ocean at age one and return to fresh water to spawn after two to three years.

1.2.2.2 Steelhead Trout

Steelhead have also been observed throughout the Big River watershed (Downie et al 2006). The steelhead (*Oncorhynchus mykiss*) was listed as federally threatened on June 7, 2000 within the Northern California ESU which includes steelhead in California coastal river basins from Redwood Creek in Humboldt County south to the Gualala River in Mendocino and Sonoma counties. The vast majority of steelhead stocks present in the North Coast are winter run whose adult upstream spawning migrations occur from December through March, with spawning taking place shortly after the arrival to the spawning grounds. Unlike Chinook and coho, most steelhead do not die after spawning, but migrate back to the marine environment and return to spawn in following years. Steelhead have flexible life histories with most spending between one and three years in freshwater before migrating to the ocean as smolts. They also spend a variable amount of time (one to four years) in the marine environment before returning to spawn. While this illustrates flexibility in adapting to variable stream conditions, it exposes juvenile steelhead to adverse over-summer and over-winter stream conditions including elevated water temperatures and sedimentation of spawning gravels. Steelhead mortality at the different life stages is closely affiliated with water temperatures. Preferred MWATs found in the literature for steelhead range from 10 to 17.5° C (60-63.5°F). Steelhead prefer to spawn in gravels 0.6-10.2 cm. in diameter, with eggs developing in approximately 31 days. When fine sediments exceed 13 percent of the substrate composition, intergravel mortality can occur.

1.2.3 Other Aquatic Species

Big River supports many aquatic and semi-aquatic vertebrate species besides fish (Table 1-3). Many of these species are completely terrestrial for varying fractions of their life histories, but may use the watercourse for feeding, breeding, and/or rearing.

In addition to coho and steelhead, four other fish species are commonly found in the fresh water environment of Big River (Table 1-3). The two sculpin species are commonly observed in most Class I watercourses in the region. Biologists employed by GP and CTM have directly observed Pacific Lamprey. Whether other lamprey species are endemic in the watershed is unknown, but all three species may occur. Big River is within the range of River and Western Brook Lamprey but these species have not been directly observed.

Table 1-3. Aquatic Species Observed or Potentially Occurring in Big River Property

Common Name	Species	Listing Status	Comments
Reptiles			
Northern Pacific Pond Turtle	*Actinemys marmorata*	None	Common
Western Aquatic Garter Snake	*Thamnophis couchi*	None	Common
Amphibians			
Coastal (Pacific) Giant Salamander	*Dicamptodon tenebrosus*	None	May hybridize with *ensatus*
Southern Torrent Salamander	*Rhyacotriton variegatus*	California Species of Special Concern (CDFG)	
Northwestern Salamander	*Ambystoma gracile*	None	
Rough-skinned Newt	*Taricha granulosa*	None	
Red-bellied Newt	*Taricha rivularis*	None	
Coast Range Newt	*Taricha torosa*	California Species of Special Concern (CDFG)	
Ensatina	*Ensatina eschscholtzi*	None	
Black Salamander	*Aneides flavipunctatus*	None	
Tailed Frog	*Ascaphus truei*	Threatened (CESA) California Species of Special Concern (CDFG)	
Western Toad	*Bufo boreas*	None	
Pacific Treefrog	*Hyla regilla*	None	

Common Name	Species	Listing Status	Comments
Bullfrog	*Rana catesbeiana*	None	Invasive species
Northern Red-legged Frog	*Rana aurora aurora*	California Species of Special Concern (CDFG)	
Foothill Yellow-legged Frog	*Rana boylei*	California Species of Special Concern	
Fish			
Pacific Lamprey	*Lampetra tridentata*	None	
River Lamprey*	*Lampetra ayresi*	None	
Western Brook Lamprey*	*Lampetra richardsoni*	None	
Threespine Stickleback	*Gasterosteus aculeatus*	None	Common
Prickly Sculpin	*Cottus asper*	None	Common
Coastrange Sculpin	*Cottus aleuticus*	None	Common
Sacramento Sucker*	*Catostomus occidentalis*	None	

* listed as within the range of these fish species by Moyle (2002), but not observed by CTM staff.

2 Background for Restoration and Enhancement

In northern California watersheds, salmonids are considered the keystone aquatic species by state and federal regulatory agencies. The State Water Resources Control Board and the US EPA consider salmonids a key indicator of water quality. Coho in this region have been listed as state and federally endangered and steelhead have been listed as federally threatened.

Consequently, the aquatic management goals are tailored to promote healthy salmonid populations with the assumption that other aquatic taxa will also thrive. Therefore, healthy instream habitat conditions that are known or assumed to promote salmonids are the overarching goal of the Aquatic Management Plan.

Management goals relative to salmonids within the Salmon Creek Watershed should be tailored towards the preservation or enhancement of aquatic habitat elements necessary for salmonid survival. These elements include maintenance/enhancement of shade canopy, recruitment of large wood (either naturally or artificially), maintenance of summer flows, and prevention of discharges of fine sediments. The incorporation of these elements into property wide management plans should be considered relative to any management activity, not just those near aquatic habitats.

2.1 Restoration and Enhancement

The following recommendations and prioritization of aquatic restoration and management actions was based on a synthesis of existing reports and recommendations pertaining to aquatic restoration. This process involved the review and analysis of pertinent documents and field surveys conducted in the watershed and formulating restoration objectives relevant to the Property. The following suggested approach relies on an analysis of limiting instream factors identified within the watershed.

Because this watershed has been 303d listed for temperature and sediment by the US EPA, numerous information sources are available on the watershed. This analysis and subsequent recommendations rely primarily on the assessment of the watershed conducted by NCWAP (Downie et al 2006), habitat inventory surveys conducted by GP, habitat inventory surveys by CDFG, and from instream temperature, aquatic vertebrate, and sediment monitoring conducted by GP and CTM from 1993-2004.

Nearly all the major watersheds in northern California have been impacted by historic logging operations, and, as discussed in Section 1.1.2.1, Big River shares a similar history. The restoration and enhancement measures prescribed in this plan rely on a conceptual limiting factors analysis to determine aquatic bottlenecks to salmonid production as per Meehan et al (1991).

2.1.1 Aquatic Limiting Factors Analysis

The life requirements for anadromous Pacific salmonids in the freshwater environment are generally well understood (Bjorn and Reiser 1991). Survival in their freshwater phases depends on the availability of cool, clean water, unlimited migratory access throughout the stream network, clean spawning gravel, suitable and adequate food supplies, and complex instream shelter components to avoid predation. These necessary life-history components are provided by a diverse and complex aquatic habitat. When any of these life history components are missing or degraded, fish stock production can be adversely impacted. The basis of a limiting factors analysis is to identify and evaluate these requirements throughout the watershed on a spatial and temporal scale. When these requirements are evaluated on both watershed and reach scales, factors that promote or limit salmonid stocks can be identified.

Natural disturbance factors such as landslides and wildfires that limit salmonid stocks in watersheds, while generally covering larger areas than sites of human disturbance, are usually not distributed throughout the watershed. The stochastic nature of these disturbances, which tend to rotate though watersheds on a broad temporal and spatial scale, allow individual sub-basins sufficient time for recovery. On a watershed scale this creates diverse and dynamic habitat conditions for salmonids. In contrast, human disturbances tend to be comparatively smaller on an individual basis, but usually more widely distributed throughout the watershed (Reeves 1995). Naturally occurring landslides and other disturbances occur within the Big River watershed; however, their impacts to salmon stocks are minimal compared to anthropogenic disturbances such as road building that are more widely distributed throughout the basin.

The concept of a limiting factors analysis was first introduced in the 1980s (Everest and Sedell 1984) (Meehan 1991) and has been utilized extensively in assessment studies of proximate regional watersheds (Klamt [NCWAP Gualala] 2002; Downie et al [NCWAP Albion] 2004; Downie et al [NCWAP Big River] 2006) by the California Department of Fish and Game and by others throughout the Pacific Northwest to identify problems within watersheds and direct stream restoration activities. For the purposes of this aquatic management plan it is not necessary to discuss the entirety of all studies and processes involved. Rather the purpose is to establish that certain stream conditions are commonly recognized to influence salmonid production in most watersheds throughout this region, and they are generally well recognized in peer reviewed articles and publications (Reeves and Everest 1989) (Bisson, In press).

In Big River and other watersheds in this region, stream condition is thought to consist of these factors: adequate stream flow, suitable water quality, and complex habitat.

Adequate stream flows are critical for salmonid production at all points through their freshwater life cycle. A suitable winter flow regime is required for upstream migrating spawners and egg development within redds, and rearing juveniles need adequate summer flows for feeding, predator evasion, and thermal refugia. A natural hydrologic regime that decreases the magnitude of winter peak flow events and increases flows during the summer drought period favors salmonid production. The natural hydrograph of coastal watersheds in northern California is often one of limited flows during summer, limiting carrying capacity and connectivity throughout the aquatic habitat. Consequently, freshwater salmonid survival is particularly tied to diminished flows during summer. In Big Salmon Creek within TCF ownership, stream diversions do not occur and drafting occurs minimally, so stream flows are thought to mimic the natural hydrologic regime and are not considered limiting beyond normal variance.

Water quality considerations for salmonid production consist of three factors: 1) water temperatures, 2) turbidity, and 3) sediment load. Steam temperature in summer is often thought to be critically important for growth and rearing in salmonids (Hines and Ambrose, 2000). Literature suggests that suitable temperatures for salmonids at this life history stage range between 10.0° – 17.5° C depending on the species. Steelhead are generally slightly more tolerant of higher stream temperatures than coho.

Turbidity, or the relative clarity of water, can affect primary productivity of aquatic vegetation. This consequently affects aquatic insect production, which in turn may alter salmonid productivity. Increased suspended sediment loads can interfere with juvenile salmonids ability to locate prey and decrease overall growth rates.

The final aspect of water quality is stream sediment bedload, which can be subdivided into two separate analyses: compositional and quantitative. Although salmonids use a winnowing process to flush out fine materials during redd construction, if the proportion of fine sediment within the substrate is excessive, survival-to-emergence (STE) of fry from the redd is reduced (Kondolf 2000). Fine sediment reduces interstitial flow through the spawning gravel, subsequently reducing the dissolved oxygen flow to embryos and the flushing of metabolites. Excessive overall quantities of sediment affect juvenile salmonids generally in two ways: debris torrents in winter, when large amounts of sediment are suspended in the water column, can cap redds as sediment comes out of suspension; and deleterious quantities of bedload within channels in summer can force stream discharge to flow subsurface, effectively reducing rearing habitat in small streams during a critical life stage.

Habitat complexity for salmonids has also been thoroughly researched and discussed in fishery literature (Flosi et al 1998). An optimally complex condition for salmonids is thought to consist of a combination of riffle, flatwater and pool habitat types. Riffles provide spawning substrate and a rearing area for fry; flatwater provides connectivity through the stream network and some rearing habitat for juveniles; pools provide refugia from predation and high stream velocities in winter, foraging habitat throughout the year, and rearing habitat in summer.

Stream conditions for salmonids are also dictated by the quality of the adjacent riparian habitat. Shade canopy from dense bank dwelling vegetation limits the amount of sunlight that reaches the stream, buffering excessive stream temperatures in summer and insulating overly cool temperatures in winter. Green leaf matter falling from streamside trees provides a nutrient source for aquatic insects that in turn become feed sources for fish. The course woody habitat elements recruited from the fall of riparian trees eventually forms roughness and shelter components within the active channel in the form of LWD. A well functioning riparian zone also provides stream bank stability with dense vegetative root masses, limiting sediment delivery from bank failures and streamside landslides.

The limiting factors assessment analyzes aquatic factors thought to limit salmonids in the instream residency component of their life history. The following narrative outlines the goals, background, discussion, and recommendations for each limiting factor identified. Habitat assessment surveys identify the majority of limiting factors in the watershed and are consequently addressed first. Table 2-1 summarizes limiting factors within the watershed and management recommendations.

Table 2-1. Summary of Limiting Factors and Management Recommendations.

<table>
<tr><th>Limiting Factor</th><th>Regulatory Reference</th><th colspan="2">Measured Parameters</th><th>Desired Condition</th><th>Management Recommendations</th></tr>
<tr><td rowspan="3">Habitat</td><td rowspan="3">Desired Salmonid Freshwater habitat Conditions for Sediment-Related Indices (NCRWQCB 2006).</td><td colspan="2">Pool habitat</td><td>Where applicable, increasing trend in frequency and length.</td><td rowspan="3">Monitoring should occur according to the protocols found in the California Stream Restoration Manual (Flosi et al 2004).</td></tr>
<tr><td colspan="2">Pool depth</td><td>Where applicable, increasing trend in pool depth.</td></tr>
<tr><td colspan="2">Primary pool distribution</td><td>Maintain 40 % of stream habitat by length in 2 nd- 4 th order streams.</td></tr>
<tr><td rowspan="3">LWD</td><td rowspan="3">Desired Salmonid Freshwater habitat Conditions for Sediment-Related Indices (NCRWQCB 2006).</td><td>Bankfull Channel Width (m)</td><td>Index (per 100m of Channel length)</td><td rowspan="3">An increasing trend in the frequency of LWD within active stream channels.</td><td rowspan="3">Monitoring should occur according to the protocols found in the California Stream Restoration Manual (Flosi et al 2004).</td></tr>
<tr><td>1 to 6</td><td>> 38 pieces</td></tr>
<tr><td>> 6 to 30</td><td>> 63 pieces</td></tr>
<tr><td>Fish Passage</td><td>California Stream Restoration Manual (Flosi et al 2004).</td><td colspan="2">Bridge and culvert parameters as prescribed in manual.</td><td>Fish passage at all crossings at all life-history stages in Class I watercourses.</td><td>Monitoring should occur according to the protocols found in the California Stream Restoration Manual (Flosi et al 2004).</td></tr>
<tr><td rowspan="3">Stream Temperature</td><td rowspan="3">NCWAP Overview and Methods (2006)</td><td>MWAT Range</td><td>Description</td><td rowspan="3">Maintain summer stream temperatures within 10º C – 16.5º C (50º F – 62º F).</td><td rowspan="3">Monitoring should occur at some or all historic monitoring stations.</td></tr>
<tr><td>10º - 15.5º C</td><td>Fully Suitable</td></tr>
<tr><td>16º - 16.5ºC</td><td>Moderately Suitable</td></tr>
<tr><td rowspan="3">Sediment</td><td rowspan="3">Desired Salmonid Freshwater habitat Conditions for Sediment-Related Indices (NCRWQCB 2006).</td><td colspan="2">Turbidity (ntu)</td><td>Turbidity should not increase more than 20 percent above naturally occurring background levels.</td><td>Stream channel confluences should be monitored for turbidity during storm events.</td></tr>
<tr><td colspan="2">Suspended Sediment Load (tons/day)</td><td>The suspended sediment load and suspended sediment discharge rate of surface waters should not adversely affect beneficial uses</td><td>Stream channel confluences should be monitored for suspended sediment loads</td></tr>
<tr><td colspan="2">Embeddedness</td><td>An increasing trend in the number of locations where gravels and cobbles are < 25% embedded.</td><td>Monitoring should occur according to the protocols found in the California Stream Restoration Manual (Flosi et al 2004).</td></tr>
</table>

2.1.1.1 Habitat Assessment

Goals

The primary goal of habitat assessment surveys is to determine the quality of the aquatic habitat within watersheds. The information generated in the assessment is used to identify areas in need of remediation and guide restoration efforts. The secondary goal is to generally identify how fish use the watershed, which areas are optimal for different components of their life history: spawning, rearing, and over-wintering.

Background

Big River and its tributaries were originally surveyed to determine habitat quality for anadromous salmonids in the 1950s and 1960s. The intent of these original surveys, however, was to gather qualitative information, and while they illustrate general stream conditions at that time they are difficult to compare to latter surveys for trend analyses. In the early 1990s CDF&G developed its present day methodology to survey, analyze, and report on aquatic habitat conditions (Flosi 1998), which relies on a more quantifiable data analysis. The streams within the Big River Property confines were surveyed using the present methodology in the late 1990s and early 2000s. Unfortunately, the methods used presently cannot be readily compared with past surveys. The two reporting systems also differed slightly in their conceptual view about aquatic habitat quality with regard to LWD. The older 1950s –1960s reports tend to regard LOD, LWD as potential barriers to fish passage that should removed, with little recognition to the aquatic benefits of logjams in streams. Consequently it is difficult to determine whether jams actually posed barriers to fish passage over a longer time scale. It is interesting to note that a 1959 survey of Two Log Creek found “17 logjams; many barriers” (Downie et al 2006). Then in 1966, two years after the 1964 flood, no barriers were observed, which illustrates the ephemeral nature of wood in a stream system over broad temporal scales.

The 2006 NCWAP analysis of the Middle and Coastal subbasin study units brings together a multitude of research efforts that encompass the Property. The results of this synthesis suggest the following three stream condition parameters are limiting salmonid production:

1. Water temperatures in Mainstem Big River during summer are not suitable for rearing salmonids.
2. Splash dam logging and wood removal projects have diminished channel complexity throughout most of the stream network.
3. Excessive sediment delivery to the watercourse from legacy and present practices may be limiting the survival-to-emergence of fry from redds, and reducing the feeding success of rearing parr.

Discussion

To effectively manage the stream network within the confines of the Big River Property, it is necessary to recognize that the tributaries require a different strategy than the mainstem. In general the NCWAP analysis suggests that the tributaries may suffer from excessive bedload and sediment, while the mainstem suffers from excessive water temperature.

All inventory surveys conducted throughout the Property clearly indicate that lack of instream structure and channel homogenization are primary factors limiting fish production in the Middle and Coastal subbasins in both the tributaries and the mainstem. These findings would then suggest a universal strategy throughout the Property to increase shelter values and pool habitat recruitment. The benefits to ecosystem resilience from instream structure have been well documented (Maser and Sedell 1994). Instream shelter components, particularly from organic sources as wood, have been attributed to many beneficial aspects of aquatic ecology, as listed:

- Aquatic macro-invertebrate production
- Structural shelter habitat for aquatic organisms including salmonids
- Structural habitat for aquatic organisms in the form of pool habitat development
- Increased over-summer water storage due to increased pool development.
- Increased bank stability due to decreased bank downcutting and increased riparian flooding during peak flows
- Shelter habitat for rearing salmonid juveniles in summer
- Shelter habitat for salmonids (adult and juvenile) from high stream velocity events in winter
- Spawning gravel retention and sorting and storage of sediment.

The NCWAP assessment indicates that of the tributaries to Big River within the Property, Two Log Creek is the most significant fish-bearing stream. The meta-population approach to determine priority locations for restoration and remediation give areas that consistently support fish populations more weight than locations with varying distributions. The basis for this approach is that thriving stocks will re-seed sink areas where habitat conditions are sub-optimal but improving. Therefore, higher priority is given to "shore up" existing high quality reaches such as Two Log Creek.

The habitat surveys indicate unsuitable embeddedness values in many of the perennial streams on the Property. These observations are then extrapolated into spawning suitability statements. A caveat to embeddedness observations, however, should be noted: embeddedness is a measure of the degree to which a surface lying cobble is buried. Observers note the degree of "buried-ness" at pool tail-outs during summertime surveys. Pool tail-outs are thought to be the most likely spawning locations for anadromous salmonids; however, empirical data from spawning surveys indicates that salmonids use a variety of channel locations (Gallagher and Wright 2007). Therefore, cobble observations taken at tail-outs may not correlate spatially to spawning areas. Additionally, embeddedness observations are taken in summer while anadromous salmonids spawn in winter, allowing a considerable temporal interval between the two assumed related events. The CDFG provides no cited references that have researched the relationship between embeddedness observations in summer and spawning suitability in winter. Stillwater Sciences (2008) found only a weak statistical relation between fine sediment and embeddedness observations, and, additionally, found no statistically significant correlation between fines measured in summer and fines measured in redds in winter. Kondolf (2000) notes that spawning salmonids actively "winnow" fine sediment from the redds as a cleansing process, and recommends a correction factor when assessing fine sediment in the substrate.

Recommendations

All recent assessment surveys and associated reports generated in the Big River Middle and Coastal subbasins consistently suggest that channel homogenization due to lack of LWD is a primary factor limiting salmonids in Big River. The other clear limitation to anadromous salmonid production is excessive summer water temperatures in the mainstem. However, there are limited management actions (see Section 2.1.1.4) available to correct this long-term problem.

The aquatic management strategy for this watershed should therefore focus on increasing wood loading in the active channel. Current forest practices will ensure that riparian corridors are managed for natural recruitment of large trees into the channel, as has been historically occurring within the recent management regime.

However, the rate of wood recruitment from natural processes like mortality, bank failures, streamside landslides and windfall is likely insufficient for the near term needs. The natural mortality of redwoods in particular (considering the life span of these trees and their resistance to disease) and fall probability (the probability that dying trees will actually fall in the channel) would result in a very slow rate of recruitment. The immediacy of the problem, therefore, suggests that artificial wood recruitment is necessary. Section 2.1.1.2 addresses artificial LWD recruitment in the watershed.

Future habitat assessments are proposed in the following phases:

Phase One (2009-2010)

- Conduct LWD surveys in select reaches of the watershed to determine deficiencies in wood loading.

Phase Two (Begin 2010)

- Conduct Habitat Inventory Surveys on a ten-year frequency to continue monitoring aquatic habitat conditions.

2.1.1.2 LWD

Goals

Reflecting the scarcity of LWD within the watercourse and the associated unfavorable aquatic habitat conditions as found in the habitat assessment surveys, the primary goal is simply to increase channel complexity through the artificial recruitment of LWD into the stream network where necessary. The secondary goal is to implement wood based enhancement projects efficiently with minimal negative ecological impacts and maximized enhancement properties.

Background

In 2004 a stream enhancement (mitigation) project was initiated by CTM throughout Two Log Creek. Channel structural values were enhanced through the use of large log structures. The design techniques incorporated elements of "hard-anchored" structures combined with loose scour logs to allow for log mobility. In all, 30 structures were completed throughout the stream, enhancing habitat values in the project reach.

Discussion

Stream enhancement projects utilizing wood structures can generally be accomplished with either wood collected from timber harvest operations, or harvested/salvaged specifically for the project. Although the 2004 Two Creek wood project successfully enhanced stream conditions, it was generally costly. A self-loading log truck transported large logs (16'- 40') harvested from outside the project area to staging areas adjacent to the 30 structure sites. The logs were then "flown" in to the site and placed with a cable yarder and an associated logging crew. To complete the installations, crews from the California Conservation Corps were hired to secure the logs to streamside anchor points.

There are a number of disadvantages to using cull logs from timber operations and logs felled away from the site. The primary disadvantage to this method is that log stock collected away from the site must be transported. A functional road network to the restoration site is then required, and heavy equipment must be used extensively within the channel and along the banks. The site's overall restoration value is consequently diminished by increased sediment delivery. In the Two Log Project, cable yarders were used to transport logs from staging areas to the sites, which minimized sediment delivery. However, cable yarding is not a cost effective method to use consistently on multiple projects. Additionally, salvaged logs are often inferior both in length and structural considerations. Logs deficient in length characteristics often must be permanently anchored to existing stationary landmarks to avoid being flushed from the basin during high flows. These associated requirements are costly and, more importantly, result in structures that are sub-optimal from the perspective of fish habitat. Permanently anchored structures don't allow log movement. As a consequence, important hydrologic processes such as scour and sediment sorting are limited because the immobile log cannot descend into the subsequent scour hole.

Large unanchored logs approximately two times the channel width should be used for in-channel structure. Length allows some hydrologic mobility while also limiting large-scale movement, retaining the valuable wood within the watershed. Due to the mature riparian conditions found in most perennial stream reaches on the Big River Property and the cooling influence of the marine dominated climate, it can be reasonably assumed that selected riparian trees in the perennial streams could be placed into the channel without undo negative impact to the stream's thermal regime. Using select riparian trees for instream structure is cost effective, it minimizes damage to the channel banks, and it minimizes damage to riparian vegetation because heavy equipment use is minimized. This method also allows for increased flexibility in site selection, as a functioning road network is not required.

A review of the information available for the Big River Basin clearly indicates the mainstem reach in the Middle and Coastal subbasins is deficient in LWD as well being thermally impaired. The wide channels found in forth order streams such as the mainstem Big River increase stream exposure to solar radiation and contribute to excessive water temperatures. Management actions along the mainstem should promote channel width reductions along with increases in channel depth. Channel structure, in the form of large logs with attached root-masses, creates scour points that increase channel depth and decrease width. Stream banks that were formerly exposed to the full scouring forces of winter peak streamflows are then protected, creating suitable recruitment zones for colonizing streamside vegetation and enhancing further bank stabilization processes. Although there is little shade canopy along the mainstem (due to the magnitude of the channel width), it seems unlikely that riparian tree growth will correct the temperature problem in the near future, with channel conditions as they presently occur. To return the channel structure to a heterogeneous state, as it likely existed before the era of logging and stream clearance activities, management should consider plans to add selected large streamside conifers with attached root-masses to the active channel as LWD. The associated increase in red alder and willow recruitment will contribute to stream cooling influences and increase feeding opportunities for rearing anadromous salmonids.

Recommendations

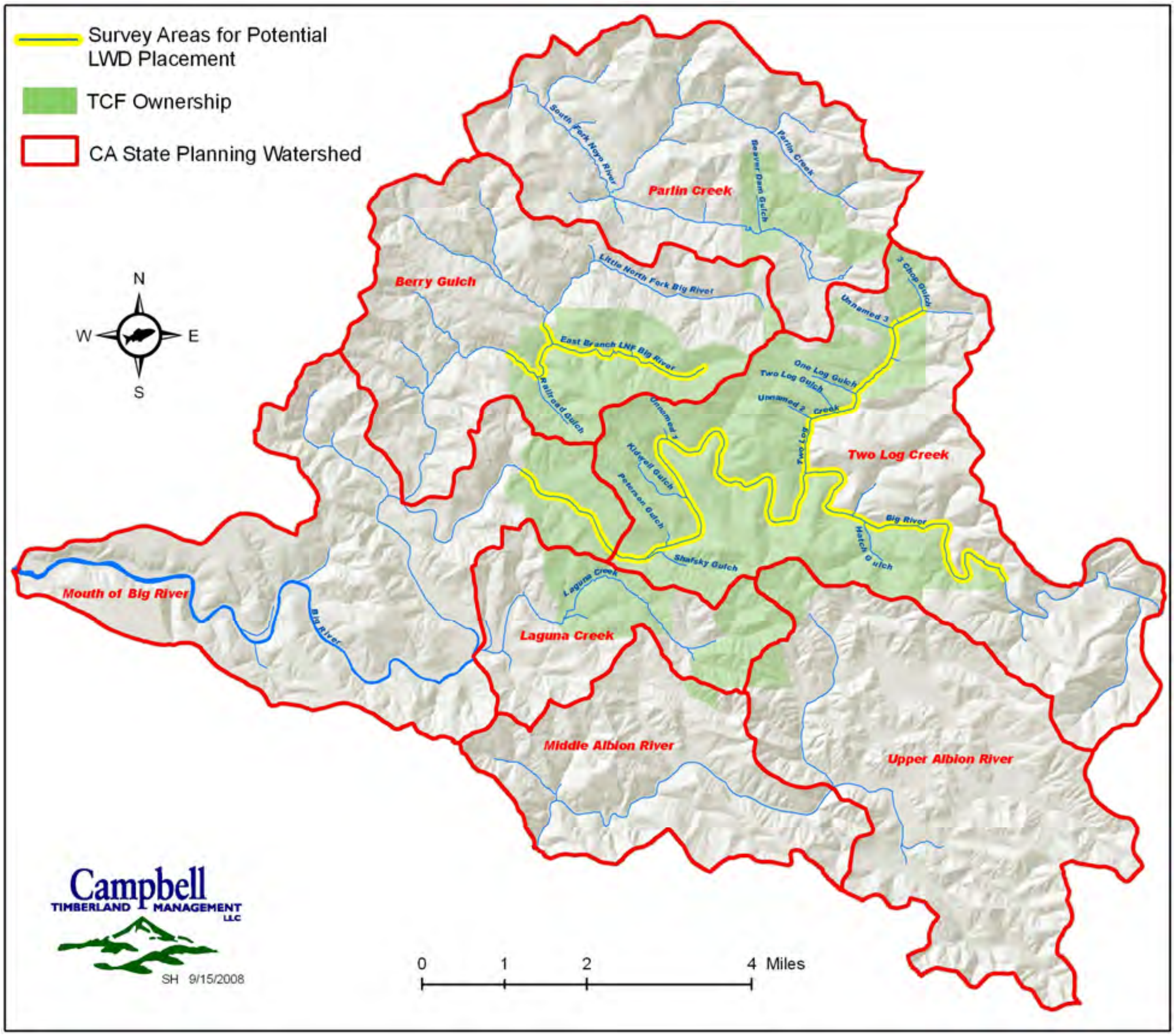
- Survey mainstem and tributary reaches in the list below to quantify LWD.

- Treat select reaches found deficient in LWD in mainstem Big River and its tributaries using the procedure described above. Note that treatment costs for the smaller channel tributaries will be less than mainstem costs. This is due to the differential in channel sizes: treatment on the mainstem requires that large trees are pulled over with heavy equipment to keep the root masses intact, while treatment on the smaller streams requires only cut logs. A rough treatment cost estimate for five to six miles of smaller stream reaches (based on a average cost of $9,000/mile) is $54,000 if all tributary reaches are treated. On the mainstem, where tractors are needed for implementation, costs can be broken down to a per tree basis. Cost estimates range from $400 to $900 per tree depending on location and difficulty. Depending on funding constraints, these reaches can be prioritized for fisheries values and implemented as resources become available.
- Assess the following prioritized areas for LWD deficiencies and, when applicable, target these areas for potential restoration sites:

  1. **Two Log Creek**
     a. Although a stream enhancement project was previously implemented in this stream, considering the fisheries values found here, additional instream structures are recommended. The entire 2.8-mile stream reach should be re-surveyed to identify supplementary placement sites.
  2. **Mainstem Big River**.
     a. The entire 11.8-mile reach between Property boundaries should be evaluated for large structure placements.
  3. **LNF Big River**
     a. The reach defined by the Property boundaries (1.2 miles) should be evaluated for LWD placement.
  4. **EBLNF Big River**
     a. The 2.1-mile reach defined by the confluence to Class I habitat termination should be evaluated for artificial LWD enhancement.

The potential for fish production in Laguna Creek and the smaller perennial streams does not warrant expenditures for stream enhancement other than best management practices of the riparian zones.

Figure 2-1. Recommended LWD Survey Reaches for Potential Stream Enhancement.



2.1.1.3 Fish Passage

Goals

Adult salmonids require access to spawning habitat, and juvenile rearing fish need access to feed sources and refugia habitat in order to thrive. Refugia habitat is often categorized as: 1) thermal refugia (cooler areas during hot periods); 2) over-wintering refugia (low velocity areas protected from peak flow events); and 3) predator refugia (areas protected from predation). Any area in the watershed utilized by fish at any point in their life history is defined as Class I habitat. This portion of the Aquatic Monitoring Plan identifies barriers to fish migration and recommends actions to eliminate them.

Background

Since 1994 past landowners have been removing problematic culverts and other anthropogenic barriers to fish migration as part of the timber harvest process and, additionally, as watershed improvements outside the process. Over time most known artificial barriers to fish passage have been removed within the watershed.

In 2002 CTM removed a 75 foot-wide barrier to fish passage from the upper EBLNF Big River in connection with the East Side Rumbler (THP 1-01-290 MEN), opening nearly a mile of potential Class I stream habitat. The legacy crossing constructed in 1976 was mainly constructed of earthen fill material and contributed deleterious quantities of aggregate sediment during peak flow events through bank failures and head cutting. More than 1,000 cubic yards were removed from the stream network in this action. However, there are few if any area left on the Property where significant amounts of potential fish-bearing habitat are disconnected from anadromous salmonid migration.

Discussion

On small watercourses, the amount of Class I habitat that is available to fish upstream of a culvert-formed partial barrier is limited, and the potential risk of downstream degradation to quality habitat from sediment released by culvert removal is high. In the few instances in the watershed where these conditions exist, the potential overall benefit to the fishery must be weighed against the potential risks and costs. Managers often have a limited restoration resource budget. The costs versus the potential overall benefit to the resource must be weighed to prioritize remediation actions. An expensive culvert removal that opens a small amount of marginal habitat may not have the same resource value as remediation in an impacted mainstem reach with potential for much greater fish production.

The current culvert crossings on both One Log Gulch and Two Log Gulch (not Creek) are an example of this management problem. Both creeks are very small (226 and 238-acre drainage area, respectively) and offer little Class I habitat due to limited flow potential. However, past land managers were required to classify the lower reaches of the stream as fish bearing based on habitat conditions - not fish presence, even below the culvert. The present culvert placement likely does not allow fish passage for salmonids (or other aquatic organisms) at all life stages. To remove the culverts would require considerable fill removal and the installation of two bridges, an expensive action. Considering the substantial amount of resources needed for remediation and monitoring on the known fish producing and impacted reaches across the Property, the removal of these culverts should be low priority. As the relatively new culverts wear out over time they should be replaced, but they are not immediate action items.

Recommendations

Monitoring and assessment of barriers to fish passage should continue throughout the watershed in the form of reconnaissance surveys, and fish passage in suspect crossing and culverts can be evaluated using protocols described in the *Salmonid Stream Habitat Restoration Manual* (Flosi et al 2002). When potential artificial barriers are identified, the risks of removal should be evaluated against potential gain to the fishery. When the assumed gain to the resource is greater than the potential negative effects, the barrier should be removed.

2.1.1.4 Water Temperature

Goals

Literature concerning stream temperatures for coho and steelhead indicates that suitable temperatures for these salmonids occur within the range of 10º to 17.5° C (50-63.5° F), when gauged from a seven-day rolling average of the daily average temperatures (Welsh 2001; Sullivan 2000; Downie et al 2006). For this Aquatic Management Plan, the thresholds developed by NCWAP (Downie et al *Big River Assessment Overview and Methods* 2006) (Walker 2007) are used (10º C to 16.5º C) (50º F – 62º F) (Table 2-1). These thresholds were developed by a panel of fisheries scientists upon a literature review of northern California stream temperatures and juvenile salmonids. The maximum of the weekly averages is referred to as MWAT and is often used as a single point metric to evaluate stream temperature. The goal for the aquatic management plan is maintain instream MWATs on the cooler end of the stated suitable range.

Background

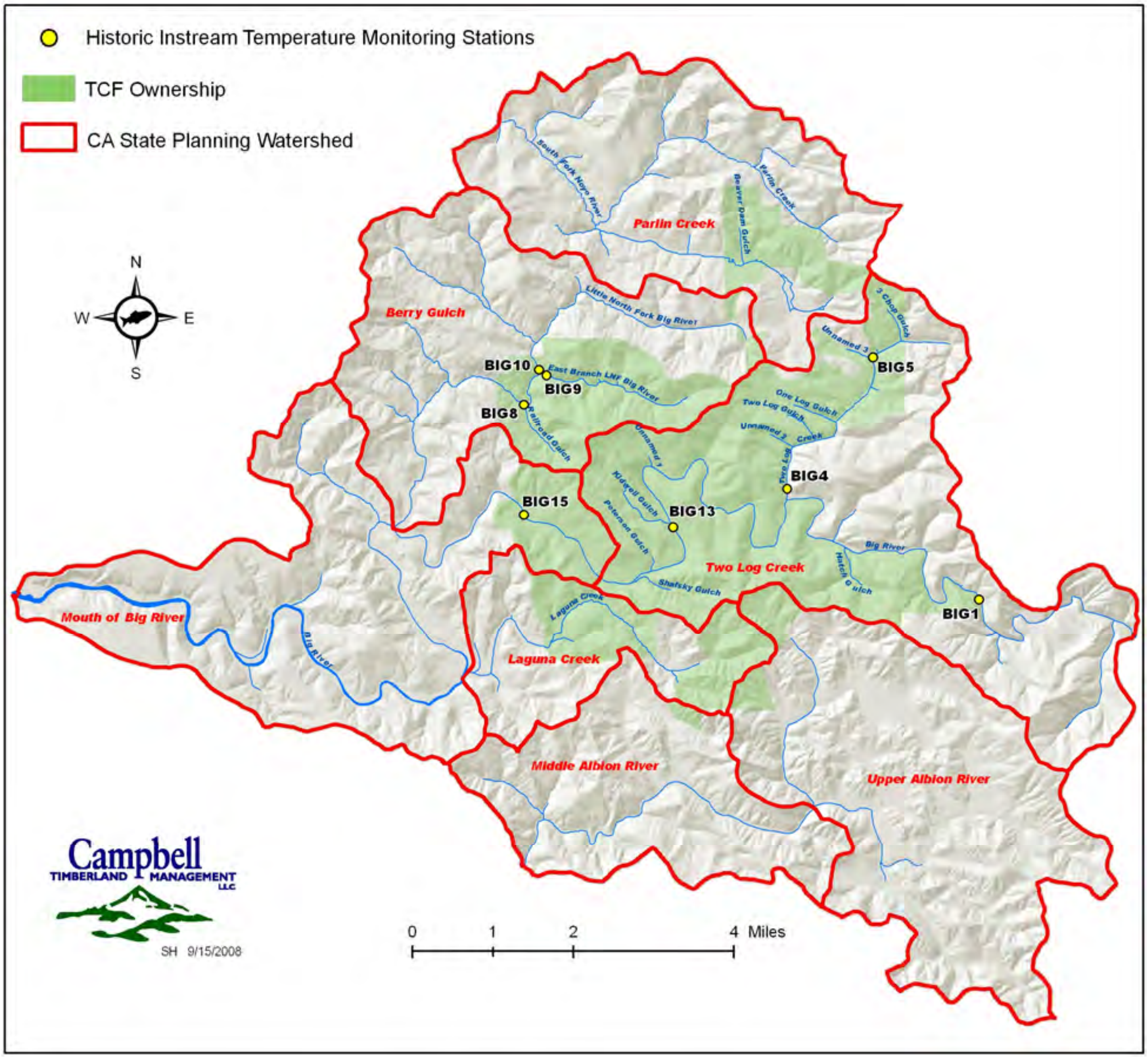
Over ten years of stream temperature data (Table 2-2) collected at eight permanent stations (Figure 2-2) by GP, CTM and TCF confirm that summer stream temperatures, shown as the Maximum of the Weekly Average Temperatures (MWAT), are unsuitable for salmonid production at the upstream Property line (Figures 2-3 and 2-4). Data also show that the temperature regime changes little as streamflow passes through the nearly twelve-mile mainstem channel on the Property. This suggests that the mainstem thermal regime is almost completely driven by upstream conditions and that TCF managers have little direct control over mainstem stream temperatures. Until upstream conditions change, the stream temperature regime in the mainstem reach within the Property will probably remain static.

Temperature monitoring data confirms that, contrary to conditions found on the mainstem reach, the perennial fish-bearing streams within the Property are more suitable for rearing salmonids (Downie et al 2006) (Figure 2-5). In 2006 a heat spell is noted in late July in both the Mainstem and Two Log thermographs.

Table 2-2: Temperature Monitoring Stations Within the Property by Year

Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
BIG1	x	x	x		x	x	x	x	x	x		x	x
BIG4	x	x			x	x	x	x	x	x		x	x
BIG5									x	x		x	x
BIG8	x	x	x		x	x	x	x	x	x			x
BIG9	x	x			x	x	x	x		x		x	
BIG10	x	x	x		x	x	x	x		x	x		
BIG13					x	x	x	x	x	x			
BIG15									x	x		x	

Figure 2-2. Instream Temperature Monitoring Stations on the Big River Property (1994-2006)



Discussion

Efforts to increase canopy along the mainstem and subsequently increase stream-cooling may help somewhat reduce temperature over the long-term. However, stream attributes tend to vary by stream size and order. Larger channels, as found on the mainstem, generally have deeper pools and more open canopy than smaller channels. Although canopy values on the mainstem did not reach CDFG target values, the mainstem of Big River is a fourth order stream and the target values do not apply (Downie et al 2006). The stream cooling properties of the riparian corridor may be enhanced in the mainstem following a management regime of LWD enhancement sites as discussed in Section 2.1.1.2. However, as previously stated, TCF managers have no control over the stream temperature in reaches upstream of the Property boundaries.

Until riparian corridors mature in the upstream reaches, stream temperatures during summer will remain high.

The results of instream temperature monitoring by previous resource managers indicate that water temperature over-summer is generally suitable for salmon in the perennial streams. This is likely due to the sub-watersheds' proximity to the coast and the optimal canopy values found in the riparian corridors.

Figure 2-3. Summer Seven-Day Rolling averages of the Daily Average Temperature (1994-2007) at the Upstream Property Boundary. The Highest Seven-Day Peak of The Rolling Average is the Annual MWAT.

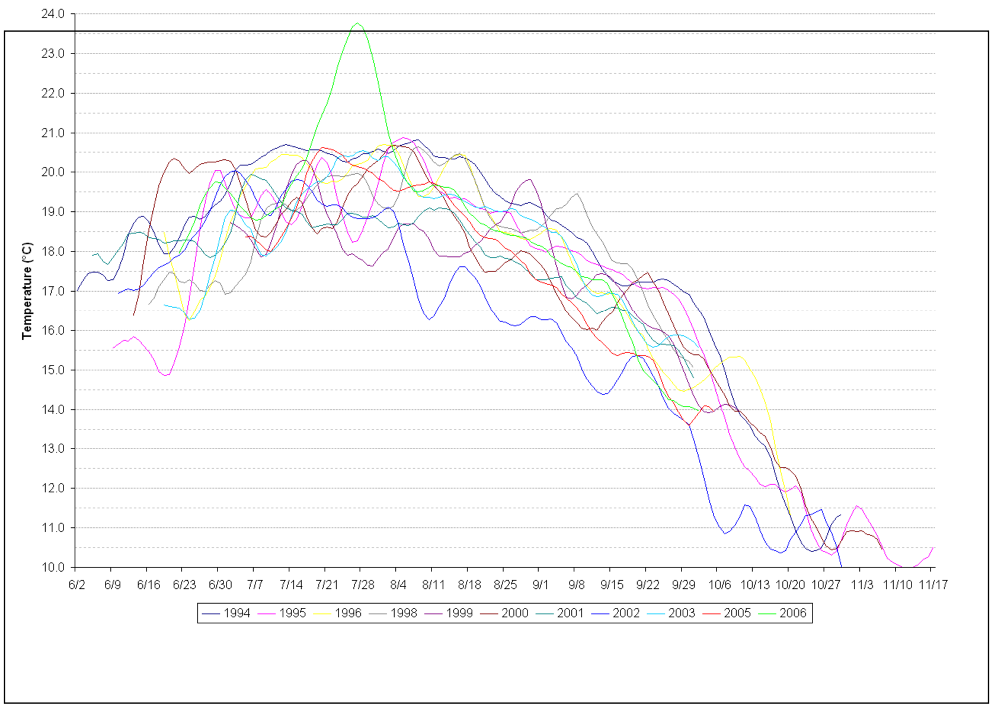
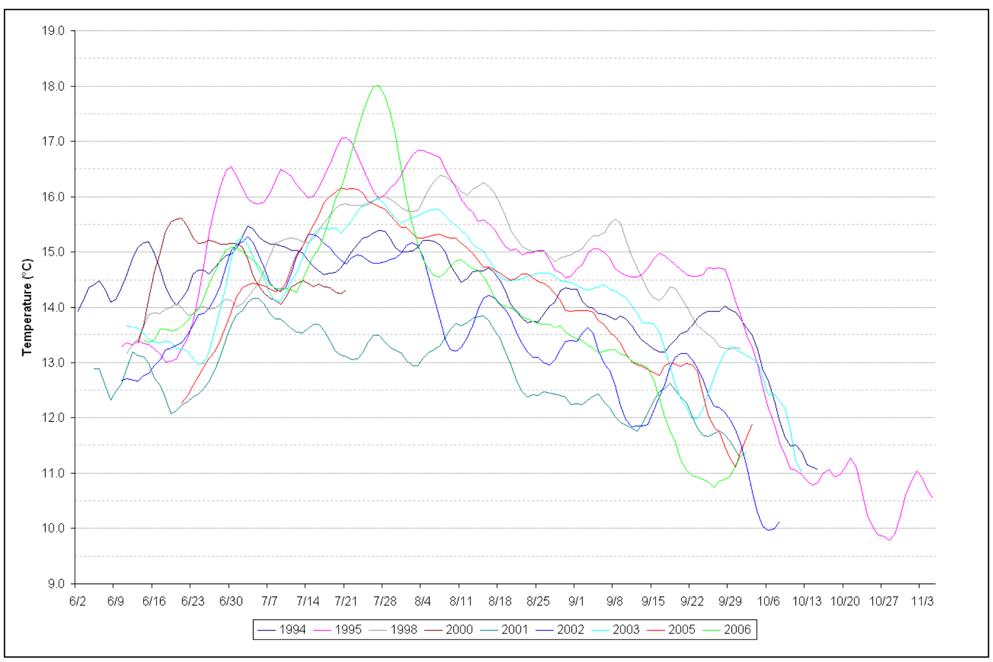


Figure 2-4. Summer 7- Day Rolling Averages Of The Daily Average Temperature (2002, 2003, 2005, 2007) Near The Downstream Property Boundary (Wheel Gulch). The Highest 7-Day Peak Of The Rolling Average Is The Annual MWAT.

Figure 2-5. Summer 7-Day Rolling Averages Of The Daily Average Temperature (1994-2007) At Lower Two Log Creek. The Highest 7-Day Peak Of The Rolling Average Is The Annual MWAT.



Recommendations

Stream temperature monitoring should continue in the watershed. At a minimum, pairs of thermal data loggers should be maintained near the downstream and upstream Property boundaries on the mainstem. As resources allow, data loggers should be installed within the lower reaches of Two Log Creek and EBLNF Big River. Other fish-bearing watercourses on the Big River Property are either too limited for fish production, or are little affected by TCF Property management actions.

The technology available for continuous stream temperature monitoring has been remarkably refined since the 1990s both in terms of memory and cost. The costs associated for monitoring two sites with redundant data-loggers (over-summer) is approximately $1,000 annually. This cost includes staff resources. The estimated cost to operate a suite of up to four monitoring sites with redundancy (over-summer) amounts to approximately $1,500 annually, including staff resources.

It should be noted that analysis of monitoring data suggests that over-summer stream temperatures in the perennial streams are generally in the range considered suitable for salmonids, although somewhat on the high end of that range. Riparian management policies in these smaller streams should promote increasing canopy trends that subsequently promote stream cooling. Temperature monitoring should continue to ensure that the instream temperature regime remains on a cooling trend. On the mainstem Big River, little can be done to alleviate high stream temperatures other than address problems associated with channel homogeny.

2.1.1.5 Sediment

Goals

Abundant literature exists documenting the negative effects of excessive sediment and turbidity on salmonids. Excessive levels of fine sediment in redds reduce the survival-to-emergence rates of fry, and excessive turbidity in the water column reduces the feeding success of parr, particularly during critical winter months.

Although many of the tributary channels to Big River are presently storing excessive sediment loads, the mainstem channel is scouring down to bedrock in some reaches due to the lack of channel structure (Downie et al 2006).

This portion of the Aquatic Management Plan identifies actions to reduce sediment delivery into the watercourse by disconnecting the existing and historic road networks from the stream network, stabilizing upslope areas, and allowing excessive bedload that have collected in the tributary channels to be redistributed downstream to the lower mainstem channel by natural hydrologic processes. Sorting and storing of gravels within the mainstem can be accomplished through the use of added LWD materials.

Background

The logging road network in this portion of TCF ownership has been developed over decades. The oldest roads were converted from railroad grades created in the first half of the 20th century. With the arrival of trucks in the 1930s, the network was extended. Overstory removal harvesting in the 1950s through 1970s was accompanied by road building throughout this portion of the watershed, generally to facilitate downhill tractor yarding. The enactment of the Forest Practice

Rules and trend toward harvesting uphill via cable yarding led to disuse of much of the old road network.

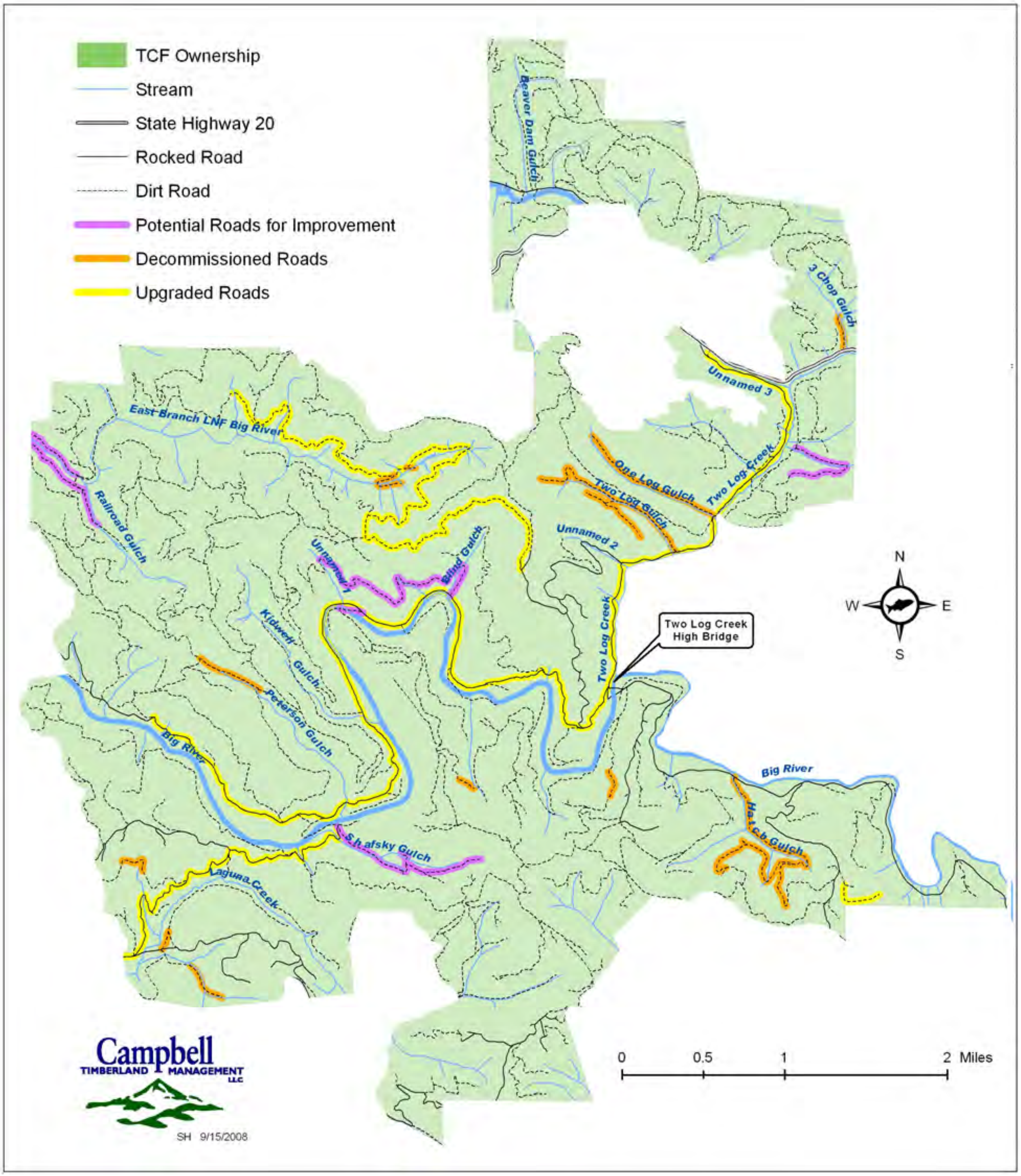
The road decommission at the head of Peterson Gulch may have been the first in this area of the Property. In the late 1990s small sections of road were decommissioned in connection with timber harvest plans north and east of Shafsky Gulch. In 1999 an agreement between Georgia-Pacific and the NCRWQCB resulted in the incorporation of a road management plan into THP 01-99-430MEN. The plan required a detailed inspection and report of the main haul road from the Two Log gate to Wheel Gulch, across Big River, and through Laguna creek. Once approved by NCRWQCB, the road drainage was upgraded, culverts replaced, and the road largely re-rocked.

Subsequent to the change in landowners from Georgia-Pacific to Hawthorne, the rate of improvement increased and a number of additional roads have been properly decommissioned. Improvements included a concerted effort to fix the road and crossings around the East Branch of the Little North Fork, which was in poor shape. This included the pulling of a large 1960s-era Humboldt crossing which was continuing to both dam the East Branch and input sediment. The road between the “Old Growth Road” to “Scotts Pond” was chosen for upgrades via outsloping and rolling dips. Of significance, the old road systems in the gulches shown as “One Log” and “Two Log” as well as Hatch Gulch have been decommissioned, removing long reaches of potential inputs.

Overall, the road system in this portion of Big River has been substantially improved in the last ten years, but there are still many legacy problems to address.

The Big River watershed was listed as an impaired water body under Section 303(d) of the Clean Water Act for sediment in 1993. The U.S. EPA approved a sediment TMDL for the Big River watershed in 2001. The TMDL specifies that anthropogenic sources of sediment associated with roads and to a lesser extent harvest areas will need to be reduced. The North Coast Regional Water Quality Control Board (NCRWQCB) has not yet developed a watershed specific TMDL implementation plan for Big River. In 2004 the NCRWQCB adopted a Total Maximum Daily Load Implementation Policy for Sediment Impaired Receiving Waters in the North Coast Region (Resolution No. R1- 2004-0087). This resolution directs the NCRWQCB Executive Officer to: " Use all available authorities, including existing regulatory standards and permitting and enforcement tools, to more effectively and efficaciously pursue compliance with sediment-related standards by all discharger of sediment waste." The resolution also directed the Executive Officer to develop a work plan that would set priorities for addressing excess sediment at a watershed-specific level and also describe how and when available authorities and permitting and enforcement tools will be used.

Figure 2-6. Decommissioned and Upgraded Roads (1994-2005), and Recommended for Improvement.



Discussion

In the last ten years a substantial number of projects have aimed at benefiting aquatic resources on the Property (Figure 2-6). In order to address upslope sediment sources, selected roads were either upgraded or decommissioned. Road upgrade work included the replacement and addition of drainage features designed to accommodate 100-year storm flows as well as road surfacing improvements. Roads prioritized for decommissioning were mainly located in streamside management zones, and efforts were made to restore natural drainage and encourage re-vegetation of the road prism. Additionally, the aforementioned LWD project in Two Log Creek successfully increased channel complexity and improved habitat conditions for salmonids.

In June 2008 the NCRWQCB adopted Resolution R1-2008-0057 regarding the Regional Board Staff Work Plan To Control Excess Sediment In Sediment-Impaired Watersheds. The Staff Work Plan describes both regional and watershed specific tasks. The Work Plan includes priority rankings for each regional task and for each sediment-impaired watershed. For Big River, NCRWQCB staff are projected to commence work in fiscal year 2013/2014. Big River watershed specific task No. 5 specifically directs staff to work TCF and other with larger landowners "educating them on their responsibilities to control excess sediment, coming agreements on time schedules and excess sediment control strategies, provide technical guidance, regularly checking on progress, and other cooperative efforts."

Recommendations

The following recommendations are based on the experience of CTM resource managers and foresters and do not take into consideration subsequent assessments and remediation by TCF. Locations referenced below are depicted in Figure 2-6.

1. Shafsky Gulch

The legacy road in Shafsky Gulch during CTM ownership had steep cuts and fills on its lowest reaches, a low gradient crossing with little fill on the Class I section needs minor improvement. Beyond this there is the class II crossing at the switchback and then a legacy crossing to an old streamside landing. During CTM ownership, the legacy crossing had steep banks that delivered sediment to the watercourse. The legacy road above this point parallels the watercourse and should be ripped and replanted to restore the WLPZ adjacent to the marshy reaches of Shafsky creek.

2. Short Spur between “unnamed 1” gulch and Blind Gulch.

There is a short spur on the south side of the river, which once led to a road crossing. This spur was never fully decommissioned and during CTM ownership there were still some associated drainage and erosion problems.

3. Blind Gulch

The road system in Blind Gulch was meant to facilitate tractor logging. During CTM ownership, the portion of the road near Blind Gulch had poor drainage. As the road exits Blind Gulch to the west, drainage problems combined with slide activity. Beyond this point the road continues to the west and needed drainage and crossing improvements. Whether this road should be decommissioned or upgraded depends on the desired harvesting techniques for the western end of the road system. It is possible that a switch back road from the "Scotts Pond" region could be designed, allowing the "Blind Gulch" section to be completely decommissioned.

4. Little North Fork Railroad Grades.

The two roads shown as ‘Potential for improvement’ were originally railroad grades. The northernmost grade is adjacent to the Little North Fork of Big River. East of the current logging road crossing, the grade is not shown as “Potential for Improvement” as there is no equipment access. There may be opportunity for equipment access downstream of the current crossing, and there is the potential for some of the old fills to be removed. These grade fills are a point source for sediment to the Little North Fork during CTM ownership. Vegetation has grown since the grade fell into disuse and would require consideration.

The second road shown as ‘Potential for improvement’ was a railroad incline that connected to Railroad Gulch. The section shown west of the current logging road has one or two failing Class III crossings which are accessible by heavy equipment. The portion of grade east of the current logging road has several Class III crossings that could be removed, as well as drainage improvements.

5. Two Log Tributary
On the east side of Two Log Creek there is a midsized tributary with a road on its north slope in reasonable condition. However, where the road crosses to the south side the crossing could be improved. The southern portion of the road is not well drained and could be improved or decommissioned.

2.2 Adaptive Management and Information

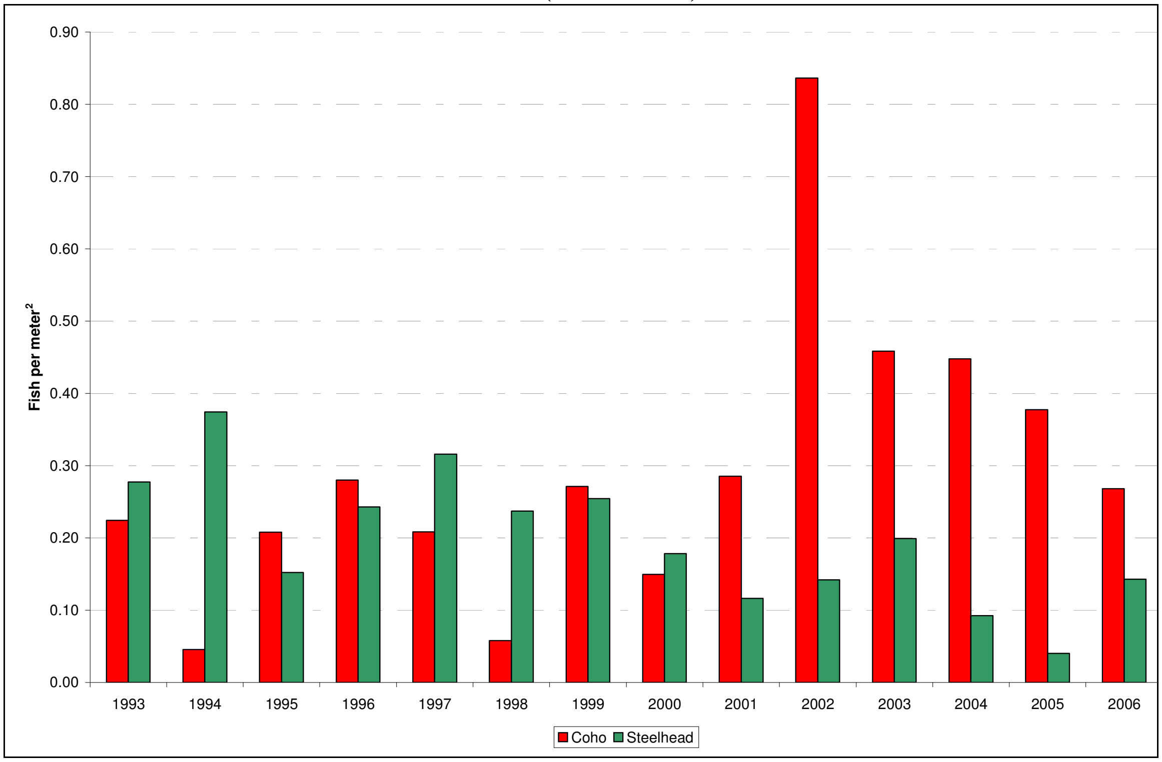
Monitoring is an essential component of the aquatic restoration planning, and monitoring of key aquatic parameters provides an index to measure the successfulness of management strategy. Monitoring restoration activities and watershed responses to landscape management activities completes the adaptive management cycle by assessing the impacts of management actions and evaluating their impact to aquatic species. Monitoring allows managers to identify and correct watershed problems as they occur and determine proper remediation.

2.2.1 Monitoring Goals and Discussion

In 1993, GP resource managers developed a monitoring plan for the Big River Property based on an index reach approach, where specific locations were monitored annually for aquatic habitat parameters; it was continued through 2005 by CTM. The monitoring regime consisted of the follwing: two monitoring stations to monitor aquatic vertebrate abundance; ten stations to monitor instream temperature; and two stations to monitor sediment (using McNeil methods) (McNeil and Ahnell 1964). In 1996 GP survey crews carried out extensive habitat typing of mainstem Big River and most of its tributaries. CDFG survey crews repeated the process in some of the tributaries and parts of the mainstem from 1999 to 2002. In 2004 the NCRWQCB adopted General Waste Discharge Requirements (GWDR) for timber operations that required erosion control plans (ECPs). As a consequence, monitoring for sediment delivery from road construction and maintenance has also been conducted on the Property.

After more than ten years of monitoring and observations, the trends in stream conditions are generally apparent: sediment and temperature related problems still occur in Big River, particularly on the mainstem. However, the trends in juvenile coho abundance from aquatic vertebrate monitoring suggest aquatic conditions are generally becoming more suitable for salmonids (Figure 2-7).

Figure 2-7. Aggregate Coho and Steelhead Densities from Two Monitoring Stations in Big River (1993-2006)



What can't be determined from the past monitoring strategy is the overall adult spawning population (escapement) and the relationship between specific riverine factors limiting salmonids and broad scale marine conditions. It is often overlooked that instream conditions only affect salmonids for half their life cycle, and there may be other regional or ESU level population trends that are beyond the control of resource managers. Electrofishing monitoring stations only capture a snapshot of juvenile abundance at a specific location within the stream and are not confident indicators of the basin-wide population. At this point in the adaptive management monitoring process, it's logical to continue some past activities such as temperature monitoring, but to also expand the scope to include more robust salmonid population monitoring.

Regional fisheries biologists for CDFG Northern Region Coastal Watershed Planning and Assessment Program have developed a sampling and modeling protocol that produces estimates of escapement (spawners) from spawning ground surveys (SGS) (Gallagher and Wright 2007). The methodology, which has been developed and implemented in this region, has been employed by neighboring landowners, and will soon be incorporated into the California Coastal Salmonid Monitoring Plan. The survey methods have been peer reviewed (Gallagher and Gallagher 2005) and fall in to a larger, regional framework. From a management standpoint it is advantageous to incorporate a proven and accepted monitoring strategy that not only produces watershed escapement estimates, but also links them to regional populations trends.

Another advantage to SGS is that they are relatively inexpensive to conduct. Survey crews of two crewmembers conduct surveys on randomly selected spawning habitat reaches on two-week intervals. Approximately 30 percent of the identified spawning habitat in the watershed is surveyed and adult spawner population estimates are generated at the end of the spawning season. The former Property manager, CTM, has employed these methods in Pudding Creek, a similar and nearby watershed, from 2004 until the present, and has have received grant funding for staffing needs for all years. Spawning surveys can also be conducted with volunteer staffing, as the survey protocol is not unduly complicated.

In order to understand how broad scale salmonid population trends influence watershed populations, managers should also determine the overall production of juveniles leaving the stream network**.** Once the spawning and outmigrant (smolt) populations are quantified, important relationships can be established between instream survival and ocean survival, illustrating potential bottlenecks in overall production. Coho are an ideal species for this type of monitoring due to their somewhat rigid life history. Coho smolts typically leave the stream at about 12 –18 months and return as adult spawners in two years, producing a reliable three-year cycle. The proportional relationship between smolts and spawners, the percentage of outmigrants that return, is a reliable indicator of ocean survival. Likewise, the proportion of spawners to their outmigrating progeny is a good indicator of overall stream production.

The Big River Property, however, only encompasses nine percent of the entire Big River Basin; so trapping of smolts in the mainstem will not produce an estimate of juvenile production solely for the Property. Unless a cooperative study effort among the larger landowners can be implemented, there would be little utility in pursuing outmigrant population estimation methods on the Property. If a cooperative study could be successfully implemented, the location below LNF Big River confluence on the mainstem adjacent to the Woodlands tract would be ideal to station a rotary screw trap. Smolt population estimates generated from trap captures below the confluence would represent the annual production for the entire basin. Considering the costly and extensive salmonid habitat restoration and remediation efforts conducted across the basin by major landowners and the public in the form of grant funds, it would be prudent for diverse resource manages to cooperate on a plan to quantify basin smolt production. Monitoring of this type, and for these species, is being conducted on similar watersheds (Hayes et al 2008) in northern California. Once outmigration is quantified, comparison of production among watersheds may reveal similar or differing trends, which then informs how the Big River population relates to the regional or ESU level population. Even without adult spawning (escapement) numbers, smolt production estimates are valuable monitoring information.

Due to the listing status of both endemic salmonids and their perceived importance by regulatory agencies as a keystone or indictor species of water quality, quantified population estimates are valuable. From the public relations perspective, population estimates of retuning adults are more meaningful to the general populace than over-summer juvenile relative abundance or other measures of instream salmon productivity. From a fishery perspective, escapement is the final measure of success for the population. Section 2.2.2 discusses a two-tier approach to aquatic monitoring in the watershed that maintains some elements of former monitoring activities and incorporates fish population monitoring.

Not all past monitoring activities should be continued. Some previous monitoring actions should be replaced with activities that more directly gauge current best management practices. For example, McNeil sampling is time and resource intensive and does not identify sources of fine sediment delivery into the watercourse. Monitoring of direct and indirect sediment sources from roads, hillsides, and channel banks will direct adaptive management decisions by prioritizing enhancement resources, and it will help identify ineffective past management practices.

2.2.2 Two Tiered Approach to Monitoring

The proposed monitoring plan that follows prioritizes monitoring in the near term, and provides a framework for long term monitoring goals. Monitoring activities listed in Tier One are actions that should be implemented in the near future to provide: 1) baseline data on fish population status; 2) feedback to managers on erosion associated with roads, hillsides and stream banks in the mainstem and sub-watersheds; and 3) continued temperature monitoring. Tier One monitoring is used to evaluate the effectiveness of current best management practices, and is considered a cost and resource-effective approach. These approaches are effective in providing relatively quick feedback to resource managers.

Tier Two provides long-term goals to apply as funding resources allow. These are more in depth watershed trend monitoring approaches over a broader temporal scale. While they are generally more costly to implement than Tier One objectives, they will provide insight on the status of long-term restoration objectives for adaptive managers.

Table 2-3. Two-Tiered Monitoring Approach

	Sediment	Temperature	Fish	Aquatic Habitat
Tier One	1) Road Assessments and Erosion Control Plan development. 2) Forensic turbidity surveys throughout winter months.	Monitoring at lower and upper Property boundary.	Determine approximate salmonid spawning populations through spawning ground surveys.	Conduct stream habitat inventory and LWD surveys at ten year intervals or as dictated by management activities
Tier Two	Continuous automated turbidity monitoring at all major tributaries.	Monitoring above and below tributary confluences to identify thermally limiting reaches.	Determine approximate smolt populations through rigorous downstream trapping program.	Conduct periodic management adaptations as a result of ongoing limiting factors analysis.

2.2.2.1 Sediment Monitoring

Tier One

Sources of delivery into Big River watercourses from roads, hillsides, and stream banks should be addressed. Qualified personnel should make assessments of existing roads, and road related erosion should be reduced where possible. Following road assessment, an ECP should be implemented. After the ECP is initiated and road erosion reduction activities have occurred, treated sites should be monitored to ensure management practices are functioning properly. Erosion from hillsides and stream banks should be identified and addressed if erosion is associated with management activities.

Forensic monitoring of turbidity is another tool used to identify sediment inputs. Monitoring can be performed either optically or by taking “grab samples” from the stream channel. Once an area of high turbidity is identified, survey crews follow the turbidity trace upstream in order to identify the sediment source. If the source is controllable, a treatment plan is subsequently drafted.

Tier Two

Continuous automated turbidity and suspended sediment monitoring is another monitoring tool used to identify tends and point sources of sediment delivery. Installation of a monitoring station can easily cost in excess of $10,000 (not including staff resources). Ideally, monitoring sites are installed on all major tributary confluences and at the lower property boundary. Although expensive, continuous automated sampling greatly reduces staff time and allows sampling to take place during peak flow events when safety is a concern.

2.2.2.2 Stream Temperature Monitoring

Tier One

Instream temperature monitoring at the stations previously developed by GP and CTM, which has been continued by TCF, should continue. A set of redundant data-loggers should be installed at the upstream and downstream Property boundaries, with summer stream temperature data collected continuously at 60 or 90-minute intervals. This simple approach would incur an annual cost of $1,000.

Tier Two

Other adaptive management prescriptions may indicate over time that additional aquatic temperature monitoring is needed to identify problematic reaches or tributaries. If managers decide to adopt this future strategy, a suite of ten monitoring sites with redundant data-loggers would incur an annual cost of $2,000- $3,000.

2.2.2.3 Salmonid Population Monitoring

Tier One

Section 2.1.1 describes a peer-reviewed methodology to estimate spawning salmonid populations on a watershed scale using spawning ground surveys. To implement this methodology at the suggested thirty percent sampling rate, it would require a staff of two on a part-time basis from November until the end of April. If the monitoring scheme were integrated with a similar plan for the Big Salmon Creek stream reaches contained within the TCF ownership, staff would be employed full-time for the survey period. The staff resources necessary to complete the population-monitoring proposal for both the Big River and Big Salmon Creek watersheds would require approximately $40,000 – $50,000 annually based on a rate of $20 per hour for two staff for six months, excluding vehicle expenses. Volunteer labor may also be utilized as previously discussed.

Tier Two

Section 2.1.1 also illustrates a plan to monitor the annual smolt, or downstream migrant, population at a watershed scale. The proposed methodology, however, is dependant on support from other landowners in the watershed. Smolt trapping on the mainstem within TCF's ownership will not generate juvenile abundance information specific to the Property. For a watershed scale estimate of smolt production, a trap located directly below the LNF Big River confluence on the mainstem is recommended. The LNF Big River is the lowest major fish-bearing tributary to the Big River basin, and it has road access which is vitally important to a trapping operation. This proposed trapping station is located on State Park's lower Big River ownership and therefore, at a minimum, would require its cooperation for access.

To implement the plan, a rotary screw trap is necessary. The use of passive integrated transponder (PIT) tags would increase the study resolution; however PIT tags are not required. A staff of one or two can safely operate the trap for the annual four month trapping period, which extends from early February to late May. Due to the seasonal overlap of the smolt trapping period and the spawning ground surveys, the same personnel can conduct both studies, maximizing funding for staff resources. Downstream monitoring expenses are shown in Table 2-2. The estimate for the initial start-up expense is approximately $30-40,000, with an annual operating budget in subsequent years of $15-16,000 excluding vehicle expenses.

Table 2-4. Expenses Related to Annual Smolt Trapping Monitoring

Expense Item	Amount	Note
8' Rotary screw trap	$20,000.00	One-time cost
PIT Tags	$6,000.00	Annual expense, but not required
PIT tag reader	$1,500.00	One-time cost
Staff	$6,400.00	1 staff, part -time @ $20.00hr for 4 months
Misc supplies	$3,000.00	Waders, etc

2.2.2.4 Stream Habitat Inventory Monitoring

Tier One

Habitat inventory surveys at 10-year intervals are recommended in order to detect watershed trends over time as suggested by CDFG (Flosi 1998). The habitat in Big River was last surveyed in 2002 and should soon be conducted to establish baseline data for the new ownership. LWD assessment surveys should also be initiated to determine watershed enhancement priorities.

Tier Two

To assess reach scale aquatic restoration needs, assessment surveys on Class I watercourses adjacent to and in conjunction with timber harvest plans are recommended. The utility of this monitoring strategy is that enhancement activities can then be conducted as a component of the THP. Enhancement actions often utilize heavy equipment and good road networks found in timber harvest operations. From the standpoint of increasing the value of enhancement activities by minimizing their ecological impact (e.g. opening new roads and tractor activity), and by increasing their economy, working within the THP process has many advantages.

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APPENDIX G

SALMON CREEK AQUATIC MANAGEMENT PLAN
CAMPBELL TIMBERLAND MANAGEMENT, LLC

Big Salmon Creek Aquatic Management Plan

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1 Overview of Properties

The Big Salmon Creek watershed has unique ecological factors that affect the stream network differently than those in found in Big River. The two watersheds have differing thermal regimes, landscape management histories, and discharge characteristics, which suggest separate treatment strategies to guide aquatic restoration, which includes increasing salmonid production. The purpose of the following watershed overview is to address factors affecting the Big Salmon Creek watershed from a fishery standpoint.

1.1 Overview

Because salmonids are often considered an indicator of watershed and ecosystem health, this section is predominantly focused on information and management recommendations relevant to salmonid habitat and populations.

Big Salmon Creek

Big Salmon Creek is a relatively small coastal watershed in Northern California, with the entire drainage area lying within eight miles of the coast (Figure 1-1). Much of the watershed is presently managed for timber production, and nearly 48 percent of the watershed is owned and managed by The Conservation Fund (TCF), hereafter referred to as the Property. Vegetation in the area is primarily conifer forest comprised of coast redwood (*Sequoia sempervirens*) and Douglas-fir (*Pseudotsuga menziesii*). The primary constituents of the riparian canopy are coast redwood, Douglas-fir, and red alder (*Alnus rubra*), which is nearly continuous throughout the stream network. Streambed gradient is generally low (<2 percent) throughout the mainstem reaches. The regional climate is characterized as Mediterranean with wet, mild winters and dry summers.

This watershed has a number of geographic and ecologic features that promote coho and steelhead production, and since the early 1990s studies based on electrofishing surveys and other methods have shown that Big Salmon Creek has supported stable populations of both species (Georgia Pacific [GP] 1995-1999 unpublished data; Campbell Timberland Management [CTM] 2000-2004 unpublished data). Big Salmon Creek is located within eight miles of the coast and the associated cool marine climate, which moderates stream temperature during the relatively hot northern California summer. Excessive stream temperature is a well-known factor limiting salmonids during the summer rearing phase of their life histories. The low stream gradients with meandering, sinuous channels found at the watershed scale in Big Salmon Creek favor coho salmon in particular. The canopy formed by the coniferous forest type also promotes cooler stream temperatures during the summer and, additionally, adds a roughness element to stream channels in the form of large wood debris (LWD), which further slows stream velocity and increases pool habitat, another factor promoting salmonid production.

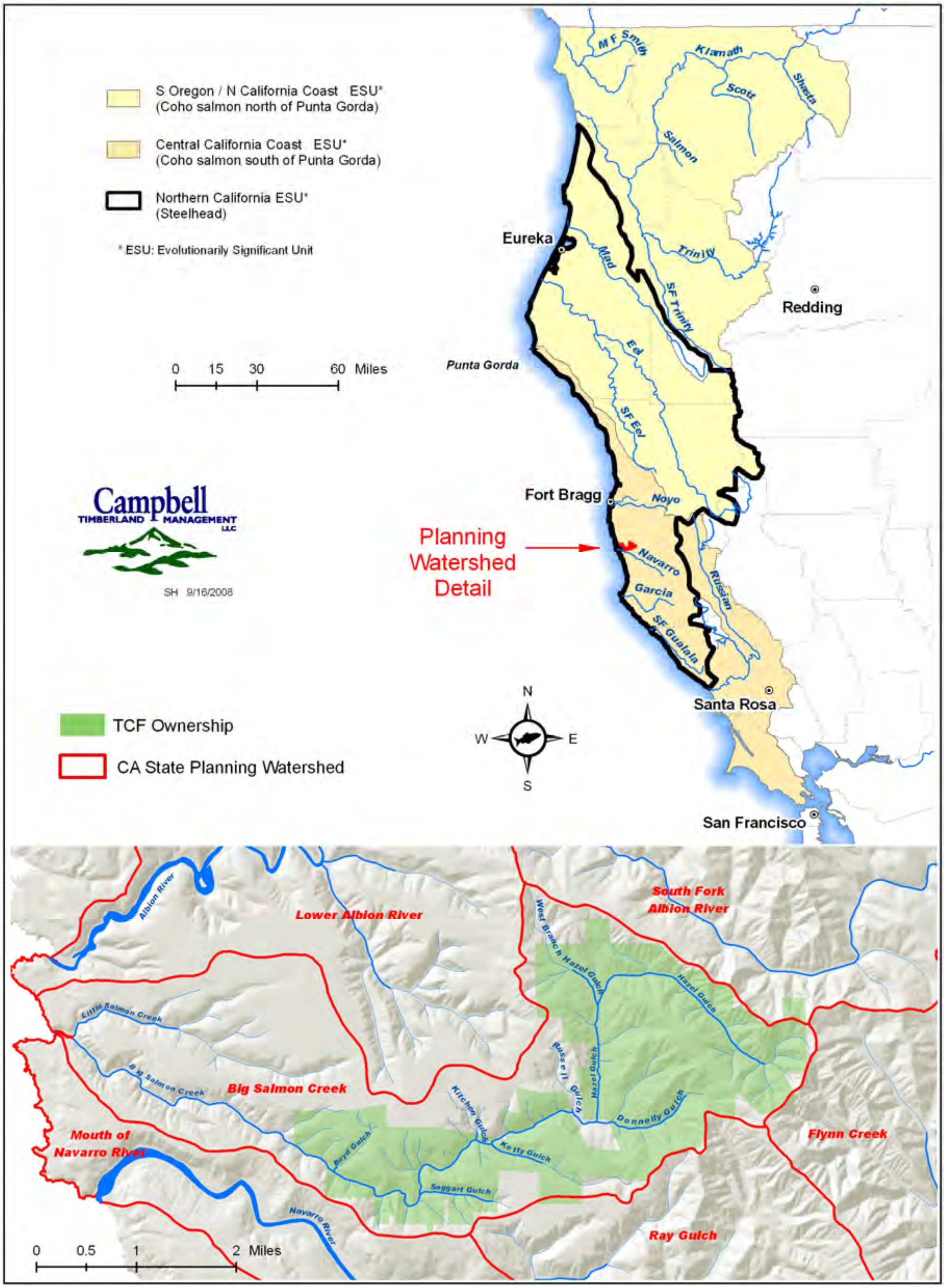
1.1.1 Location and Stream Description

Big Salmon Creek is located in Mendocino County California, drains approximately 8,600 acres (Figure 1-1) and is tributary to the Pacific Ocean. Elevations range from sea level at the mouth of the creek to approximately 1,200 feet in the headwater areas. To locate the mouth of Big Salmon Creek, refer to Section 35; T16N R17W of the Elk 7.5 minute U.S. Geological Survey quadrangle map. Instream conditions such as discharge, thermal properties, and gradient typify many of the characteristics commonly associated with small, coastal northern California watersheds. Discharge rates, which are not influenced by snow pack, vary significantly between summer and winter flows. Instream daily average temperatures range from 16.5° C (62° F) in summer to approximately 7° C (45° F) in winter, and the summertime water temperatures are moderated by the watershed's close proximity to the coastal marine climatic conditions. Within the Property boundaries, Big Salmon Creek is predominantly a low gradient, moderately entrenched F-3 Rosgen channel type[1] characterized by high pool development and low velocity discharge. Big Salmon Creek has optimal coho habitat conditions and, considering the small drainage area, has had relatively high rates of coho production.

[1] Rosgen channel types include 42 distinct channel classes, primarily based on gradient and dominant substrate characteristics. Various quantitative metrics help to classify channels, although it is not uncommon for specific metrics to vary among several classes.

1.1.1.1 Location Map with Coho and Steelhead ESUs

Figure 1-1. Fishery Overview of TCF Salmon Creek Ownership with Coho and Steelhead ESUs.



1.1.2 Context

Aquatic conditions in Big Salmon Creek, like many watersheds in the region, are presently more influenced by recovery processes from past management practices than by present practices. Therefore, in order to prescribe management practices that improve aquatic conditions and promote fish production, Section 1.1.2.1 provides a brief description of the past land use history of the Big Salmon Creek watershed from a fishery perspective.

1.1.2.1 History

Logging and ranching operations were initiated in the Big Salmon Creek watershed as early as the 1860s. By 1880 a logging railroad had been constructed within the floodplain, and linked the coastal mill at the ocean confluence (Whitesboro) with reaches as far upstream as Hazel Gulch. In that period logs were generally skidded down slope to floodplain based railcars and logging camps, mobilizing soil downslope to the active stream channel. In the upper areas of Hazel Gulch, logs were likely skidded by oxen down the active channel, which had been cribbed or converted to a log skid road to facilitate log transport. Remnants of the cribbing within the active channel still exist in parts of upper Hazel Gulch (small channels were often converted to oxen skid roads by planking logs crosswise to the channel to allow oxen to pull logs downstream).

Figure 1-2. Remnant Dam Structure on Hazel Gulch

Although dams were constructed for log and ranch ponds at various locations within the channel, splash dam logging, or stream based log drives, did not significantly occur in the Big Salmon Creek watershed. Logs were moved to the coast mill by railway. A remnant dam structure can still be observed just above the confluence of Hazel Gulch and West Branch Hazel (Figure 1-2).

The present day effects from the railroad era logging practices on fish production are a presumed increased sediment load in the active channel and floodplain. Historically, it is assumed that mobilized upslope soils inundated the watercourse beyond background levels. However, the legacy impacts on stored instream bedload, and, consequently, on present day fish production is unknown. The remnants of the railroad grade, which in many areas ran within or adjacent to the floodplain, is presently sloughing off into the watercourse in some areas during peak flow events, increasing sediment delivery into the watercourse on a stochastic (randomly determined) basis. Excessive instream sediment has been attributed to poor salmonid production at many points in their life history (Burns 1970; Kondolf 2000; Trappel and Bjornn 1983).

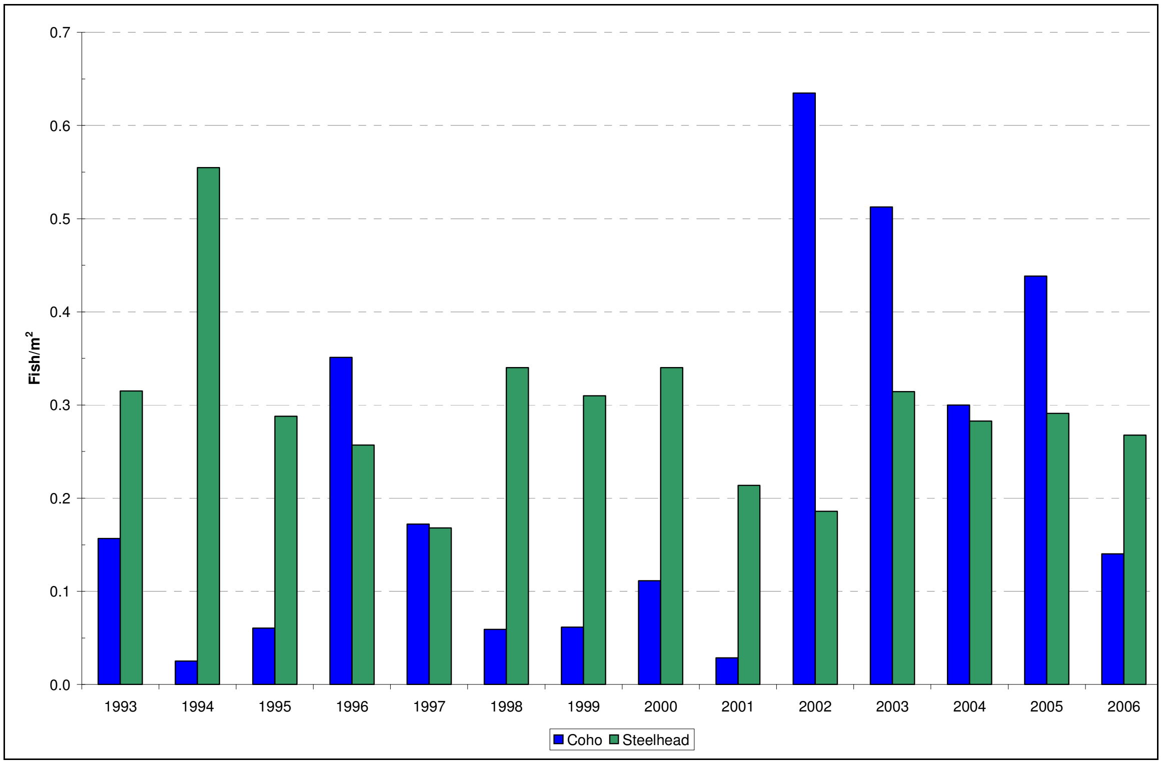
By the 1950s logging was accomplished largely by tractor operations. As a consequence, a network of streamside roads and landings were constructed throughout the Property. Tributary streams were often completely blocked during operations, and the impounded areas were inundated with green logging slash and exposed to direct sunlight, resulting in severe dissolved oxygen deficiencies, high stream temperatures, and corresponding juvenile fish mortality (Figures 1-4 to 1-7). Upon completion of tractor operations, logging debris was routinely disposed into the watercourse. During this era it was also common to operate tractors within the active channel to facilitate operations.

The impact on fisheries from the 1950s and 1960s operations was likely severe. The combined effects of: 1) massive sediment delivery into the stream network from tractor yarding and road and landing construction: 2) barriers to adult fish passage (spawners); and 3) direct mortality of rearing juvenile fish most likely had a devastating impact on Big Salmon Creek fish populations. By 1966 CDFG considered instream habitat conditions poor for salmonids (Primbs and Edward 1966).

By the early 1960s CDFG recognized the negative impacts to upstream migration from the practice of disposing of large tree boles and logging waste into the stream network, which had three primary aquatic impacts: 1) it prohibited migrating fish to access upstream spawning habitat in winter; 2) it introduced deleterious quantities of sediment to the stream; and 3) it reduced instream dissolved oxygen content in summer from rotting green waste. In addition to the impacts on fish, these practices impacted most endemic aquatic animal species within the watershed, from aquatic macro-invertebrates to amphibians.

Concerns regarding this practice resulted in the institution and initiation of the era of large woody debris (LWD) removal from northern California stream networks. Work crews were routinely hired by various state and county agencies to clear streams of large wood. Additionally, CDFG instituted policies that mandated stream clearance with tractors by the end of logging operations. The net result of these policies, while well intentioned, was the removal of most instream structure and the straightening of sinuous channels and a secondary negative impact on salmonids after the first setback from the initial logging practices. Many stream sections in Big Salmon Creek are presently deficient in LWD and have straight (bowling alley) stream reaches that are approximately a tractor blade width wide. This development can be observed in the mainstem reach around Saggart Gulch where the channel has been straightened and lacks LWD. The channel is downcutting in this area as a result.

Figure 1-3. Aggregate Relative Abundance of Juvenile Coho and Steelhead at All Monitoring Locations in Big Salmon Creek (1993-2005).



Since the 1970s, the Big Salmon Creek fishery conditions have been improving. As the knowledge base of timber harvest practices and resulting impacts on stream conditions increased, streamside-logging practices have dramatically improved. The Z'berg-Nejedley Forest Practice Act of 1973 mandated timber harvest prescriptions that consider the effects on wildlife and fisheries, and the era of LWD removal ended in the 1990s. Electro-fish sampling by former land managers suggest that coho and steelhead populations within Big Salmon Creek are presently stable (Georgia Pacific unpublished data 1993-1999; CTM unpublished data 2000-2005)(Figure 1-3). The salmonid community within Big Salmon Creek may now be more influenced by broad scale oceanographic and climatic conditions than by current specific instream factors. For example, MacFarlane and Hayes (2008) from the NMFS Southwest Science Center attributed a 70% decline in 2007 run of coho spawners throughout California and southern Oregon to extremely poor ocean conditions. However, although there is evidence to suggest that presently instream conditions may not be the primary limiting factor to fish production, there is still need for restoration and enhancement within the watershed.

1.1.2.2 Historic Photographs

Figure 1-4. Typical 1960s Era Stream Crossing, Possibly Located in Donnelly Gulch (SFPWM 1965-66).

Figure 1-5. Stream Crossing with Impounded Flow, Green Logging Waste, and Direct Exposure to Sunlight, Possibly in Donnelly Gulch (SFPWM 1965-66).

Figure 1-6. Typical 1960s Stream Crossing Through Mainstem Big Salmon Creek, Possibly Located Near Elliot Road (SFPWM 1965-66).

Figure 1-7. Tour of Big Salmon Creek for Committee Report Prepared by the Subcommittee on Forest Practices and Watershed Management (SFPWM 1965-66).

1.2 Ecological Conditions

This section describes habitat types, riparian communities, and aquatic species of special concern found on the ownership.

1.2.1 Species Occurrences and Habitat Types

1.2.1.1 Riparian Communities

The smaller tributary streams to Big Salmon Creek are often intermittent and do not show substantial riparian tree development. The riparian corridor on mainstem Big Salmon Creek and its Class I perennial tributaries, however, is often dense. Migratory neotropical birds are expected to be more abundant in these areas.

Table 1-1, below, is a summary of the total miles class I, II, and III streams found in each Planning Watershed contained within the Salmon Creek ownership. Calculations are based on data collected by CTM (2001).

Table 1-1. Summary of Total Stream Miles, By Classification, Within State Planning Watersheds Located on TCF Ownership, Salmon Creek.

Planning Watershed	**Predominant Stream**	**Total Watershed Acres**	**Acres of Ownership in Watershed**	**Percent of Ownership in Watershed**	**Class I** (total mi) on TCF Salmon Creek	**Class II** (total mi) on TCF Salmon Creek	**Class III** (total mi) on TCF Salmon Creek
1113.400005	Big Salmon Creek	8,602	4,126	98.12	9.9	15.5	23.6
1113.400002	South Fork Albion River	5,837	40	0.95	0	0	0
1113.500706	Ray Gulch	3,910	26	0.62	0	0	0
1113.400003	Lower Albion River	8,076	8	0.19	0	0	0
1113.500705	Flynn Creek	4,865	4	0.10	0	0	0
1113.500707	Mouth of Navarro River	7,782	1	0.02	0	0	0
Total	-	-	**4,205**	**100**	**9.9**	**15.5**	**23.6**

1.2.1.2 Rivers

Big Salmon Creek Mainstem

The Property encompasses approximately 48 percent of the Big Salmon Creek watershed (Table 1-1). Temperature monitoring conducted by GP (1994-1999) and CTM (2000-2004) (Figure 2-3) indicate that stream temperature during summer months are within suitable ranges for coho and optimal ranges for steelhead. Stream habitat surveys conducted by CDFG in 2007 suggest that the surveyed reaches within the ownership contained generally good habitat conditions for salmonids. Shade canopy values were good at over 90 percent. Spawning habitat conditions were also considered good, with 85 percent of the habitat units surveyed described as being good or acceptable. Pool habitat by depth was also rated as good, with 62 percent of the pools having optimal depth for the stream order. CDFG (Flosi and Renyolds 1998) protocol states that ideally

40 percent of instream habitat (by length) should be in pool habitat. In Big Salmon Creek, surveyors found 38 percent of the stream in pool habitat, indicating a slight deficiency. Pool shelter was also found to be slightly but not significantly low at 86(CDFG 2007). CDFG (Flosi and Renyolds 1998) states that a measure of 100 is desirable in pools. Low pool frequency and shelter values may result from the lack of large woody debris (LWD) as discussed in Section 1.1.2.1.

Juvenile coho and steelhead presence has been regularly observed throughout the Big Salmon Creek mainstem through electro-fish abundance surveys (GP unpublished 1995-1999, CTM unpublished 2000-2004), and stream habitat typing (CDFG 2007). Eight 50-meter electro-fish monitoring stations were established throughout the ownership on Big Salmon Creek and its tributaries and monitored annually. CDFG conducted routine stream habitat inventory surveys throughout the watershed in 2007.

1.2.1.3 Perennial Streams

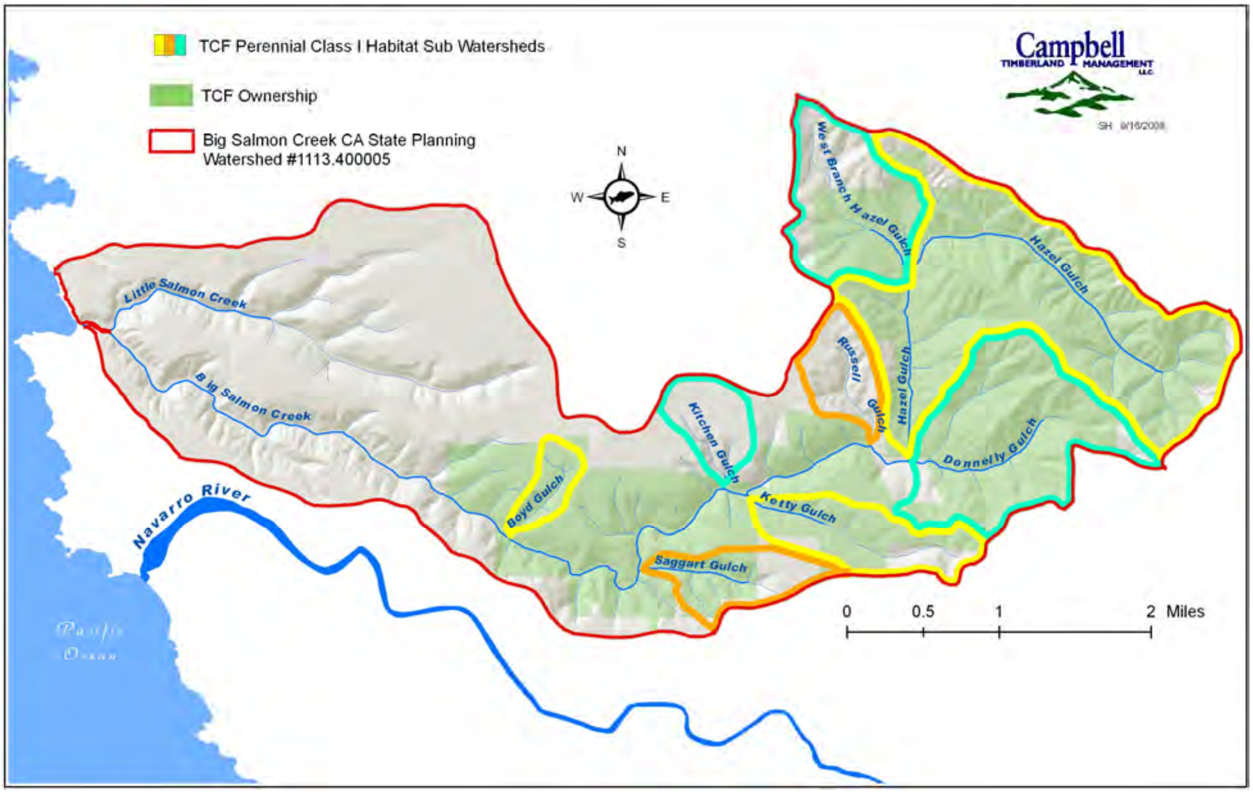
There are approximately nine small creeks and tributaries to Big Salmon Creek that are considered, in part, class I stream habitat, displayed on a map in Figure 1-8 (GP Unpublished 1996; CTM Unpublished 2005; CDFG 2007). A class I stream classification denotes potential habitat for salmonid species exists, and that the presence of salmon is not required for this classification.

Table 1-2. Summary of Total Stream Miles By Classification Within Perennial Class I Habitat Sub Watersheds Located on TCF Ownership, Salmon Creek.

Sub Watershed Name	**Total Acres**	**Acres of Ownership in Sub Watershed**	**Percent of Ownership in Sub Watershed**	**Class I** (total mi) on TCF Salmon Creek	**Class II** (total mi) on TCF Salmon Creek	**Class III** (total mi) on TCF Salmon Creek
Boyd Gulch	124.7	122.1	2.90	0.07	1.17	0.72
Donnelley Gulch	818.6	748.7	17.80	0.93	1.60	6.10
Hazel Gulch*	2124.0	1731.0	41.16	3.87	6.01	11.07
Ketty Gulch	369.5	276.7	6.58	0.56	0.89	0.51
Kitchen Gulch	207.4	3.5	0.08	0.07	0	0
Russell	221.2	16.7	0.40	0	0	0
Saggart Gulch	260.4	160.6	3.82	0.75	0.80	0.78
Subtotal	-	**3,059**	**72.75**	**6.25**	**10.47**	**19.18**
Remainder of Big Salmon Creek mainstem	-	1,068	25.39	3.65	5.03	4.42
All other minor drainages	-	78	1.85	0	0	0
Total	**-**	**4,205**	**100**	**9.9**	**15.5**	**23.6**

* Includes class I perennial tributary: West Branch Hazel Gulch

Figure 1-8. Map of Perennial Class I Habitat , Within the Sub Watersheds, on TCF Ownership, Salmon Creek.



The following short narratives are provided for all Class I tributaries. They are listed in watershed position, beginning with the most downstream tributary within the ownership.

Boyd Gulch

This watercourse contains 1.24 miles of combined Class I and II stream habitat. However, only a small proportion of the gulch (Table 1-2) is considered Class I habitat. No recorded surveys have been conducted there but it can be assumed that no other fishery management prescriptions are necessary other than best forest management practices.

Saggart Gulch

Saggart Gulch has similar conditions to those found in Ketty Gulch. It is a small, low gradient watercourse with limited flow potential. Observations within the watercourse indicate anthropogenic negative factors for fisheries from 1960s era logging practices. In the 2007 CDFG survey, this gulch was not considered an anadromous stream. However, foresters for CTM classified 0.75 mi of the stream as fish habitat due to the potential for restorability.

Kitchen Gulch

Most instream habitat in this watercourse is not suitable for juvenile salmonid rearing due to gradient and insufficient flow potential. The 2007 CDFG survey found that only a small proportion of the lower stream channel was acceptable for salmonids (Table 1-2). The survey determined that canopy was optimal, but pool habitat and shelter conditions were slightly deficient. It must be noted that Kitchen Gulch is a small watercourse and would not normally support pool habitat formations similar to that found in the mainstem.

Ketty Gulch

A stream survey conducted by CTM (2005) found the instream habitat characteristics observed in Ketty Gulch to resemble other low order gulches of moderate gradient in the Big Salmon Creek watershed. The survey reach appeared to be moderately impacted and, in some places, heavily impaired by historic logging practices and associated road construction. Evidence of near-channel tractor activity, from most likely the 1960s era timber harvesting and associated road construction, remains today. The banks and channel are unstable in some locations, but it appears that the moderate to heavy pool filling is the result of legacy effects. Despite the filled-in pools, embeddedness values are relatively low with 71 percent of the observed spawning riffles considered suitable for spawning.

Riparian canopy structure within the surveyed reach was acceptable at 90 percent. Large woody debris levels in the surveyed reach appear to be favorable with 22 pieces per 1000 ft; however, much of the LWD was centralized in large logjams affording structural complexity to only that particular location.

Russell Gulch

Class I habitat in Russell Gulch extends a small distance upstream from its confluence with the mainstem up to a bedrock sheet barrier (Table 1-2). The small amount of Class I habitat likely serves as over-wintering refugia for juveniles during high flow events.

Hazel Gulch

This watercourse is the largest tributary to Big Salmon Creek. It contains approximately 2.7 miles of Class I habitat (Table 1-2) and a large proportion of the spawning, rearing and over-wintering habitat within the entire Big Salmon Creek watershed. The 2007 CDFG survey found good shade canopy for salmonids. However, survey results suggest that Hazel Gulch is deficient in LWD, which is evidenced not only in low wood counts, but also as deficiencies in other channel attributes associated with instream LWD. Survey results suggest that shelter values are deficient, pool habitat lacking, and gravel storage and sorting processes need improvement. The paucity of LWD in the channel is consistent with the legacy effects from the historic impoundment in Hazel near its confluence with West Branch Hazel Gulch. Much of the stream channel in this area was inundated as a log/farm pond, then later subject to stream clearance activities during timber harvest operations in the 1960s. Coho and steelhead have been observed throughout this gulch (CDFG 2007).

West Branch Hazel

This gulch is tributary to Hazel Gulch and offers a small amount of marginal salmonid habitat (Table 1-2), and is generally better suited for steelhead and rainbow trout. The channel entrance is an 18 ft bedrock sheet with a 45° slope, which probably partially limits adult migration (Primbs 1966). Within the gulch there is little available spawning habitat due to natural geomorphic conditions. Rainbow trout have been observed in the gulch (CDFG 2007).

Donnelly Gulch

This tributary resembles Hazel Gulch and Ketty Gulch. It is a low order watercourse with moderate to low gradient and limited streamflow potential. The lower end of Donnelly Gulch sustained some channel damage from logging operations in the 1960s era. As a result, sediment delivery mostly occurs as bank failures in the gulch. Additionally, LWD and the other stream processes associated with wood in channels are deficient. Coho and steelhead have been consistently observed in Donnelly (GP unpublished 1993- 1999; CTM unpublished 2000-2005; CDFG 2007), and Class I habitat extends for nearly 0.93 miles (Table 1-2). Pullen Gulch is a small sub-watershed tributary to Donnelly and provides a small amount of Class I habitat at the confluence.

1.2.2 Special Status Animal Species

1.2.2.1 Coho Salmon

Coho have been definitively observed throughout Big Salmon Creek and most of its tributaries. The coho salmon (*Oncorhynchus kisutch*) was listed as federally threatened on December 2, 1996 within the Central California Coast Evolutionary Significant Unit (ESU) and was listed as state and federal endangered status in 2005. This ESU includes all naturally spawned populations of coho salmon in coastal streams south of the Mattole River to the San Lorenzo River in Santa Cruz County. Coho salmon are anadromous salmonids that require migration access to streams, cold, clean, well oxygenated water and prefer the cover of overhanging vegetation, undercut banks, submerged vegetation, rocks, and logs and deep, slow-moving water. Coho typically initiate upstream migration between late October and mid-February. Preferred mean weekly average temperatures (MWATs) found in the literature for coho range from 10 to 17.5° C (50-63.5° F) (a greater range than proposed for management thresholds). Redds are constructed in gravel that range in size from 1.3 to 10.2 cm. in diameter and intergravel mortality begins to occur when fine sediments exceed 13 percent of the substrate composition within the redd egg pocket. Note that redd construction involves a winnowing process that clears the egg pocket of most fine material. After emergence from gravels, juvenile coho spend the rest of the year in the freshwater environment. This makes coho reliant on over-summer and over-wintering habitat needs within rivers and streams, engendering susceptibility to impacts from degraded freshwater habitat. Favored summer habitat is deep coldwater pools often formed by the presence of large woody debris and sufficient cover. Winter habitat includes low velocity stream habitats (alcoves, backwaters, side channels and floodplains) where juveniles can weather high winter flows. The majority of coho juveniles migrate to the ocean at age one and return to fresh water to spawn after two to three years.

1.2.2.2 Steelhead Trout

Steelhead have also been observed throughout the Big Salmon Creek watershed. Steelhead (*Oncorhynchus mykiss*) were listed as federally threatened on June 7, 2000 within the Northern California ESU which includes steelhead in California coastal river basins from Redwood Creek in Humboldt County south to the Gualala River. The vast majority of steelhead stocks present in the North Coast are winter run whose adult upstream spawning migrations occur from December through March, with spawning taking place shortly after the arrival to the spawning grounds. Unlike Chinook and coho, some steelhead do not die after spawning, and migrate back to the marine environment and return to spawn in following years. Steelhead have flexible life histories with most spending between one and three years in freshwater before migrating to the ocean as smolts. They also spend a variable amount of time (one to four years) in the marine environment before returning to spawn. While this provides flexibility to adapt to variable stream conditions, it makes juvenile steelhead susceptible to adverse over-summer and over-winter stream conditions. Adverse conditions concerning this species are elevated water temperatures and sedimentation of spawning gravels. Steelhead mortality at the different life stages is closely affiliated with water temperatures. Preferred MWATs found in the literature for steelhead range from 10° C to 17.5° C (50-63.5°F) (a greater range than proposed for management thresholds). Steelhead prefer to spawn in gravels 0.6-10.2 cm. in diameter, with eggs developing in approximately 31 days. When fine sediments exceed 13 percent of the substrate composition within the egg pocket of the redd, intergravel mortality begins occur. Steelhead spawning behavior generally winnows out fine sediment material.

1.2.3 Other Vertebrate Aquatic Species

Big Salmon Creek supports many aquatic and semi-aquatic vertebrate species besides fish (Table 1-3). Many of these species are completely terrestrial for varying fractions of their life histories, but may use the watercourse for feeding, breeding, or rearing.

Table 1-3. Aquatic Species Directly Observed Or That May Occur In Big Salmon Creek Within The Property.

Common Name	Species	Listing Status	Comments
Reptiles			
Northern Pacific Pond Turtle	*Actinemys marmorata*	None	
Western Aquatic Garter Snake	*Thamnophis couchi*	None	
Amphibians			
Coastal (Pacific) Giant Salamander	*Dicamptodon tenebrosus*	None	May hybridize with *ensatus*
Southern Torrent Salamander	*Rhyacotriton variegatus*	California Species of Special Concern (CDFG)	
Northwestern Salamander	*Ambystoma gracile*	None	
Rough-skinned Newt	*Taricha granulosa*	None	
Red-bellied Newt	*Taricha rivularis*	None	
Coast Range Newt	*Taricha torosa*	California Species of Special Concern (CDFG)	
Ensatina	*Ensatina eschscholtzi*	None	
Black Salamander	*Aneides flavipunctatus*	None	
Tailed Frog	*Ascaphus truei*	Threatened (CESA) California Species of Special Concern (CDFG)	
Western Toad	*Bufo boreas*	None	
Pacific Treefrog	*Hyla regilla*	None	

Common Name	Species	Listing Status	Comments
Bullfrog	*Rana catesbeiana*	None	Invasive species
Northern Red-legged Frog	*Rana aurora aurora*	California Species of Special Concern (CDFG)	
Foothill Yellow-legged Frog	*Rana boylei*	California Species of Special Concern	
Fish			
Pacific Lamprey	*Lampetra tridentata*	None	
River Lamprey	*Lampetra ayresi*	None	
Western Brook Lamprey	*Lampetra richardsoni*	None	
Threespine Stickleback	*Gasterosteus aculeatus*	None	Common
Prickly Sculpin	*Cottus asper*	None	Common
Coastrange Sculpin	*Cottus aleuticus*	None	Common

In addition to coho and steelhead, generally three other fish species are commonly found in Big Salmon Creek (Table 1-3). The two sculpin species are commonly observed in most Class I watercourses in the region. Biologists employed by GP and CTM have also directly observed Pacific Lamprey. Whether other lamprey species are endemic in the watershed is unknown, but all three species may occur.

2 Management Goals

In northern California watersheds, salmonids are considered the keystone aquatic species by state and federal regulatory agencies. The State Water Resources Control Board and the US EPA consider salmonids a key indicator of water quality. Coho in this region have been listed as state and federally endangered and steelhead have been listed as federally threatened.

Consequently, the aquatic management goals are tailored to promote healthy salmonid populations with the assumption that other aquatic taxa will also thrive. Therefore, healthy instream habitat conditions that are known or assumed to promote salmonids are the overarching goal of the Aquatic Management Plan. These elements include maintenance/enhancement of shade canopy, recruitment of large wood (either naturally or artificially), maintenance of summer flows, and prevention of discharges of fine sediments. The incorporation of these elements into property wide management plans should be considered relative to any management activity, not just those near aquatic habitats.

2.1 Restoration and Enhancement

This aquatic restoration and enhancement plan was prepared by: 1) synthesizing existing reports and recommendations pertaining to aquatic restoration; and 2) identifying and prioritizing aquatic restoration and management actions. This process involved the review and analysis of pertinent documents and field surveys conducted in the watershed and formulating restoration objectives relevant to the Property. The suggested approach relies on an analysis of limiting instream factors identified within the watershed. However, this watershed has not been listed as water quality limited under section 303(d) of the Federal Clean Water Act (impaired). Consequently, there is generally less baseline information available than neighboring watersheds germane to restoration and enhancement. This analysis and subsequent recommendations rely on aquatic habitat inventory surveys conducted GP in 1996, CDFG in 2007, and from instream temperature, aquatic vertebrate, and sediment monitoring conducted by GP and CTM from 1993-2004.

Nearly all the major watersheds in northern California have been impacted by historic logging operations, and, as discussed in Section 1.1.2.1, Big Salmon Creek shares a similar history. The restoration and enhancement measures prescribed by this aquatic management plan relies on a conceptual limiting factors analysis to determine aquatic bottlenecks to salmonid production as per Meehan et al (1991).

2.1.1 Aquatic Limiting Factors Analysis

The life requirements for anadromous Pacific salmonids in the freshwater environment are generally well understood (Bjorn and Reiser 1991). Survival in their freshwater phases depends on the availability of cool, clean water, unlimited migratory access throughout the stream network, clean spawning gravel, suitable and adequate food supplies, and complex instream shelter components to avoid predation. These necessary life-history components are provided by a diverse and complex aquatic habitat. When any of these life history components are missing or degraded, fish stock production can be adversely impacted. The basis of a limiting factors analysis is to identify and evaluate these requirements throughout the watershed on a spatial and temporal scale. When these requirements are evaluated on both watershed and reach scales, factors that promote or limit salmonid stocks can be identified.

Natural disturbance factors such as landslides and wildfires that limit salmonid stocks in watersheds, while generally covering larger areas than sites of human disturbance, are usually not distributed throughout the watershed. The stochastic nature of these disturbances, which tend to rotate though watersheds on a broad temporal and spatial scale, allow individual sub-basins sufficient time for recovery. On a watershed scale this creates diverse and dynamic habitat conditions for salmonids. In contrast, human disturbances tend to be comparatively smaller on an individual basis, but usually more widely distributed throughout the watershed (Reeves et al 1995). Naturally occurring landslides and other disturbances occur within the Big Salmon Creek watershed; however, their impacts to salmon stocks are minimal compared to anthropogenic disturbances such as historic road building that are more widely distributed throughout the basin.

The concept of a limiting factors analysis was first introduced in the 1980s (Everest and Sedell 1984) (Meehan 1991) and has been utilized extensively in assessment studies of proximate regional watersheds (Klamt et al [NCWAP Gualala] 2002; Downie et al [NCWAP Albion] 2004; Downie et al [NCWAP Big River] 2006) by the North Coast Watershed Assessment Program (NCWAP California Resources Agency) and by others throughout the Pacific Northwest to identify problems within watersheds and direct stream restoration activities. For the purposes of this aquatic management plan it is not necessary to discuss the entirety of all studies and processes involved. Rather the purpose is to establish that certain stream conditions are commonly recognized as influencing salmonid production in most watersheds throughout this region, and they are generally well recognized in peer reviewed articles and publications (Reeves and Everest 1989) (Bisson In press).

In Big Salmon Creek and other watersheds in this region, stream condition is thought to be primarily controlled by these factors: adequate stream flow, suitable water quality, and complex habitat.

Adequate stream flows are critical for salmonid production at all points through their freshwater life cycle. A suitable winter flow regime is required for upstream migrating spawners and egg development within redds, and rearing juveniles need adequate summer flows for feeding, predator evasion, and thermal refugia. A natural hydrologic regime that decreases the magnitude of winter peak flow events and increases flows during the summer drought period favors salmonid production. The natural hydrograph of coastal watersheds in northern California is often one of limited flows during summer, limiting carrying capacity and connectivity throughout the aquatic habitat. Consequently, freshwater salmonid survival is particularly tied to diminished flows during summer. In Big Salmon Creek within the Property, stream diversions do not occur and drafting occurs minimally, so stream flows are thought to mimic the natural hydrologic regime and are not considered limiting beyond normal variance.

Water quality considerations for salmonid production consist of three factors: 1) water temperatures, 2) turbidity, and 3) sediment load. Steam temperature in summer is often thought be the critically important for growth and rearing in salmonids (Hines and Ambrose, 2000). Literature suggests that suitable temperatures for salmonids at this life history stage range between 10.0° – 17.5° C depending on the species. Steelhead are slightly more tolerant of higher stream temperatures than coho.

Turbidity, or the relative clarity of water, can affect primary productivity of aquatic vegetation. This consequently affects aquatic insect production, which in turn may alter salmonid productivity. Increased suspended sediment loads can interfere with juvenile salmonids' ability to locate prey and feed thereby decreasing overall growth rates.

The final aspect of water quality is stream substrate composition, which can be subdivided into two separate analyses: compositional and quantitative. Although salmonids use a winnowing process to flush out fine materials during redd construction, if the proportion of fine sediment within the substrate is excessive, survival to emergence (STE) of fry from the redd is reduced (Kondolf 2000). Fine sediment reduces interstitial flow through the spawning gravel, subsequently reducing the dissolved oxygen flow to embryos and the flushing of metabolites. Excessive overall quantities of sediment affect juvenile salmonids generally in two ways: debris torrents in winter (when large amounts of sediment are suspended in the water column) can cap redds as sediment comes out of suspension; and in summer, deleterious quantities of bedload within channels can force stream discharge to flow subsurface, effectively reducing rearing habitat in small streams during a critical life stage.

Habitat complexity for salmonids has also been researched and discussed in fishery literature (Flosi and Renyolds 1998). An optimally complex condition for salmonids is thought to consist of a combination of riffle, flatwater and pool habitat types. Riffles provide spawning substrate and a rearing area for fry; flatwater provides connectivity through the stream network and some rearing habitat for juveniles; pools provide refugia from predation and high stream velocities in winter, foraging habitat throughout the year, and rearing habitat in summer.

Stream conditions for salmonids are also dictated by the quality of the adjacent riparian habitat. Shade canopy from dense bank dwelling vegetation limits the amount of solar radiation that reaches the stream, buffering excessive stream temperatures in summer and insulating overly cool temperatures in winter. Green leaf matter falling from streamside trees provides a nutrient source for aquatic insects that in turn become feed sources for fish. The coarse woody habitat elements recruited from the fall of riparian trees in the form of LWD eventually forms roughness and shelter components within the active channel. A well functioning riparian zone also provides stream bank stability with dense vegetative root masses, limiting sediment delivery from bank failures and streamside landslides.

The limiting factors assessment analyzes aquatic factors thought to limit salmonids in the instream residency component of their life history. The following narrative outlines the goals, background, discussion, and recommendations for each limiting factor identified. Habitat assessment surveys identify the majority of limiting factors in the watershed and are consequently addressed first. Table 2-1 summarizes limiting factors within the watershed and management recommendations.

Table 2-1. Summary of Limiting Factors and Management Recommendations.

<table>
<tr><th>Limiting Factor</th><th>Regulatory Reference</th><th colspan="2">Measured Parameters</th><th>Desired Condition</th><th>Management Recommendations</th></tr>
<tr><td rowspan="3">Habitat</td><td rowspan="3">Desired Salmonid Freshwater habitat Conditions for Sediment-Related Indices (NCRWQCB 2006).</td><td colspan="2">Pool habitat</td><td>Where applicable, increasing trend in frequency and length.</td><td rowspan="3">Monitoring should occur according to the protocols found in the California Stream Restoration Manual (Flosi et al 2004).</td></tr>
<tr><td colspan="2">Pool depth</td><td>Where applicable, increasing trend in pool depth.</td></tr>
<tr><td colspan="2">Primary pool distribution</td><td>Maintain 40 % of stream habitat by length in 2 nd- 4 th order streams.</td></tr>
<tr><td rowspan="3">LWD</td><td rowspan="3">Desired Salmonid Freshwater habitat Conditions for Sediment-Related Indices (NCRWQCB 2006).</td><td>Bankfull Channel Width (m)</td><td>Index (per 100m of Channel length)</td><td rowspan="3">An increasing trend in the frequency of LWD within active stream channels.</td><td rowspan="3">Monitoring should occur according to the protocols found in the California Stream Restoration Manual (Flosi et al 2004).</td></tr>
<tr><td>1 to 6</td><td>> 38 pieces</td></tr>
<tr><td>> 6 to 30</td><td>> 63 pieces</td></tr>
<tr><td>Fish Passage</td><td>California Stream Restoration Manual (Flosi et al 2004).</td><td colspan="2">Bridge and culvert parameters as prescribed in manual.</td><td>Fish passage at all crossings at all life-history stages in Class I watercourses.</td><td>Monitoring should occur according to the protocols found in the California Stream Restoration Manual (Flosi et al 2004).</td></tr>
<tr><td rowspan="3">Stream Temperature</td><td rowspan="3">NCWAP Overview and Methods (2006)</td><td>MWAT Range</td><td>Description</td><td rowspan="3">Maintain summer stream temperatures within 10º C – 16.5º C (50º F – 62º F).</td><td rowspan="3">Monitoring should occur at some or all historic monitoring stations.</td></tr>
<tr><td>10º - 15.5º C</td><td>Fully Suitable</td></tr>
<tr><td>16º - 16.5ºC</td><td>Moderately Suitable</td></tr>
<tr><td rowspan="3">Sediment</td><td rowspan="3">Desired Salmonid Freshwater habitat Conditions for Sediment-Related Indices (NCRWQCB 2006).</td><td colspan="2">Turbidity (ntu)</td><td>Turbidity should not increase more than 20 percent above naturally occurring background levels.</td><td>Stream channel confluences should be monitored for turbidity during storm events.</td></tr>
<tr><td colspan="2">Suspended Sediment Load (tons/day)</td><td>The suspended sediment load and suspended sediment discharge rate of surface waters should not adversely affect beneficial uses</td><td>Stream channel confluences should be monitored for suspended sediment loads</td></tr>
<tr><td colspan="2">Embeddedness</td><td>An increasing trend in the number of locations where gravels and cobbles are ? 25% embedded.</td><td>Monitoring should occur according to the protocols found in the California Stream Restoration Manual (Flosi et al 2004).</td></tr>
</table>

2.1.1.1 Habitat Assessment

Goals

The primary goal of habitat assessment surveys is to determine the quality of the aquatic habitat within watersheds. The information generated in the assessment is used to identify areas in need of remediation and guide restoration efforts. The secondary goal is to generally identify how fish use the watershed and which areas are optimal for different components of their life history: spawning, rearing, and over-wintering.

Background

In 1996 a comprehensive habitat inventory survey was conducted by GP throughout the Big Salmon Creek watershed to assess aquatic habitat conditions and subsequently recommend potential habitat enhancement options.

When CTM assumed management of the watershed in 2000, a plan was instituted to evaluate all Class I watercourses adjacent to and within Timber Harvest Plans for factors limiting salmonid production. In the case of road related sediment delivery issues, road network upgrades were implemented as part of timber operations (see Section 2.1.1.5).

As a result of the assessment information generated and as mitigation for a quarry accident on Big River, in 2004, CTM implemented a stream enhancement LWD project on the mainstem of Big Salmon Creek and selected tributaries. The project area is upper mainstem Big Salmon Creek and Lower Hazel Gulch, and consists of 16 log structures that use anchored and unanchored design elements. In 2007 CDFG revisited the watershed and conducted habitat inventory assessments with associated recommendations.

Discussion

The results from the GP habitat inventory surveys, THP related surveys, and the CDFG survey in 2007 all suggest that lack of channel complexity, or channel homogenization, is the most apparent problem for the aquatic ecosystem. Presumably these are legacy effects from the 1960s era logging practices and stream clearance activities. The benefits to ecosystem resilience from instream structure have been well documented (Maser and Sedell 1994). Instream shelter components, particularly from organic sources such as wood, have been attributed to many beneficial aspects of aquatic ecology, as listed below:

- Aquatic macro-invertebrate production
- Structural shelter habitat for aquatic organisms including salmonids
- Structural habitat for aquatic organisms in the form of pool habitat development
- Increased over summer water storage due to increased pool development
- Increased bank stability due to decreased bank downcutting and increased riparian flooding during peak flows
- Shelter habitat for rearing salmonid juveniles in summer
- Shelter habitat for salmonids (adult and juvenile) from high stream velocity events in winter
- Spawning gravel retention and sorting and storage of sediment.

Although sediment delivery issues remain a problem in some areas, all the assessment surveys on the mainstem suggest, contrary to what might be expected, that the watershed may lack suitable quantities of spawning substrate due to stream channel homogenization. Many stream reaches, both in the mainstem and within the tributaries, have actively downcut through the floodplain to bedrock. Heterogeneous channels with sufficient roughness from geologic and biologic sources (boulders and large wood) store and sort sediment. These areas of sediment deposition are often primary spawning habitat for salmonids. The paucity of spawning habitat and downcutting in Big Salmon Creek was noted in the 2007 CDFG surveys as well as in earlier reports by CTM and GP.

This phenomenon has also occurred within the neighboring Albion River watershed, presumably for the same reasons. Cynthia LeDoux-Bloom, Associate Marine Fisheries Biologist for CDFG, recommends the addition of suitable spawning gravels in certain areas of the watershed, as was implemented in the Albion River (Pers. Comm. 2008).

Lack of suitable spawning substrate may not necessarily limit populations of coho or steelhead in small stream systems. Density dependant juvenile population dynamics and stream carrying capacity create an ecological feedback loop such that when many spawners succeed, the resultant overabundance of progeny may be significantly depleted by limits to stream carrying capacity and density dependant interactions. Conversely, when few spawners are successful the mortality in progeny from density dependent interactions is decreased. Therefore, few successful spawners may seed a small stream network as adequately as numerous spawners, although the genetic range in the progeny will be less.

In Big Salmon Creek, however, suitable spawning substrate is presently distributed more heavily in the tributary gulches than the mainstem. In years where high flows predominate, this distribution would benefit fish spawning higher in the network, whereas in drought years spawning habitat would be limiting. An additional consideration during drought conditions with fish spawning lower is that progeny, due to low flow, would have limited opportunities to migrate upstream to avoid density dependant interactions and competition with other fish - essentially limiting available rearing habitat. Although stream networks rarely attain ideal attributes for salmonids at all spatial and temporal scales - because habitat conditions naturally vary - the optimal distribution of spawning substrate in Big Salmon Creek should be more equivalent between tributary and mainstem reaches. This would allow a greater range of useful spawning habitat during all streamflow conditions and ensure a higher probability of spawning success in all types of streamflow conditions.

Suitable rearing habitat occurs throughout the Class I stream network on the Property. During wet years with favorable rainfall, all Class I tributaries and the mainstem serve as beneficial rearing habitat. During drought conditions, however, the lack of flow potential and pool habitat in the tributaries limits habitats for fish, and often forces fish to migrate downstream in search of better conditions. This further increases competition in the mainstem and ultimately mortality rates as well. The flow potential of tributary reaches cannot be increased. However, the anthropogenic lack of channel structure exacerbates the problem with the subsequent lack of pool formation and water storage. The overabundance of bedload in these small channels then deteriorates the situation even further due to the tendency of streams to flow hyporheic, or sub-surface, during low flow periods. Over time, overabundant sediment in the tributaries will redistribute in the mainstem if there is sufficient channel structure available for storage.

The entire basin encompassed by the Property offers suitable over-wintering habitat for juvenile salmonids during dips in the hydrograph between storms. During high-flow or peak events, however, water velocity can severely impact juveniles and cause significant mortality – particularly in the mainstem. As discussed, significant channel structure slows stream velocity and therefore offers refugia for over-wintering salmonids. The observed paucity of channel structure in the mainstem suggests that, presently, it does not offer adequate over-wintering habitat during extended periods of high flow. And that fish are subsequently forced to use the smaller tributary confluences as over-wintering refugia. Fish probably use the confluences of Pullen, Hardel, Russell, Boyd, and Kitchen Gulches as refugia during peak flows.

Recommendations

All assessment surveys and associated reports generated in Big Salmon Creek since 1996 consistently suggest that channel homogenization due to lack of LWD is the major factor limiting salmonids in Big Salmon Creek - within the ownership. The other factors generally thought to limit fish production in northern California streams, such as canopy and associated stream temperatures are not nearly as critical in this watershed (see Section 2.1.1.4).

The aquatic management strategy for this watershed should therefore focus on increasing wood loading in the active channel. Riparian corridors should be managed for natural recruitment of large trees into the channel, as has been historically occurring within the recent management regime.

However, the rate of wood recruitment from natural processes like mortality, bank failures, streamside landslides and windfall is likely insufficient for the near term needs. The natural mortality of redwoods in particular (considering the life span of these trees and their resistance to disease) and fall probability (the probability that dying trees will actually fall in the channel) would result in a very slow rate of recruitment. The immediacy of the problem, therefore, suggests that artificial wood recruitment is necessary. Section 2.1.1.2 addresses artificial LWD recruitment in the watershed.

Future habitat assessments are proposed in the following phases:

Phase One (2009-2010)

- Conduct LWD surveys in select reaches of the watershed to determine deficiencies in wood loading.

Phase Two (2012-2017)

- Conduct Habitat Inventory Surveys on a five-year frequency basis to continue monitoring aquatic habitat conditions or following ten year flood events.

2.1.1.2 LWD

Goals

Reflecting the paucity of LWD within the watercourse and the associated detrimental aquatic habitat conditions as found in the habitat assessment surveys, the primary goal is simply to increase channel complexity through the artificial recruitment of LWD into the stream network where necessary. The secondary goal is to implement wood based enhancement projects efficiently with minimal negative ecological impacts and maximized enhancement properties.

Background

As previously discussed, in 2004 an LWD project was implemented in Big Salmon Creek and Hazel Gulch. Although design components were primarily anchored structures, some unanchored logs were added to the channel.

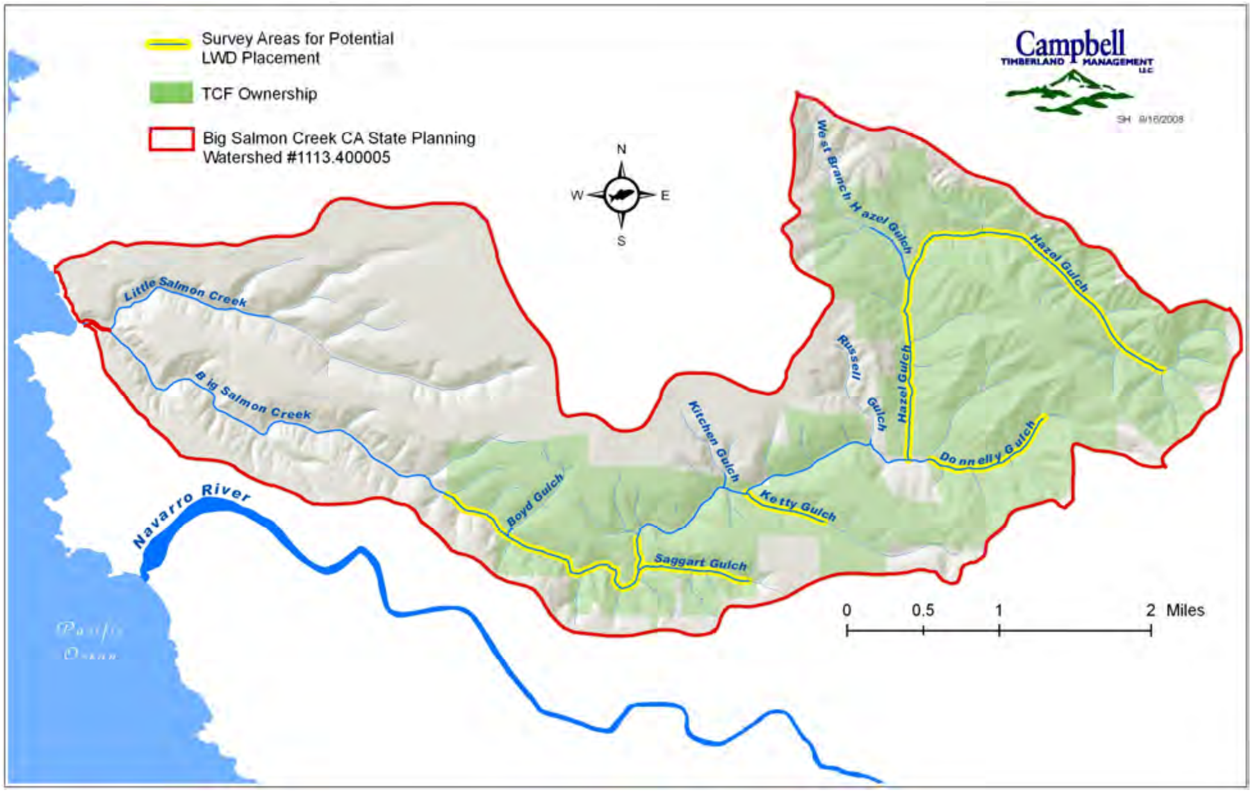
Discussion

Stream enhancement projects utilizing wood structures can generally be accomplished with either wood collected from timber harvest operations, or harvested/salvaged specifically for the project. In the 2004 Big Salmon Creek wood project, managers found a number of disadvantages to using cull logs from timber operations and logs felled away from the site. The primary disadvantage to this method is that log stock collected away from the site must be transported. A functional road network to the restoration site is then required, and heavy equipment must be used extensively within the channel and along the banks. The site's overall restoration value to aquatic organisms is consequently diminished by the potential for increased sediment delivery. Additionally, salvaged logs are often of inferior quality both in length and structural considerations. Logs deficient in length characteristics often must be permanently anchored to existing stationary landmarks to avoid being flushed from the basin during high flows. These associated requirements are costly and, more importantly, result in structures that are sub-optimal from the perspective of fish habitat. Permanently anchored structures also don't allow log movement. As a consequence, important hydrologic processes such as scour and sediment sorting are limited because the immobile log cannot descend into the scour hole.

Ideally, large unanchored logs approximately two times the channel width should be used for in-channel structure. Length allows some hydrologic mobility while also limiting large-scale movement, retaining the valuable wood within the watershed. Due to the excellent canopy values found in this watershed and the cooling influence of the marine dominated climate, it can be reasonably assumed that selected riparian trees could be placed into the channel without undo negative impact to the stream's thermal regime. Using select riparian trees for instream structure is cost effective, it minimizes damage to the channel banks, and it minimizes damage to riparian vegetation because heavy equipment use is minimized. This method also allows for increased flexibility in site selection, as a functioning road network is not required.

Recommendations

Figure 2-1. LWD Survey Reaches for Potential Stream Enhancement.



Due to the problems associated with anchored instream structures, many institutions involved with LWD enhancement projects have started implementing an "accelerated recruitment" approach in which streamside trees of sufficient length are placed directly into the channel. Other resource managers in the region have implemented this method on nearby watersheds at cost of approximately $9,000 per mile. Accordingly, recommendations include:

- Survey Class I mainstem and tributary reaches to quantify LWD;
- Treat select reaches found deficient in LWD in mainstem Big Salmon Creek and its tributaries using this "accelerated recruitment" procedure. A rough treatment estimate of three to four miles of mainstem reaches and ten miles of tributary reaches produces an overall estimate of $117,000. Depending on funding constraints, these reaches can be prioritized for fisheries values and implemented as resources become available.
- Assess the following areas for LWD deficiencies and, when applicable, identify and implement potential restoration sites (see also Figure 2-1):

  1. **Hazel Gulch**
     a. Lower Hazel from confluence with Donnelley Gulch to West Branch Hazel
     b. Upper Hazel from North Fork Hazel to end of Class I habitat
  2. **Lower mainstem Big Salmon Creek.**
     a. From "first crossing" to lower Property boundary

3. **Donnelly Gulch**
    a. From Pullen Gulch to Class I habitat termination
4. **Ketty Gulch**
    a. Confluence to Class I habitat termination
5. **Saggart Gulch**
    a. Confluence to Class 1 termination

The mainstem reach between Russell Gulch and Saggart Gulch has the lowest priority for LWD assessment and implementation because this area was the location for the 2004 LWD project reach. Stream enhancement in this area may still be necessary, but untreated areas in the basin now have higher priority.

2.1.1.3 Fish Passage

Goals

Adult salmonids require access to spawning habitat, and juvenile rearing fish need access to feed sources and refugia habitat in order to thrive. Refugia habitat is often categorized as 1) thermal refugia, or cooler areas during hot periods; 2) over-wintering refugia, or low velocity areas protected from peak flow events; and 3) predator refugia, or areas protected from predation. Any area in the watershed utilized by fish at any point in their life history is defined as Class I habitat. The goal of the aquatic management plan is to allow fish access to these areas by identifying and removing all barriers to fish migration.

Background

Since 1994 past landowners have been removing problematic culverts and other anthropogenic barriers to fish migration as part of the timber harvest process and, additionally, as watershed improvements outside the timber harvest process. Over time most known artificial barriers to fish passage have been removed within the watershed.

Discussion

On small watercourses, such as Kitchen Gulch, the amount of Class I habitat available to fish upstream of a culvert formed partial barrier is limited, and the potential risk of downstream degradation to quality habitat from sediment released by culvert removal is high. In the few instances in the watershed where these conditions exist, the potential overall benefit to the fishery must be weighed against the potential risks.

Recommendations

Monitoring and assessment of barriers to fish passage should continue throughout the watershed in the form of reconnaissance surveys. When potential artificial barriers are identified, the risks of removal should be weighed against potential gain to the fishery. When the assumed gain to the resource is greater than the potential negative effects, the barrier should be removed. Fish passage in suspect crossing and culverts can be evaluated using protocols described in the *Salmonid Stream Habitat Restoration Manual* (Flosi et al 2002).

2.1.1.4 Water Temperature

Goals

Literature concerning stream temperatures for coho and steelhead indicates that suitable summertime temperatures for these salmonids occur within the range of 10° C to 17.5° C (50°-64° F), when gauged from a seven day rolling average of the daily average temperatures (Welsh et al 2001; Sullivan et al 2001; Downie et al 2006). For this Aquatic Management Plan, the thresholds developed by NCWAP (Downie et al *Big River Assessment Overview and Methods* 2006) (Walker 2007) are used (10º C to 16.5º C) (50º F – 62º F) (Table 2-1). These thresholds were developed by a panel of fisheries scientists upon a literature review of northern California stream temperatures and juvenile salmonids. The maximum of the weekly averages is referred to as MWAT and is often used as a single point metric to evaluate stream temperature. The goal for the aquatic management plan is maintain instream MWATs within, or preferably below, the stated suitable range.

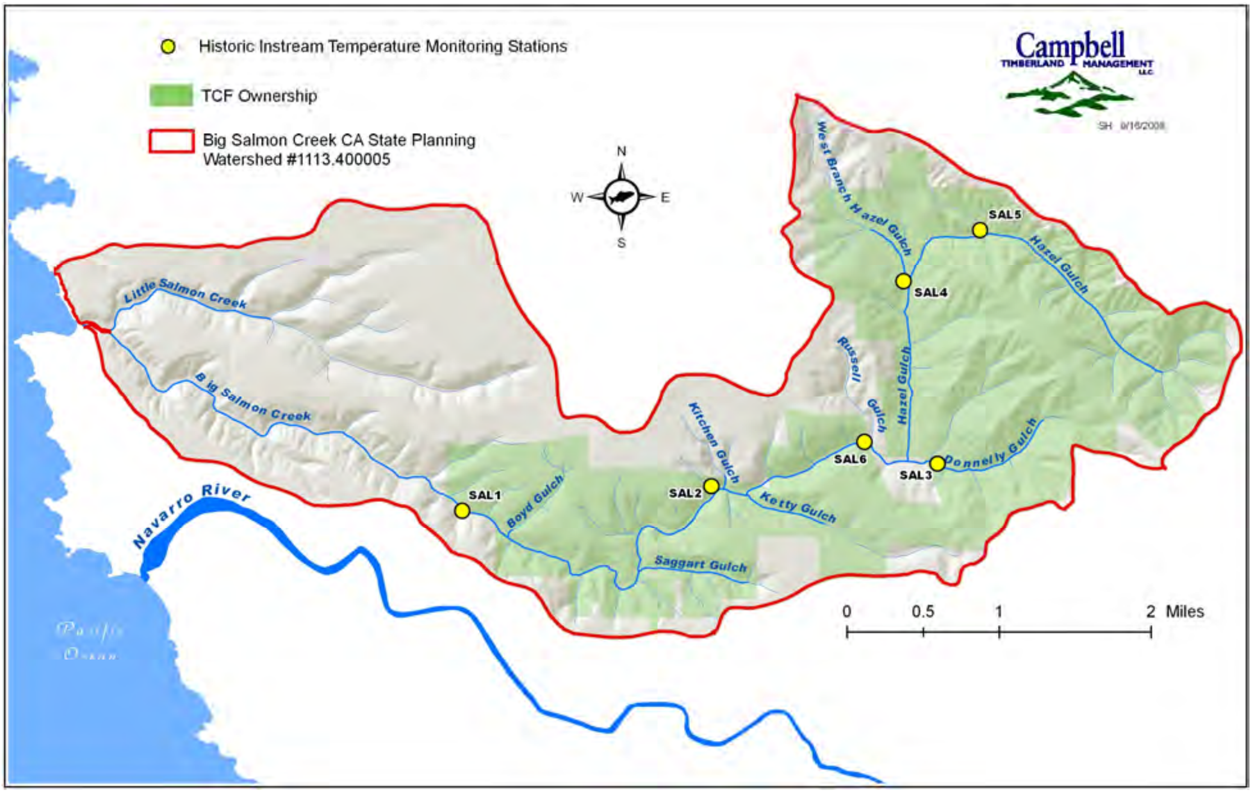
Background

Table 2-2. Temperature Monitoring Sites Within the Property and Years Deployed.

Station	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
SAL1		X	X	X	X	X	X	X	X	X	X			X
SAL2	X	X	X	X	X	X	X	X						
SAL3	X	X	X	X	X	X	X	X						
SAL4	X	X	X	X		X	X	X						X
SAL5	X	X												
SAL6		X	X			X	X	X	X	X				X

Since 1994 resource management staff on the Big Salmon Creek ownership have maintained six temperature data loggers throughout the stream network (Table 2-1, Figure 2-2). In 2005 a separate, additional long-term aquatic temperature study was initiated in lower Hazel Gulch, which is presently ongoing.

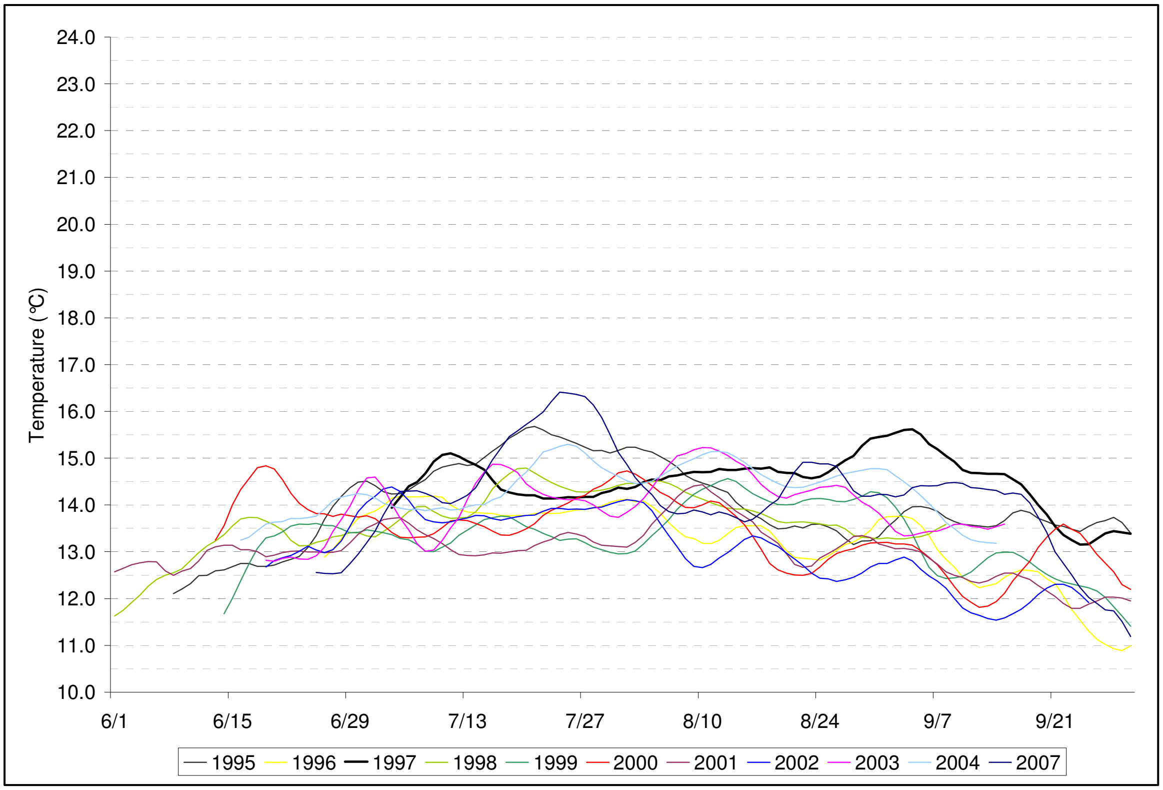
Figure 2-2. Instream Temperature Monitoring Stations On The Big Salmon Creek Property (1994-2007)



Discussion

The results of long-term instream temperature monitoring by previous resource managers indicate that water temperature over summer is suitable for salmon and steelhead (Figure 2-3). As previously discussed, this is likely due to the watershed's proximity to the coast and the optimal canopy values found in the riparian corridors.

Figure 2-3. Summer Rolling Averages Of The Daily Average Temperature (1995-2007). The Highest 7-Day Peak Of The Rolling Average Is The Annual MWAT. (SAL 1)



Recommendations

Stream temperature monitoring should continue in the watershed. At a minimum, two thermal data loggers should be maintained near the downstream Property boundary. As resources allow, data loggers can be installed above and below stream confluences to help identify thermally impaired reaches, if they occur.

The technology available for continuous stream temperature monitoring has been remarkably refined since the 1990s both in terms of memory and cost. The costs associated for monitoring a single site with redundant data-loggers (over summer) is approximately $1,000 annually. This cost includes staff resources. The estimated cost to operate a suite of ten monitoring sites with redundancy (over summer) amounts to approximately $2,000 – 3,000 annually, including staff resources.

It should be noted that analysis of monitoring data suggests that over-summer stream temperatures are in a suitable range for salmonids. Temperature monitoring should continue to ensure that this regime is suitable, but expenditures of resources to reduce stream temperature other than normal best management practices in the basin are presently unnecessary. Available stream enhancement resources should be applied to other identified watershed deficiencies in this basin, or other watersheds on the Property.

2.1.1.5 Sediment

Goals

There is abundant literature documenting the negative effects of excessive sediment and turbidity on salmonids. Excessive levels of fine sediment in redds reduce the survival to emergence rates of fry, and excessive turbidity in the water column reduces the feeding success of parr, particularly during critical winter months.

Although many of the tributary channels to Big Salmon Creek are presently storing excessive sediment loads from earlier logging practices, the mainstem is actually deficient in some reaches (see Section 2.1.1.1), which results in a reduction of available spawning habitat.

The sediment goals of the aquatic management plan are to reduce sediment delivery into the watercourse by disconnecting the existing and historic road networks from the stream network, stabilizing upslope areas, and to allow excessive sediment load in tributary channels to be redistributed within the mainstem channel by natural hydrologic processes. Sorting and storing of gravels within the mainstem can be accomplished through the use of added LWD materials.

Background

Since 1992 the THP process has resulted in the remediation of numerous sources of sedimentation across the ownership within the Big Salmon Creek watershed. In addition to these beneficial measures, the previous landowner had proactively addressed sediment sources outside of the THP process. These activities included culvert/crossing upgrades on Lower Pullen Gulch, Russell Gulch, N.F. Hazel Gulch, Upper Donnelly Gulch, Middle Donnelly Gulch, Center Fork Hazel Gulch, and Kitchen Gulch. Significant road reconstruction occurred on both the Elliott and Iron Gate roads, previously considered the largest perceived sediment sources remaining on the then Hawthorne Timber Company ownership in Big Salmon Creek.

These two roads were subject to the following treatments: berm removal, out-sloping, and installation of rolling dips on approximately 8,300 feet of seasonal road; and rocking of 6,000 feet of the Elliott Road.

The following list is a summary of road related improvements on property in the Big Salmon Creek watershed:

- Road Abandonment: 5.25 miles (27588 feet) of road length, including associated landings (compared to less than 1.5 miles new construction)
- Road Geometry Modification: 8,300+ feet of existing seasonal road altered to maintenance-free design.
- Road Rocking: 4.1 miles (21677 feet) of road length.
- Watercourse crossing removals: 35+ crossings.
- Class I Upgrades: two crossings upgraded to bridges.
- Other Upgrades: replacement of 5+ undersized culverts on Class II and III crossings and installation of a culvert at one chronic wet spot location.

Discussion

The watershed has undergone a long history of impactive logging and ranching operations. Although Big Salmon Creek is on a recovery trend from excessive sediment within stream channels, undoubtedly, many sediment delivery sources still exist that should be identified and treated.

Recommendations

Outside the THP process, road monitoring during the winter period should be conducted throughout the road network to identify and treat sources of road related sediment delivery. Within the THP process, road related sediment sources should also be identified and treated. To identify and possibly implement treatment for landslides and bank failures within the watershed, reconnaissance surveys of the major channels in the watershed should be conducted for signs of obvious sediment intrusions during winter months following ten year flood events.

2.2 Adaptive Management and Information

Monitoring is an essential component of the aquatic restoration plan, and monitoring of key aquatic parameters provides an index to measure the success of management strategies. Monitoring of restoration activities and watershed responses to landscape management activities completes the adaptive management cycle, by assessing the impacts of management actions and general ecological conditions and evaluating the impact to aquatic species. Monitoring allows managers to identify and correct watershed problems as they occur and determine proper remediation.

2.2.1 Monitoring Goals and Objectives

Although Big Salmon Creek has not been listed as impaired under the Clean Water Act, a monitoring regime had been previously implemented. In 1993, GP resource managers developed a monitoring plan based on an index reach approach, and it was continued through 2005 by CTM. Eight monitoring stations were established to monitor aquatic vertebrate abundance, instream temperature, and sediment (using McNeil methods) (McNeil and Ahnell 1964). In 1996 GP survey crews carried out extensive habitat typing of mainstem Big Salmon Creek and most of its tributaries. CDFG survey crews repeated the process in 2007. In 2004 the NCRWQCB adopted General Waste Discharge Requirements (GWDR) for timber operation that required erosion control plans (ECPs). As a consequence, monitoring for sediment delivery from road construction and maintenance has also been conducted on the Property.

After more than ten years of monitoring and observations, the trends in stream conditions are generally apparent. Although sediment related problems still occur in Big Salmon Creek, the trends shown from monitoring habitat, instream fish abundance and temperature parameters indicate that aquatic conditions are generally beneficial for salmonids. What is not known, and cannot be determined from the past monitoring strategy, is the overall adult spawning population (escapement) and the relationship between specific riverine factors limiting salmonids and broad scale marine conditions (i.e., the number of salmonids that exit from and return to the watershed). It is often overlooked that instream conditions only affect salmonids for possibly half their life cycle, and there may be other regional or ESU level population trends that are beyond the control of resource managers. At this point in the adaptive management monitoring process, it is logical to continue some past monitoring activities such as temperature, but to also expand the scope to include salmonid population monitoring.

Regional fisheries biologists for CDFG Northern Region Coastal Watershed Planning and Assessment Program have developed a sampling and modeling protocol that produces estimates of escapement (spawners) from spawning ground surveys (SGS) (Gallagher and Wright 2007). The methodology, which has been developed and implemented in this region, has been employed by neighboring landowners, and will soon be incorporated into the California Coastal Salmonid Monitoring Plan. The survey methods have been peer reviewed (Gallagher and Gallagher 2005) and fall into a larger, regional framework. From a management standpoint it is advantageous to incorporate a proven and accepted monitoring strategy that not only produces watershed escapement estimates, but also links them to regional populations trends.

Another advantage to SGS is that they are relatively inexpensive to conduct. Two member survey crews conduct surveys on randomly selected spawning habitat reaches on two-week intervals. Approximately 30 percent of the identified spawning habitat in the watershed is surveyed and adult spawner population estimates are generated at the end of the spawning season. The former Property manager, CTM, has employed these methods in Pudding Creek, a similar and nearby watershed, from 2004 until the present, and they have received grant funding for staffing needs for all years. Spawning surveys can also be conducted with volunteer staffing, as the survey protocol is not unduly complicated.

In order to understand how broad scale salmonid population trends influence watershed populations, managers must also determine the overall production of juveniles leaving the stream network. Once the spawning and outmigrant (smolt) populations are quantified, important relationships can be established between instream survival and ocean survival, illustrating potential bottlenecks in overall production. Coho are an ideal species for this type of monitoring due to their somewhat rigid life history. Coho smolts typically leave the stream at about 12 –18 months and return as adult spawners in 2 years, producing a reliable 3-year cycle. The proportional relationship between smolts and spawners, the percentage of outmigrants that return, is a reliable indicator of ocean survival. Likewise, the proportion of spawners to their outmigrating progeny is a good indicator of overall stream production. Based on CDFG surveys (Primbs and Edward 1966, CDFG 2007) and the professional judgment of biologists previously employed in the watershed, the Property encompasses much of the prime spawning and rearing habitat in the Big Salmon Creek basin, and is consequently well suited for this type of monitoring.

Due to the listing status of both endemic salmonids and their perceived importance by regulatory agencies as a keystone or indictor species of water quality, quantified population estimates are valuable. From the public relations perspective, population estimates of returning adults are more meaningful to the general populace than over-summer juvenile relative abundance or other measures of instream salmon productivity, and from a fishery perspective, escapement is the final measure of success for the population. Section 2.2.2 discusses a two-tier approach to aquatic monitoring in the watershed that maintains some elements of former monitoring activities and incorporates fish population monitoring.

Not all past monitoring activities should be continued. Some previous monitoring actions should be replaced with activities that more directly gauge current best management practices. For example, McNeil sampling is time and resource intensive and does not identify sources of fine sediment delivery into the watercourse. Monitoring of direct and indirect sediment sources from roads, hillsides, and channel banks will direct adaptive management decisions by prioritizing enhancement resources, and it will help identify ineffective past management practices.

2.2.2 A Two Tiered Approach to Monitoring

The proposed monitoring plan provides information for priority monitoring in the near term, and a framework for long term monitoring goals. Monitoring activities listed in Tier One are actions that should be implemented in the near future to provide 1) baseline data on fish population status, 2) feedback to managers on erosion associated with roads, hillsides and stream banks in the mainstem and sub-watersheds, and 3) continued temperature monitoring. Tier One monitoring is used to evaluate the effectiveness of current best management practices, and are generally thought to be cost and resource effective approaches (Table 2-3). Though these approaches may be more basic, they are effective in providing relatively quick feedback to resource managers.

Tier Two provides long-term goals to apply as funding resources allow. These are more in depth watershed trend monitoring approaches over a broader temporal scale. While they are generally more costly to implement than Tier1 objectives, they will provide insight on the status of long-term restoration objectives for adaptive managers.

Table 2-3. Two Tiered Monitoring Approach Table.

	Sediment	Temperature	Fish	Aquatic Habitat
Tier One	1) Road Assessments and Erosion Control Plan development. 2) Forensic turbidity surveys throughout winter months.	Monitoring at lower Property boundary	Determine approximate salmonid spawning populations through spawning ground surveys.	Conduct stream habitat inventory surveys at 5 year intervals or as dictated by management activities
Tier Two	Continuous Automated Turbidity Monitoring at all major tributaries	Monitoring above and below tributary confluences to identify thermally limiting reaches	Determine approximate smolt populations through rigorous downstream trapping program.	Conduct periodic management adaptations to results of ongoing limiting factors analysis

2.2.2.1 Sediment Monitoring

Tier One

Although Big Salmon Creek is not listed as an impaired waterbody for sediment, sources of delivery from roads, hillsides, and stream banks should be addressed. Qualified personnel should make assessments of existing roads, and sites of road related erosion should be treated. Following a road assessment, an ECP should be implemented. After the ECP is initiated and erosion reduction activities have occurred, treated sites should be monitored to ensure management practices are functioning properly. Erosion from hillsides and stream banks should be identified and addressed to the extent feasible, particularly if erosion is associated with management activities.

Forensic monitoring of turbidity is another tool used to identify sediment inputs. Monitoring can be performed either through direct ocular observation or by taking “grab samples” from the stream channel. Once an area of high turbidity is identified, survey crews follow the turbidity trace upstream in order to identify the sediment source, and a treatment plan is subsequently drafted.

TCF’s “Salmon Creek Sediment Source Assessment Project,” proposed in 2007 and selected by CDFG’s Fisheries Restoration Grants Program for funding in 2008, will develop an erosion prevention action plan, including recommended treatment prescriptions and implementation cost estimates, in order to correct sediment related problems that currently have negative impacts on salmonids and water quality.

Specific project tasks include: 1) Assess upslope sediment sources along 70 miles of roads within the upper half of the Big Salmon Creek watershed. 2) Identify sites of sediment delivery, prioritize erosion risk, and develop detailed, site specific prescriptions and costs for upslope erosion control and erosion prevention treatments. 3) Provide workshops to general public, regulators and interested citizens. All inventory methods, calculations, prioritization and recommended treatments will follow guidelines and standards described in the "Handbook for Forest and Ranch Roads, a Guide for Constructing, Re-constructing and Maintaining Wildland Roads" commissioned by CDF&FP, the NRCS and the MCRCD (1994), and the “California Salmonid Stream Habitat Restoration Manual, Chapters 9 and 10” (Flosi et al 1998 and 2002).

Tier Two

Continuous automated turbidity and suspended sediment monitoring is another monitoring tool used to identify tends and point sources of sediment delivery. Installation of a monitoring station can easily cost in excess of $10,000 (not including staff resources). Ideally, monitoring sites are installed on all major tributary confluences and at the lower Property boundary. Although expensive, continuous automated sampling greatly reduces staff time and allows sampling to take place during peak flow events when safety is a concern.

2.2.2.2 Stream Temperature Monitoring

Tier One

As discussed and recommended in the limiting factors analysis (Section 2.1.1), stream temperature in Big Salmon Creek does not appear to presently limit salmonid production. A pair of thermal data-loggers installed at the pre-existing lower Property boundary monitoring station would adequately measure temperature trends in the watershed. This simple approach would incur an annual cost of $1,000.00.

Tier Two

Other adaptive management prescriptions may indicate over time that additional aquatic temperature monitoring is needed to identify problematic reaches or tributaries. If managers decide to adopt this future strategy, a suite of ten monitoring sites with redundant data-loggers would incur an annual cost of 2- $3,000.

2.2.2.3 Salmonid Population Monitoring

Tier One

Section 2.2.1 describes a peer-reviewed methodology to estimate spawning salmonid populations on a watershed scale using spawning ground surveys. To implement this methodology at the suggested thirty percent sampling rate, it would require a staff of two on a part-time basis from November until the end of April. If the monitoring scheme were integrated with a similar plan for the Big River stream reaches contained within the TCF ownership, staff would be employed full-time for the survey period. The staff resources necessary to complete the population monitoring proposal for both The Big Salmon and Big River watersheds would require approximately $40,000 – $50,000 annually based on a rate of $20 per hour for two staff for six months. The proposed expense budget does not include vehicle expenses. Volunteer labor may also be utilized as previously discussed.

Tier Two

Section 2.2.1 also illustrates a plan to monitor the annual smolt, or downstream migrant, population at a watershed scale. To implement the plan, a rotary screw trap is necessary. The use of PIT (passive integrated transponder) tags would increase the study resolution; however PIT tags are not required. A staff of one or two can safely operate the trap for the annual four month trapping period, which extends from early February to late May. Due to the seasonal overlap of the smolt trapping period and the spawning ground surveys, the same personnel can conduct both studies, maximizing funding for staff resources. Downstream monitoring expenses are shown in Table 2-3. The estimate for the initial start-up expense is approximately $30-40,000, with an annual operating budget in subsequent years of $15-16,000. This budget does not include vehicle operating expenses.

Table 2-4. Expenses Related To Annual Smolt Trapping Monitoring.

Expense Item	Amount	Note
Rotary screw trap	$17,000.00	One-time cost
PIT Tags	$6,000.00	Annual expense, but not required
PIT tag reader	$1,500.00	One-time cost
Staff	$6,400.00	1 staff, part -time @ $20.00hr for 4 months
Misc supplies	$3,000.00	Waders, etc

2.2.2.4 Stream Habitat Inventory Monitoring

Tier One

This plan suggests surveys of habitat inventory in five-year intervals or after ten year flood events in order to detect watershed trends over time. CDFG (Flosi and Renyolds 1998) protocol indicates a ten-year interval. The habitat in Big Salmon Creek was last surveyed in 2007 and consequently is a low priority monitoring action until 2012.

Tier Two

To assess reach scale aquatic restoration needs, the Plan calls for assessment surveys on Class I watercourses adjacent to and in conjunction with timber harvest plans. The utility of this monitoring strategy is that enhancement activities can then be conducted as a component of the THP. Enhancement actions often utilize heavy equipment and good road networks as found in timber harvest operations. From the standpoint of increasing the value of enhancement activities by minimizing their ecological impact (by opening new roads and tractor activity), and by increasing their economy, working within the THP process has many advantages.

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APPENDIX H

THE CONSERVATION FUND

North Coast Forest Conservation Program Policy Digest
Original version August 2010; this version September 2018

TABLE OF CONTENTS

North Coast Forest Conservation Program Policy Digest Overview
The Conservation Fund's North Coast Forest Conservation Program
Primary authors: Jenny Griffin, Evan Smith
August 2010, updated September 2012, 2014, 2017

Introduction

The following summary of The Conservation Fund's North Coast California forest management policies was prepared to facilitate review and provide links for more information in a single source document.

Program Background

The Conservation Fund's California forest properties were acquired as part of the Fund's North Coast Forest Conservation Initiative, which is dedicated to the permanent protection and restoration of coastal forests in the Redwood Region of northern California. The strategic foundation for the Initiative is described in "Conservation Prospects for the North Coast"[1] prepared in 2005 by The Conservation Fund for the California Coastal Conservancy. This study noted the extraordinary biological diversity and economic productivity of the coastal forests of the Redwood Region and recommended that conservationists "move quickly to establish 'working landscape' conservation management on large, strategically located forest …. properties in Humboldt, Mendocino and Del Norte counties."

The Conservation Fund acquired the 23,785-acre Garcia River Forest in February, 2004. In October 2006, The Conservation Fund acquired an additional 16,100 acres in two tracts – the 11,707-acre Big River Forest and the 4,204-acre Salmon Creek Forest. In December 2011, The Fund acquired the 13,537 acre Gualala River Forest. The Fund acquired the 177 acre Hardell property, adjacent to Salmon Creek, in September of 2012. The Hardell property will be managed as part of the Salmon Creek tract. In 2013, the Fund acquired the 18,120 acre Buckeye Forest in Sonoma County. The Conservation Fund and its partners developed an Integrated Resource Management Plan (IRMP) for each acquisition[2] to guide the management and restoration plan for these properties. Partners include the State Coastal Conservancy, Wildlife Conservation Board, State Water Board, North Coast Regional Water Quality Control Board, David and Lucile Packard Foundation, Nature Conservancy, and National Fish and Wildlife Foundation and Sonoma County Agricultural Preservation and Open Space District. These properties represent a collective capital investment of approximately $120 million.

By acquiring these properties, the Fund and its partners hope to demonstrate that these large tracts of intensively managed coastal forest can gradually be returned to sustainable timber production and ecological vitality through the use of innovative financing and patient management by a nonprofit organization in partnership with private and public agencies and community stakeholders.

Property-specific Background

The Conservation Fund owns five forests in California as part of its North Coast Forest Conservation Program: Salmon Creek, Big River, Garcia River Gualala River and Buckeye Forest. While there is one overall program, each property has some unique management requirements that are outlined in each individual IRMP.All reference documents are available at http://www.conservationfund.org/our-conservation-strategy/focus-areas/forestry/north-

[1] Available at: http://www.conservationfund.org/north_coast_forests
[2] ibid

coast-conservation-initiative/north-coast-forest-reference-documents/ and at the Fund's North Coast Office.

There are a number of planning differences between the various forests (these are described in more detail in the Forest Management Policies):

1. Because of the different funding sources and loan agreements, each program has its own accounting records and revenue-sharing requirements. Some expenses such as staff time are shared between the accounts but are tracked and reported separately.
2. The Garcia River Watershed has an approved Total Maximum Daily Load (TMDL) Action Plan developed by the EPA and adopted by the North Coast Regional Water Quality Control Board. In compliance with the action plan TCF has developed an ownership-wide program to meet the TMDL requirements through implementation of an approved Site-Specific Management Plan and Erosion Control Plan. Water quality protection is an objective across all of the properties, but because of the TMDL status, the reporting, monitoring and specific policies for the Garcia River Forest are slightly different. [A very small portion of the Gualala Forest is also within the Garcia watershed and subject to the TMDL requirements—these will be addressed in site-specific project prescriptions.]
3. While a key objective on all properties is to increase the volume and quality of the timber inventory, the Annual Allowable Cut levels are different between the forests, primarily because of the different initial inventory conditions and partially because of the loan repayment obligations for BR/SC.
4. The Nature Conservancy holds perpetual conservation easements on the Garcia River and Gualala River Forests which, among other things, protects the land from future development. There is an established Ecological Reserve Network that comprises 35% of the Garcia River Forest where management is limited to techniques that advance the desired ecological goals, namely late-seral forest development and protection.
5. BR/SC also have permanent conservation restrictions, but in a slightly different form. Use of the BR/SC property is limited to conservation purposes (including forest management) and the State Coastal Conservancy and the Wildlife Conservation Board are responsible for ensuring the conservation objectives are met.
6. Sonoma County Agricultural Preservation and Open Space District holds a conservation easement on the Buckeye Forest. The Buckeye has a unique profit-sharing agreement with the State Coastal Conservancy.

Program Goals

The North Coast Forest Conservation Program shall be guided by the following objectives:

- Acquire forestland with high conservation values that is under threat of loss or degradation because of human development and protect those properties for continued forest management and restoration.
- Manage the forests sustainably [and profitably], increasing the economic productivity and ecological health, while providing meaningful local employment and recreation opportunities.
- Respect the local community by operating honestly, transparently and efficiently; soliciting and responding to feedback; hiring local services and purchasing local goods; and holding ourselves to the highest standards for professional, safe and courteous conduct.

- Work collaboratively with local businesses, civic institutions, and other organizations and landowners to increase the understanding, appreciation, and value of the region's forest systems.

Unified Management

All properties that are acquired as part of the North Coast Forest Conservation Program are to be managed consistent with the TCF Forest Management Policies, the property-specific management plan, and the North Coast Forest Conservation Program Goals. In addition, TCF is committed to the Principles and Criteria of the Forest Stewardship Council® (FSC®-C001535) and Sustainable Forestry Initiative® (SFI®) and to maintaining our annual independent certification under those systems. The Management Policies and Program Goals and their implementation will be reviewed every year as part of the Annual Program Review and updated as necessary; the management plans will be reviewed and updated on a ten-year cycle. This document and all management plans and policies are intended to be publicly available.

Policies

Existing stand alone policy documents (attached):
TCF Forest Management Policies
Road Management Policies
Commitment to Safety and Health
HCVF RSA Program Memo
Social Benefit/Impact Assessment
Certified Product Chain-of-Custody Program
Herbicide Application and Hardwood Management Policy

Policies on the following topics are detailed within the respective IRMPs:
Ecological Reserve Network (GRF IRMP, pgs. 17, 25-27)
Aquatic habitat restoration (GRF pgs. 44; BR/SC pgs. 63-64, 108-192; GuRF pgs. 61-63; BF pgs. 71-74)
Invasive species management (GRF pgs. 64; BR/SC pg. 67; GuRF pgs. 64; BF pgs 75-76.; see also July 15, 2010 Draft "Invasive Plant Management Plan for the Salmon Creek Forest")
Water Quality (GRF pgs. 16-21; 254-257; 259-274; BR/SC pgs. 29-37; 58-64; 108-192; GuRF pgs. 26-41; BF pgs. 26-51)
Community Use and Involvement (GRF pgs. 67-68; BR/SC pgs. 80-84; GuRF pgs. 3,67-68; BF pgs.78-79)
Monitoring (GRF pgs. 50, 55, 61, 64, 68; BR/SC pgs. 77-79; 258-265, 274; GuRF pgs. 50, 55, 61, 64, 68; BF pgs. 60, 65, 71, 76, 79)

FSC/SFI Standards:
TCF is committed to forest management certification under Forest Stewardship Council (FSC-US Forest Management Standard version 1.0) and Sustainable Forestry Initiative (2015-2019 Standard). Available at https://ic.fsc.org/united-states.298.htm and http://www.sfiprogram.org/sfi-standard/forest-management-standard/

FOREST MANAGEMENT POLICIES
For The Conservation Fund's North Coast Forest Conservation Program
Principal authors: Evan Smith, Scott Kelly, Jenny Griffin
August 2010; expanded annually

Contents

I. Program Overview

These forest management policies have been developed to guide management of The Conservation Fund's California forest properties. These properties were acquired as part of the Fund's North Coast Forest Conservation Initiative, which is dedicated to the permanent protection and restoration of coastal forests in the Redwood Region.

The strategic foundation for the Initiative is described in "Conservation Prospects for the North Coast" prepared in 2005 by The Conservation Fund for the California Coastal Conservancy. This study noted the extraordinary biological diversity and economic productivity of the coastal forests of the Redwood Region and recommended that conservationists "move quickly to establish 'working landscape' conservation management on large, strategically located forest…properties in Humboldt, Mendocino and Del Norte counties."[1]

This recommendation is based on two key findings:

1. Population growth, increasing land values, depletion of timber inventories and global competition in the commodities markets are putting increasing pressure on traditional resource-based land uses, making land use conversion increasingly likely as landowners look for more profitable uses of their land.[2]
2. The traditional approach of public acquisition and preservation of forest and range lands is not sufficient to meet this challenge: there is not nearly enough public money to purchase or manage such large properties and local communities are concerned about the fiscal and economic impacts of taking working lands out of production.

1 The Conservation Fund, 2005, *Conservation Prospects for the North Coast, A Review and Analysis of Existing Conservation Plans, Land Use Trends and Strategies for Conservation on the North Coast of California* at page 134.

2 Id. at page 131.

In furtherance of this strategy, The Conservation Fund acquired the 24,000-acre Garcia River Forest in February, 2004, thereby establishing the first non-profit owned "working forest" in California. An Integrated Resource Management Plan (IRMP) for the property was collaboratively developed over a two-year planning period to meet the following general objectives:

- Restore and protect a productive and relatively natural coastal California forest ecosystem.
- Protect fish and wildlife habitat associated with this ecosystem, in particular the oak woodlands, serpentine grasslands, redwood/-Douglas-fir forests, and spawning habitat for coho salmon and steelhead trout.
- Protect significant water resources, springs and the water quality thereof.
- Maintain the capacity of the Property for productive forest management, including the long-term sustainable harvest of high quality forest products, contributing to the economic vitality of the state and region.
- Provide outdoor recreational opportunities, as appropriate.

In October 2006, The Conservation Fund acquired an additional 16,100 acres in two tracts – the 11,700-acre Big River Forest and the 4,400-acre Salmon Creek Forest. A similar management and restoration plan for these new properties was completed in August 2009 (Big River and Salmon Creek Integrated Resource Management Plan). This plan identifies and describes in detail the following specific management goals:

- Improve ecological conditions by protecting and enhancing water quality.
- Improve ecological conditions by protecting and enhancing terrestrial and aquatic habitat on the Forests.
- Generate sufficient revenue to cover SRF loan and the Packard loan payments (the latter from non-timber revenue, such as the sale of carbon offsets, and only after the accrued SRF obligations are fulfilled), property taxes, on-site maintenance, management, and restoration projects.
- Develop and implement conservation-based forest management greenhouse gas reduction projects under the California Climate Action Registry's Forest Project Protocol version 2.1.
- Practice continual improvement through adaptive management based on monitoring of water quality and forest health against specific objectives described in the Plan.
- Support the local business community by utilizing local contractors and suppliers.
- Involve the local community by seeking input on management of the Forests, including review of this Plan and timber harvest plans implemented under the Plan, and providing compatible public access, educational, and recreational opportunities.

In 2011, The Conservation Fund acquired the 13,900 acre Gualala River Forest and in 2013 the Fund acquired the 18,120 acre Buckeye Forest in Sonoma County. Integrated Resource Management Plans have been completed for these properties. All activities on the property shall be in conformance with these Forest Management Policies and all other organizational policies and commitments.

These combined acquisitions (74,000 acres) represent a collective capital investment of approximately $120 million. By acquiring them, the Fund and its partners hope to demonstrate that these large tracts of intensively managed coastal forest can gradually be returned to sustainable timber production and ecological vitality through the use of innovative financing and patient management by a nonprofit organization in partnership with private and public agencies and community stakeholders.

Guiding these properties from their current forest conditions (which reflect a legacy of clear cutting or excessive harvesting resulting in young and in some cases understocked timber stands) to the desired future condition of economic stability and ecological integrity will take decades. Along the way we will need to overcome many challenges, including relatively low current timber volumes, the unnatural predominance of hardwoods in places, the burden of maintaining and improving extensive road systems, and the uncertain economic, regulatory and political environment affecting the timber economy as a whole.

At the same time, there is broad awareness that North Coast forests are at an historic crossroad, with one road leading to fragmentation and loss of forest productivity and ecological integrity, the other leading to intact watersheds, recovering fish and wildlife, and a sustainable timber economy for the region. With the cooperation and goodwill of the community and public and private stakeholders, we are optimistic that we are setting off down the latter, more hopeful road.

II. Policy Introduction

These guidelines and policies apply to management and operations on the Garcia River, Gualala River, Buckeye, Big River, and Salmon Creek properties. This document is a "work-in-progress" and will be revised and refined based on the experience and perspective of our project foresters, program partners, and agency staff as we all develop increasing familiarity with the properties and the forests' response to the silvicultural and other management measures described here, and in the IRMPs for each Forest (all plans are available at http://www.conservationfund.org/our-conservation-strategy/focus-areas/forestry/north-coast-conservation-initiative/north-coast-forest-reference-documents/).

III. Forest Management General Strategy

[Taken, without editing, from the Garcia River Forest IRMP and also detailed in each additional IRMP]

- Our silviculture will be primarily uneven-aged, to develop and maintain a range of tree sizes and ages within a stand, with the goal of producing valuable sawtimber and utilizing natural regeneration.
- We have a responsibility to manage the properties to generate reasonable revenue for loan payments, re-investment in the property (e.g. restoration projects, road upgrades) and, potentially, for conservation projects elsewhere in the region.
- Our harvest levels will be significantly less than growth rates over the next few decades so as to increase the timber inventory.
- We are providing for increased riparian buffers on our Class I streams so as to improve riparian habitat conditions and provide late-seral connectivity across the landscape.
- Special attention will be given to critical wildlife habitat features, such as snags, down wood, and trees of significant size.
- We recognize that because of past practices the forest contains smaller trees and more hardwoods than would have occurred naturally and we will work to more closely approximate natural conditions.
- There are no old growth stands on the properties; there are individual trees that may be residual old growth—these and other very large trees and true oaks will be maintained.
- We anticipate no need to clearcut; we may use even-aged variable retention harvests (that retain large trees and habitat features) to rehabilitate conifer sites now dominated by hardwood or in future salvage situations; group selection will likely be used on Douglas-fir sites; and all regeneration harvests will encourage natural regeneration.

- We have committed to certification of our forest management under the Forest Stewardship Council and Sustainable Forestry Initiative standards and to reporting our carbon sequestration through the California Climate Action Registry.

IV. Critical Landscape Features

Most of these policies are intended to guide the management of those areas of the property which will support commercial timber harvesting operations. However, one of the most important steps in determining how to manage a forest is recognizing which areas have unique ecological values that outweigh their potential contribution from a commercial harvest perspective. For example, oak woodlands are fairly geographically limited and support a very different set of birds and small mammals than dense coniferous forest. Likewise, springs, seeps, and small wetlands occupy only a very small portion of the property but probably support more amphibians than the rest of the forest. The protection of these features is critical to achieving the program objectives of restoring habitat for species of concern and increasing the ecological health of these forests. Specific policies to address these areas include the following:

- All pygmy forest and true oak (Quercus spp.) woodlands and native grasslands are to be preserved.
- Springs, seeps, and small wetlands shall receive protection measures at least equivalent to Class 3 WLPZ. [There are no large wetlands on the properties.]
- Riparian forests, particularly along Class 1 streams, will be managed to provide for closed canopy mature forest with a high component of down logs and other late-seral features. [Some removal of timber can be consistent with this objective - see WLPZ Protection Measures for more detail in Section XIV, below.]
- Other features that are fairly rare on the landscape and may have unique habitat value include cliff faces, alder thickets, and recently-burned areas. These will be mapped and receive site-specific protection measures when they are within or adjoining a potential timber harvest area.

V. Harvest Levels

Careful determination of appropriate harvest levels is critical to ensuring sustainability and achieving the conservation and economic objectives for the properties we manage. As described below, each project has slightly different harvest levels because of the differing starting inventories and financial responsibilities.

In the **GRF** IRMP, we committed to harvesting not more than 35% of growth on the working forest (non-reserve) portion of the Garcia River Forest (GRF) for each of the first two decades (measured on a rolling ten-year basis). The net harvest levels shown here are based on the forest growth and yield stream developed in 2013 for TCF's Long Term Sustained Yield Plan as required by the California Forest Practice Rules. The Conservation Fund used the FORSEE growth and yield model to simulate harvests. The model was programmed to incorporate the various management constraints of the forest. The model shows an annual allowable harvest of 2.26 mmbf (million board feet) for the first 5 year planning period (2014-2018). Over the next decade this should result in an increase in standing timber volume on the non-reserve portion of the property from 11.4 mbf (thousand board feet) per acre to 15.0 mbf per acre (reaching 20 mbf per acre around 2038).

In the **BR/SC** IRMP we committed to an annual net harvest level for each of the first two decades of 4.65 million board feet (the MOU restriction is for not greater than 5.1 million board feet and the appraisal estimated that the FPR would allow harvest of 8.5 million board feet). The allowable harvest levels shown here are based on the forest growth and yield stream developed in 2013 for

TCF's Long Term Sustained Yield Plan as required by the California Forest Practice Rules. The Conservation Fund used the FORSEE growth and yield model to simulate harvests. The model was programmed to incorporate the various management constraints of the forest. The model shows an annual allowable harvest of 7.3 and 7.7 mmbf for BR and SC respectively for the first 5 year planning period (2014-2018). Where the growth and yield model exceeds the restrictions of the MOU the MOU will be adhered to. Over the next decade this should result in an increase in standing timber volume on the non-reserve portion of the property from 22.8 mbf (thousand board feet) per acre to 28.9 mbf per acre for Big River and should result in an increase in standing timber volume on the non-reserve portion of the property from 26.4 mbf (thousand board feet) per acre to 31.5 mbf per acre for Salmon Creek.

For the Gualala Forest The Conservation Fund used the FORSEE growth and yield model to simulate growth and harvest, the model was programmed to incorporate the various management constraints of the forest. The harvest levels shown here are based on the forest growth and yield stream developed in 2013 for TCF's Long Term Sustained Yield Plan as required by the California Forest Practice Rules. The model shows an annual allowable harvest of 1.7 mmbf (million board feet) for the first 5 year planning period (2014-2018). Over the next decade this should result in an increase in standing timber volume on the non-reserve portion of the property from 9.4 mbf (thousand board feet) per acre to 11.6 mbf per acre (reaching 20 mbf per acre around 2039).

For the Buckeye Forest, growth forecasting and harvest scheduling is underway as part of our overall management of the property. In the interim, annual harvest is not to exceed 1.5mmbf for the first 5 year planning period, which is based on being comparable in size and composition to the Garcia River Forest (non-reserve). This should be no more than 35% of expected growth and allow the forest to significantly increase in stocking.

VI. Silvicultural Objectives

Our goal is to grow large high-quality trees and be able to perpetuate that through selective harvests. We want to maximize value growth and develop and maintain important late-seral habitat characteristics for wildlife and non-timber forest vegetation. Our "crop tree" target diameters are 30-36" for redwood and 26-28" for Douglas-fir (most high-quality trees below this diameter range will be retained while most non-wildlife trees above this diameter range will be removed). Generally, we are not trying to mimic old-growth or late-seral stand conditions, we are trying to ensure that late-seral ecological functions and processes are present within a managed forest. For example we will be seeking to develop stands that have high canopy closure, some large mature trees, and a high degree of structural diversity. In time we may elect to allow certain stands to return to old growth, once they are on an appropriate trajectory.

The success of our initiative and these acquisitions depends on our ability to generate revenue to support ongoing management and restoration projects and repay loans for the acquisition of the properties in a manner that over time achieves our stated silvicultural and ecological objectives. In consultation with project foresters and biologists, we will continually strive to balance our harvest levels and methods to carefully meet our financial and management obligations while improving ecological health and vitality. We will not fixate on the silvicultural semantics of "uneven-aged," "all-aged" or "multi-aged" or the coefficient of the "reverse J-shaped curve," but on the question of whether we are growing high-quality trees and maintaining desired habitat conditions. In addition we have the broader objectives of engaging the local community and businesses in what we do, which relates back to how we conduct harvesting operations.

This silvicultural strategy is also aligned with what we understand about historical disturbance patterns and evolutionary forces in the redwood region. To generalize from many years of complementary academic research, including the Proceedings from the past two Redwood Forest Science Symposiums, it is safe to say the pre-European settlement conditions were very different than the processes of today. Most forests were quite old, in the 500-2000 years in the canopy, with a modest amount of tanoak (10-15% of basal area), with occasional small (under 1000 acre) patches of younger and brushier forest, and relatively limited bareground or early seral stage conditions (caused by flooding, landslides or extreme fires). Fires were frequent (10-20 year recurrence) and low intensity, likely driven by Native American burning as much as lightning strikes. Individual tree mortality was limited, mostly due to self-thinning (competition-induced) and occasional windstorm damage. In general, the redwood forest was fairly stable at large temporal and spatial scales. Our silvicultural practices follow these patterns, emphasizing low-intensity but extensive single-tree selection harvests, similar to what would occur under self-thinning stages of stand development. Our group selection harvests are probably similar in size (1-2 acres) to openings created by landslides, flood scouring or higher intensity fires. Variable retention harvests, especially because we utilize this approach on dryer sites, are probably similar to conditions after a more intense fire. In short, our silviculture should restore and maintain more natural forest conditions and simulate natural disturbance patterns, with the exception that development of true late seral stage characteristics will only occur in the Ecological Reserve, riparian buffers and NSO habitat core areas-- and not across the managed forest.

VII. Silvicultural Decisions

To the extent that it is possible to generalize types of stands and approaches, we have attempted to describe likely decision pathways below. Forests are highly variable so it is impossible and unwise to prescribe "one-size fits all." Further, each of the forests reflects a management legacy that limits our silvicultural options. For example, prior management of the Garcia River Forest, Gualala Forest and Buckeye Forest has left very young stands with limited commercial volumes. For the most part, these stands are growing well—they just have limited silvicultural options in the short-term. On Big River and Salmon Creek, a history of clear-cuts forces difficult choices between the remaining well-stocked stands and stand classes that are several years away from supporting our preferred silvicultural methods. Additionally many of the partial harvests of the past did not always leave the high-quality trees we desire. Finally, we are learning more every day about how to manage forests for both economic and environmental objectives and our approaches will change with future scientific research and operational realizations.

Our preferred silviculture is high retention (150 sf/acre basal area) single tree selection with re-entries every 10-20 years to remove most trees that exceed the target crop-tree size and thin the smaller size classes. Stands that have reached this condition (referred to as stand condition A) will be maintained indefinitely through thinning, individual tree selection, and small group selection harvests. Most stands are not anywhere near the desired stand condition A. Some stands may consist of smaller diameter classes or be less dense but generally have good form and growth (referred to as stand condition B). These stands might be dense even-aged stands of 40-60 years or they may be more open stands of indeterminate age that have had past selection harvests; regardless, the key silvicultural criteria is that they have good material to work with. (The Garcia LNF THP, the BR Riverbends THP, and the selection units of LSC THP are good examples of B conditions.) B stands are in an excellent position because they can support commercially-viable selection harvests and with a few decades of growth and just one or two intermediate harvests that maintain high-quality trees and increasing stocking, they will reach A condition. The silviculture to go from B to A is similar to the selection silviculture to maintain A (although in B we are not particularly concerned with creating a new age class). These are “easy” decisions, because the stands have good stocking and growth and the pathway to the desired conditions is evident and readily achievable.

However because of past harvesting practices, very few stands are currently in A or B condition (because of lower stocking, smaller diameters and/or poorer-quality trees). Most stands will take several decades to reach this steady-state condition with multiple intermediate harvest entries to guide this development. Until we reach the ideal steady-state condition, the silviculture focus will be on creating and/or building stands of higher quality and better growth potential. Many stands (especially on Big River) are young and even-aged, from clearcuts or aggressive selection harvests in the last thirty years (referred to as stand condition C). C stands are, for the most part, growing quickly and with good-quality stems—but they are small in diameter (average 12” or less) and lack structure from a habitat perspective. C stands will receive thinnings to accelerate stand development and concentrate growth on high-quality stems. These selective harvests will occur every 10-20 years with the long-term objective of moving the C stands into B and then A condition. These thinnings will yield low harvest volumes and small average piece sizes so they will need to be carefully-designed to be economically-viable. These low-value harvests will be a good source of employment in the local community and will also allow us to shape the stand at an early age to better achieve our long-term growth and habitat objectives. (The better-stocked parts of the Jack’s Opening THP fit this generalization.) In some cases pre-commercial thinning will be considered.

A different category of stands (condition D) has resulted from the merchantable trees having been excessively “picked over;” most of the dominant trees were removed leaving uneven regeneration, a low-quality overstory and often a high degree of tanoak competition. The overstory may be of average to large diameter but the entire stand is usually less than 100 square feet of basal area per acre and not comprised of the high-quality stems we desire (and therefore not growing in value). In most of these cases the younger “regeneration” age classes exhibit good growth, height, form and stocking. Harvests in D stands need to balance the removal of the poor-quality overstory (to accelerate the development of the higher-quality regeneration and pole-sized trees) with the need to maintain habitat structure and late-seral elements. (The “seed tree removal” units in the LSC THP and the variable retention units in the Jarvis Camp THP fall into this category.) This is not “easy” silviculture as it will feel like an aggressive harvest. The residual stand will be open-looking and often we will need to reduce hardwood competition and/or plant additional conifers. A good indication for this type of harvest is that given twenty years without harvest the stand would not be appreciably improved (hence the need for an intervention). In the short-term it is easy to think, “maybe it would be better to not harvest here,” but it should be obvious that in the long-term the stand and the program will benefit from this harvest. These D harvests result in a good-quality young stand that is growing well and has some late-seral elements. Given two to three decades to develop without commercial harvest they will become C and B stands.

Of course not all stands fit these generalizations. In some stands, especially on the east side of the Garcia, it is more appropriate to manage primarily for Douglas-fir than redwood and since Douglas-fir lacks redwood’s remarkable abilities to release and sprout, these will likely have long-term management through group selection, although the first couple of entries will look more like B thinnings. And some stands, again on the east side of Garcia, are completely dominated by tanoak. While it might be better ecologically and financially to be growing more conifers on these sites the short-term cost of such a rehabilitation will likely preclude much action.

VIII. THP Operational Realities

The complexity of forest regulations and the high cost of harvesting operations impose additional constraints on our operations, beyond simply what silviculture we want to apply. For example, almost all of our harvests are some type of thinning (a selective harvest not designed to introduce another age class) but under the Forest Practice Rules (FPR) they may need to be called Selection, Group Selection, Commercial Thinning, Transition, Variable Retention, Rehabilitation, or Alternative Prescription because of the differing requirements for initial and post-harvest stocking and tree diameter requirements defined in the FPR for each specific silvicultural treatment listed above. And in the Timber Harvest Plan (THP) document we will commit to meeting only the FPR stocking requirements (rather than a voluntary higher standard) to avoid risk of violation in areas where initial stocking is low prior to harvest. Regardless of what the prescription is called, we will only implement the silviculture that enables us to meet our long-term project goals and follows the retention requirements and tree marking guidelines below.

Another operational reality relates to the distribution of THPs across the landscape. Our THPs will need to be fairly large (200-500 acres) and geographically-concentrated because of the high costs of THP development and maintenance. The goal is to increase operational efficiency by concentrating planning and road costs. We will try to treat all the eligible stands within a selected area (rather than cherry-picking across the property). Thus THPs will often include several types of FPR silviculture but almost all of them will meet stocking requirements immediately following the harvest. In the future we will not use amendments to increase THP area (unless there is a significant market or regulatory shift) but in 2007 as part of adapting the approved LSC THP to our preferred approach we used an amendment as an expedient means. Another important economic constraint is that currently we have limited ability to cable-thin young Douglas-fir stands because of high logging costs and low Douglas-fir prices.

IX. THP Development and Review Process

Our goal is to develop clear and consistent THPs that incorporate the concerns of the public and conservation partners before they are submitted to the state agencies. THPs are, by requirement, cumbersome documents and long-term legal obligations; we do not expect to revolutionize THP writing. We have adopted the following procedures for the development and review of THPs:

1. General harvest locations will be informed by harvest scheduling plans and reviewed by Scott Kelly (TCF's Forest Manager).
2. Field foresters will review past materials and field conditions, decide on likely unit layout, silvicultural prescriptions, access needs, road improvements, etc., and consult with project consultants and partners on habitat and restoration implications and opportunities.
3. Evan and Scott will field review harvest unit selections and general operation strategies.
4. Field foresters will coordinate necessary surveys and access (geologist, botanist, NSO).
5. Field foresters will begin unit layout and stand marking.
6. "Field Consultation"-- staff, contract foresters and advisors will discuss, in the field, the proposed operation.
7. Garcia only—notice to TNC will be provided and field review scheduled if desired.
8. Stakeholder tour. Tours will be offered just prior to CAL FIRE submittal (when all the potential THP issues are well-identified and resolved). Holly Newberger, Program Coordinator, will coordinate.
9. Field foresters will complete drafting of the THP.
10. THPs will be submitted to Scott for review.
11. Field foresters will prepare final version and submit to CAL FIRE, with copy for TCF office.

Field Consultations are a very important step in our review process because they leverages the combined experience of our foresters and biologists to ensure that only sound and well-planned

THPs that reflect TCF goals and objectives go forward and because it offers an opportunity for everyone to learn from each other, thus helping our program grow efficiently.

X. Retention Requirements

[Quoted from the Big River and Salmon Creek IRMP - with edits italicized and in brackets - and equally applicable to all properties]

Within a harvest area, the Fund will permanently retain or recruit downed wood, snags, and trees with high wildlife value given their recognized ecological role and ability to enrich the surrounding stand. The following policies for downed wood, snags, and wildlife trees are meant to implement this strategy by providing clear rules and numerical targets for certain types of features. [The FPR do not categorically address general wildlife habitat retention trees (although there are some requirements for protection of active raptor nests), but additional guidance is available from DFG.] Retention trees will be painted ("W") or tagged by the field foresters as they are marking the timber harvest to communicate the value of these features not just to the loggers but also the public and future foresters. Because a harvest can include over a thousand retention trees, they are not mapped or recorded unless they are suspected NSO nest trees. And while maintaining trees with high wildlife value is important, it is also critical to recognize the wildlife value of the surrounding stand and the conserved landscape, and not expect the harvest stand to mimic or contain all features which may be better represented in other areas of the property.

Downed Wood

Target: two pieces per acre (at least one conifer, 18 inch minimum diameter and ten feet minimum length).

Actions:

- Retain existing downed wood except in situations of recent windfall or fire outside of WLPZ. (In most stands this should be sufficient to meet the target.)
- Retain snags and mark trees for recruitment snags to eventually become downed wood.
- Redistribute cull logs from the landing (unless used for firewood or instream restoration).

Snags and Wildlife Trees

Target: four per acre on average across stand. [*While every effort shall be made by the Licensed Timber Operator (LTO) to retain all snags, it is understood that some snags may be cut for safety considerations by the LTO with the project foresters approval (e.g. snags near active landings which may fall into the landing if bumped by logging equipment or snags used to anchor yarder guy lines or tail holds).*]

Criteria for mandatory retention:

- Snags (all should be retained but only those greater than 18-inch DBH and 20 foot height shall count towards the retention targets);
- Conifers greater than 48-inch DBH;
- Old-growth trees (use MRC definition if in question – see Appendix K [*of Big River/Salmon Creek IRMP*]);
- Raptor nest trees (active or likely to be re-used);
- Any hardwood [*tanoak, true oak, madrone, chinquapin, and alder*] over 20 inches;
- Murrelet habitat trees (use MRC definition if in question – see Appendix K [*of Big River/Salmon Creek IRMP*]);
- Den trees (cavity greater than three inch diameter and greater than ten feet above ground);

- Trees with basal hollows or other significant features (cavities, acorn granaries, significant burn scars, significant or unusual lichen accumulation, signs of deformity, decadence, unusual bark patterns, or other unique structure or features).

Actions:

- Retain all mandatory [*retention*] trees and snags except where necessary to fall for operator safety, and protect with screen trees if appropriate.
- If below the target number, mark and retain additional recruitment trees. [*Additional wildlife trees will likely be marked in the future from the surrounding stand as it develops.*]
- [*At the discretion of the project forester live trees may be designated for girdling to accelerate snag recruitment within a THP area.*]

XI. Retention General Guidelines

- Marked wildlife trees…are not intended for future harvest and are allowed to grow beyond the crop tree target size.
- In the absence of mandatory retention trees, on average at least one conifer per acre should be retained from the largest ten percent of the diameter distribution of the stand.
- Marking of the wildlife trees (with paint or tags) is intended to communicate the recognition of the importance of that stem to future foresters, agency reviewers, and the public.
- For the next 20 years some preference for snag and downed log creation and wildlife tree recruitment will be given to cull trees and whitewoods (because of their low financial value) even though they may have a shorter lifespan.
- All retention is subject to operational considerations; the felling of any tree is permitted when necessary for operator safety, road right of way, or yarding corridors. Field foresters will attempt to avoid locating yarder corridors where they would conflict with mandatory retention wildlife trees.
- Targets shall be assessed across the entire harvest stand, not on an individual acre basis.
- Preference is for spatial grouping (clumps of downed wood, snags, and/or wildlife trees).
- The above criteria shall apply to selection harvests. When marking variable retention harvests extra screen trees may be appropriate.

All of the foregoing requirements and guidelines are subject to further review and amendment as the science and practice of forest management evolves and new research is developed and applied. Because of past practices, some portions of the Forests do not have sufficient wildlife features and the initial targets set forth above are intended to guide the long-term retention and recruitment of these features.

Two or three of anything per acre is an admittedly arbitrary number chosen to put our forestlands on the right trajectory for the development and maintenance of late-seral habitat characteristics within a managed forest; achieving some of these targets will likely take more than one entry. These distribution and size targets are not expected to be the ultimate value but merely what is appropriate to select and recruit in the next twenty years; the development of late-seral habitat elements is a long-term process and will be shaped over several harvest entries. In addition, it is unclear how the establishment of Sudden Oak Death (documented on GRF) will affect the Forests.

XI.I. Habitat Retention

When encountered, rare plants, animals and their associated habitat will be protected per the guidelines established by CalFire, USFWS or CDF&G. Established general habitat retention guidelines for the Northern Spotted Owl, Marbled Murrelet and California Red Legged Frog are followed. In the absence of pre-established guidelines, protection measures developed in consultation with CalFire, CDF&G and/or USFWS will be implemented. Habitat protection measures for coho salmon and steelhead trout are embedded in the forest practice rules and included in the "Specific Watercourse and Lake Protection Zones (WLPZ)" described below. Other rare species are generally protected on a case by case basis during the timber harvest planning and review process.

XII. Hardwoods

Hardwood species, including tanoak, true oaks, madrone, chinquapin, and alder, are an important ecological component of North Coast forests. Past management practices have resulted in an unnaturally high abundance of tanoak in many areas that historically were dominated by conifers. Mixed hardwoods account for 13.8 percent of the basal area on the Salmon Creek Forest, 16.8 percent on the Big River Forest, 34.1 percent on the Garcia River Forest, 39.6 percent on the Gualala River Forest and 34.7 percent on the Buckeye Forest; in some stand types in Salmon Creek and Big River it is as high as 46 percent, and on the Garcia up to 83 percent. For comparison, old growth conifer stands in the area often have ten percent or less of the basal area in hardwood species. On Salmon Creek and Big River, stands with greater than 25 percent of the basal area in hardwood species account for 23 percent of the forested acres. On the Garcia, stands with greater than 25 percent of the basal area in hardwood species account for 91 percent of the forested acres, and stand with greater than 50 percent of the basal area in hardwood species account for 45 percent of the forested acres.

In addition to the ecological imbalance, the high concentration of tanoak significantly reduces conifer growth and stocking and therefore the future financial value of the properties, since tanoaks have effectively no commercial value (it costs more to log and deliver than they are worth as firewood). The long-term goal is to maintain an appropriate level of tanoak and other hardwoods (probably around ten percent on average). It is important to not try to eliminate tanoak—merely to increase conifer site occupancy over time. To achieve these objectives, the following management measures will be implemented:

- All true oak (*Quercus* spp.) woodlands are to be preserved [*these occur primarily on GRFand Gualala*].
- All hardwood wildlife trees are to be retained (which includes all hardwoods 20 inches or greater), except where removal is required for safety concerns or necessary for yarding or road corridors.
- Where the post-harvest hardwood basal area would exceed 30 square feet of basal area per acre (averaged across the stand), tanoak shall be controlled through manual falling or girdling or herbicide treatment through direct basal injection ("hack-and-squirt") or stump treatment to provide a post-harvest hardwood basal area of 15 to 30 square feet per acre. This may take more than one entry to achieve.
- Most tanoak reduction will be achieved within a selection or thinning harvest by selective falling (of tanoaks) to release existing conifers. While the tanoak stumps will likely re-sprout, the conifers should have established dominance and will eventually shade-out most of the sprouts. In this type of incremental treatment (selective falling), clumps of hardwoods and individual hardwoods which do not compete with desirable conifers will be left alone. [*This treatment occurred to varying degrees in almost all of THPs prepared to date, the best example of which might be the Jack's Opening THP on GRF.]*
- There are many stands where selective tanoak felling would not be sufficient to meet the desired level of conifer site occupancy. In these situations, a more aggressive treatment will be utilized through an herbicide treatment that kills a majority of the tanoak to release either

existing conifers or seedlings planted shortly before or after the tanoak treatment. Even within these prescriptions, smaller areas of intact hardwoods would be intentionally retained (for biodiversity reasons). Preference for hardwood retention will be given to large trees (greater than 20 inches), true oaks, chinquapins and madrones, and groups of hardwoods. Rehabilitation treatments (including the use of herbicides) are intended to be one-time interventions and should not need to be repeated because of the decreased openings and ground disturbance associated with subsequent harvests. [*An example of this treatment occurred within the Variable Retention units of the Jarvis Camp THP on Big River.*]

- The only herbicide to be used in tanoak control treatments currently is imazapyr (tradename Arsenal). Only licensed and insured contractors with a good track record for safety and compliance may apply herbicides. All herbicide application must be in conformance with label guidelines and applicable laws. Additional herbicides may be considered in the future as they are developed and tested and reviewed with respect to Forest Stewardship Council and Sustainable Forestry Initiative standards.
- Any planned use of herbicide will be clearly identified in the THP and THP summary.
- Reduction in the use of herbicides is an important objective; alternatives to herbicide treatment have been and will continue to be evaluated on a periodic basis. A comparison of herbicide treatment and logging of tanoaks for commercial firewood was evaluated as part of the Jarvis Camp THP. Monumented plots will allow for long-term evaluation of effectiveness but the initial impressions are that the logging method resulted in increased cost and site disturbance (exposed soil and damage to the residual stand). That said, a commercial market for tanoak would be pursued if it develops. Areas with well-established and good quality hardwoods will likely be managed for mature hardwoods instead of attempting to re-establish conifer.
- There will be no tanoak control with herbicides in WLPZs; manual falling or girdling of small tanoak may be used, but only as part of a riparian shade enhancement project (likely with conifer underplanting).
- Priority for rehabilitation treatments will be given to high site, tractor-operable ground, with existing desirable redwood growing stock. Herbicide treatments will be less than 100 acres annually (on a rolling average basis) on Big River. No acreage limitations for herbicide have been adopted for Garcia, Gualala and Buckeye.
- Tanoak control measures will be reviewed periodically and revised as appropriate based on knowledge and experience gained in the field over the next several years. Herbicides will likely also be used to control certain exotic invasive plants, primarily jubata grass and broom. No other uses of herbicides or pesticides are anticipated.
- See also in this Policy Digest "HERBICIDE APPLICATION AND HARDWOOD MANAGEMENT POLICY"

XIII. Pre Commercial Thinning

Pre commercial thinning involves the selective cutting of small trees and brush that are not subsequently processed into forest products. PCT is generally done in stands of young, 10-15 year old plantations with the purpose of accelerating stand development and promoting conifer dominance. Vigorous growth of small trees and brush in the early stages of stand development following clear cutting often leads to intense competition for a site's resources including water, soil nutrients and sunlight. By selectively cutting brush and small trees we can focus more of a site's resources on fewer tree stems. This increases individual tree growth and promotes sustained vigorous growth across the stand and into the future. Trees selected for retention are generally in the upper 25% of stem diameters within the stand and have full crowns and straight stems without crooks, forks, dead, or broken tops. The ideal spacing between conifer stems is generally 15 feet, though additional trees may be left around the edges of small openings as they are encountered. When thinning redwood stump sprouts, 2-3 sprouts are left around each stump, trees sprouting from the root collar are favored over trees spouting from the top of the stump. Tanoak and other miscellaneous brush species are cut wherever they are competing with conifer regeneration. Thinning is also used for "species control" in which desirable commercial species are favored to remain on site. Wherever possible redwood is favored as a leave tree, Douglas-fir and Grand-fir are retained where no redwood trees exists or where hotter, dryer site conditions dictate that Douglas-fir be left in favor of redwood. To retain structural and compositional diversity, clumps of brush and hardwood species that are not competing with conifers are left uncut.

Pre commercial thinning is implemented in young stands with chainsaws and no heavy equipment is used therefore, impacts to non timber resources including wildlife habitat, rare plants and water quality are assumed to be negligible. Conifer and Hardwood trees identified for retention with an orange stripe by the previous owner(s) are retained for wildlife habitat. TCF does not remove or burn slash generated from PCT, slash is lopped such that it is contact with the ground to promote decomposition and return nutrients to the soil. Habitat values for some species of birds and rodents can be improved by the slash accumulation associated with PCT which provides ground cover necessary for those species. It is felt that forage values for deer and bear are generally unaffected by thinning slash accumulations.

If PCT is to be implemented between February 1st and July 10th of any year the most recent NSO call records are reviewed to ensure that our operations are more than ¼ mile from an active NSO nest. One quarter mile is the recommended distance to avoid auditory harassment of NSO during the breeding season. The stands targeted for PCT are too young (to small) to be considered nesting habitat for NSO or other raptors. It has been shown that NSO do forage in clear cuts for wood rats which prefer heavy slash accumulations for nesting. It is assumed that PCT does not negatively impact forage for NSO and it may improve wood rat habitat by replenishing the available downed material.

XIV. Timber Marking Guidelines

Timber marking (designating individual trees for harvest) is the art of shaping future forest stand conditions by extracting merchantable forest volume while protecting and enhancing wildlife habitat such that the end result is a well-stocked, rapidly-growing, and healthy forest with abundant and diverse wildlife habitat features. Approaches to timber marking vary by stand condition and silvicultural objective and it is difficult to identify a universal prescription.

Because of the thousands of individual judgment calls that are made while marking a stand, even individual foresters with the same objective would inevitably make slightly different decisions. The general goal of timber marking by the Fund is relatively simple: current (pre-harvest) conditions should be improved by the time of re-entry (typically ten to twenty years) while also increasing net growth. "Improved" is a subjective term but for our purposes it means increased values for conifer basal area, merchantable volume, snags and downed logs per acre. These are also some of the values that will be used to monitor forest trends across the properties.

Below is a summary of The Fund's timber marking criteria incorporating recommendations from two experienced local foresters (Jim Able and Craig Blencowe). These guidelines strive to capture some of the art of achieving the desired balance between habitat recruitment and retention while removing sufficient conifer volume to satisfy the economic needs of the project. Timber marking will be conducted with these criteria in mind. One of the purposes of the Field Consultations (both pre- and post- harvest) is for the forestry team to discuss the timber marking, particularly in riparian stands, understocked areas, and near NSO activity centers.

Timber marking criteria

Marking can vary according to two criteria: the type of stand and the management objectives. These two factors permit flexibility to the extent that the marking adheres to the overall management goal of maintaining a productive sustainable forest.

To this end, what we leave is more important than what we cut. Following a harvest, a stand should have a higher proportion of high-quality trees with well-developed crowns (high potential for increased growth). The key question we must answer before marking a tree is, “What is the potential for the tree to grow in the future?” Trees with little or no potential to grow (i.e. put on recoverable volume) should be removed [unless they are retained for wildlife trees]. The difficult questions arise when a tree’s potential is not readily apparent (often in the case of co-dominants). For this reason, beginning timber markers (and even experienced ones) benefit from boring trees and comparing recent growth with crown size, color, and form.

There are factors other than maximum growth which determine which trees we mark. We place as much emphasis upon high quality and high future value as we do upon maximizing growth rate. For that reason, trade-offs exist and while our stands may be maximizing annual value growth, they may not necessarily be growing at the maximum rate.

In addition to the wildlife tree retention requirements, our “normal” marking scheme for selection harvests involves the following:

- Retained trees should be thrifty and of good quality (e.g. minimum 30% crown ratio). Leave best formed trees regardless of diameter and spacing.
- Focus on attaining “target sizes” of 30-36” in redwood and 26-28” in Douglas-fir. This means that you must be very cautious about marking in the 24-28” dbh classes (redwood) and the 22-24” dbh classes (fir), since these will be your “crop trees” at the next entry.
- Assume that 20% of the trees are doing 80% of the growing so it’s not which trees to cut, it’s which trees should be left to grow. Figure out which of the trees are in this 20% grower category, and leave them. (Percentages will vary from stand to stand.)
- Green culls, conk-infected fir, and large rough wolf trees are usually retained for wildlife.
- Trees that have reached ‘crop tree” size should be harvested, along with other suppressed and intermediate trees to capture mortality and improve the growth of the residual stand. Perpetuate the development of a new age class or the growth of existing advance regeneration at each entry by introducing sunlight to the forest floor. Without the new age classes sustainable selection silviculture will not work!
- You can always opt to allow trees to grow larger than crop size; however, when leaving trees 40” dbh +, you must carefully weigh your decision. Are they to be a legacy tree? Remember trees greater than 48” are to be permanently retained and many large trees with large crowns may reduce the growth of seedlings and future crop trees. Suggest no more than 4 large legacy trees per acre in addition to other trees retained for wildlife and snag recruitment.

- Removal of suppressed and intermediate trees with little or no growth potential. Severely suppressed trees (even redwood) do not release significantly (volume wise) or at least should not be counted on to add significant growth. Cutting suppressed trees does not generally benefit growth and timber recovery, but it will significantly increase logging costs. Cut a few with each entry.
- Removal of grand-fir overstory trees to specifically release viable redwood and Douglas-fir understory is appropriate. We will be managing for mixed-species stands but we do need to guard against encouraging grand-fir in the understory - it is shade tolerant and can dominate a redwood forest in the absence of periodic wildfires. Alternatively, grand-fir can be designated for girdling for accelerated snag recruitment (especially in poor market conditions). These treatments are designed to mimic the high natural mortality rate of grand-fir in an unmanaged forest.
- Removal of 25-35% of the stand volume with a re-entry of 10-15 years. In the field, this usually works out to marking perhaps 30-50% of the volume in a redwood clump, and leaving the well-formed trees growing in the open..
- In windy areas, we try to remove less volume and leave some kind of a wind buffer on the windward side of the stand (usually these trees are wind-beat anyway).
- Where only one large tree (e.g. 26"dbh+) occurs in a clump of smaller (12-14" trees), we mark it, especially if it is on the south side of the clump. Cutting one large high-quality tree is preferable to generating the same value by cutting three or four small high-quality trees.
- Spacing improvement becomes more important when we are returning for the 2nd or 3rd time to a stand because the trees are larger and the crowns need room to expand to maintain high growth rates.
- Do not "give up" WLPZ areas and mark them to the extent it is appropriate and consistent with WLPZ Measures in Section XIV, below.
- Mark hardwoods for removal where small redwood or Douglass- fir trees or a sprouting redwood stump will receive more light.
- It is sometimes necessary to have logistics trump silviculture (e.g. we may have to mark the tree that can be physically felled or yarded, even though it may not be the one we really want to cut). This is especially true in WLPZs
- Group selections work in places where there are few if any good trees to leave or where you need to cut volume across a low-to-medium volume stand. Better to lose the growth on 2.5 acres than to over cut 50 acres.
- Likewise, aesthetics may also trump silviculture in given locations (e.g. along county roads).
- Do not become "hung up" on whether you are doing "all age" or "even age" management. If you are truly selecting the best trees to retain for the future and perpetuating the development of the next age class you are probably doing both.

XV. Watercourse and Lake Protection Zone (WLPZ) Measures

TCF places a very high priority on protecting and improving water quality and aquatic and riparian habitat. On the Garcia River Forest, a detailed Site Specific Management Plan (SSMP) required under TMDL regulations was submitted to and approved by the North Coast Regional Water Quality Control Board (NCRWQCB). The GRF SSMP is available from TCF or RWQCB staff; all of the harvesting and road maintenance operations on the Garcia River Forest must be in compliance with the SSMP. For Big River and Salmon Creek, we were required to develop a Water Quality Management and Restoration Plan, which was incorporated into the management plan for BR/SC and included in its entirety as an appendix. WLPZ Protection Measures are based primarily on the framework established in the Forest Practice Rules (FPR). We have chosen to supplement the FPR requirements for our policies in Gualala, Big River and Salmon Creek rather than creating entirely new requirements (e.g. the GRF SSMP) so as to provide for greater consistency and clarity with existing expectations and professional practices. In all of our operations we and our contractors will comply with all applicable regulations and TCF-imposed obligations.

BR/SC and Gualala WLPZ Protection Measures
[Taken, without editing, from the Big River and Salmon Creek IRMP]
The California Forest Practice Rules and other requirements of the NCRWQCB and DFG provide extensive and complex protections for watercourses. By most estimations, combined they are the world's most comprehensive and restrictive regulations governing forestry operations near watercourses. These rules are designed to protect against changes in sediment delivery, shade, large wood recruitment, late seral wildlife habitat, bank stability, and many other issues. The rules were developed in response to major declines in salmonid habitat conditions over the last three decades.

In general, aquatic conditions seem to be slowly recovering from the past practices and current regulatory protective measures should prevent further degradation. But it is unclear whether aquatic conditions are recovering quickly enough to recover and sustain salmonids, particularly in light of human impacts on other life stages. The acceleration of both aquatic and terrestrial restoration measures proposed in this Plan is intended to improve the prospects for the recovery and maintenance of salmonids in the Big River and Salmon Creek Forests.

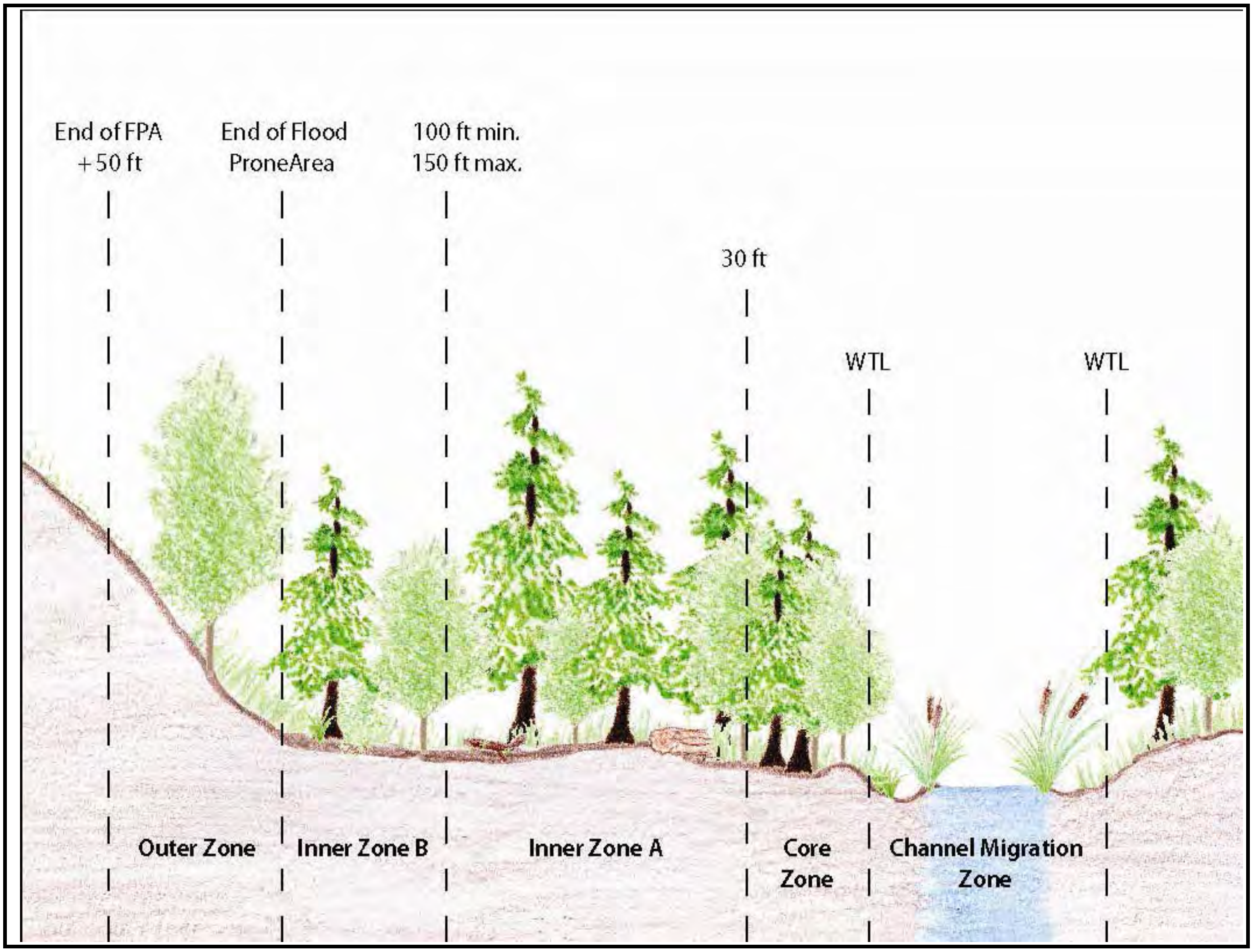
As stated above, improvement of spawning and migration habitat for salmonid species is a key management goal for the Fund and one of the principal motivations for the acquisition of the Forests. Prohibiting development and agricultural uses on the properties will preclude the largest possible impacts on water quality, followed by comprehensive property-wide road assessments to identify and prioritize sites with sediment delivery potential (the treatment of which will occur over the next ten to fifteen years at an estimated expense of over $5 million). In addition, the following silvicultural practices …also will be implemented to improve water quality:

1. Upslope silviculture. Practicing principally uneven-age single-tree selection silviculture to maintain a mature forest across the Forests with minimal openings will reduce the potential hydrologic impacts of even-aged management, which studies at Caspar Creek (http://www.fs.fed.us/psw/topics/water/caspar/) have linked to temporary increases in peak flows, sediment yields, and ambient temperature. Uneven-aged management does, however, require more frequent entries and increased road infrastructure, which is why the next strategy is so important.
2. Increased riparian protection. In addition to standard Watercourse and Lake Protection Zone measures, forest management will include increased canopy retention across all classes of streams.

Specific Gualala and Big River/Salmon Creek WLPZ Protection Measures
<u>Class 1 Watercourses:</u>
Timber operations within the Class I WLPZ have been designed and will be conducted to protect, maintain, and contribute to restoration of properly functioning salmonid habitat and listed salmonid species. To achieve this goal, timber operations will:

- Prevent significant sediment load increase to a watercourse system or lake
- Prevent significant instability of a watercourse channel or of a watercourse or lake bank.
- Prevent significant blockage of any aquatic migratory routes for any life stage of anadromous salmonids or listed species.
- Prevent significant adverse effects to stream flow.
- Protect, maintain, and restore trees (especially conifers), snags, or downed large woody debris that currently, or may in the foreseeable future, provide large woody debris recruitment needed for instream habitat structure and fluvial geomorphic functions.
- Protect, maintain, and restore the quality and quantity of vegetative canopy needed to provide shade to the watercourse or lake to maintain daily and seasonal water temperatures within the preferred range for anadromous salmonids or listed species where they are present or could be restored; and provide a deciduous vegetation component to the riparian zone for aquatic nutrient inputs.
- Prevent significant increases in peak flows or large flood frequency.

Profile View of Class I WLPZ in flood prone areas and channel migration zones (not to scale)



<u>Channel Migration Zone:</u> When a CMZ is present upslope of the WTL it is incorporated into the Core Zone. No timber harvesting is proposed in this zone.

<u>Core Zone:</u> The primary objective for this zone is streamside bank protection to promote bank stability, wood recruitment by bank erosion, and canopy retention. Timber operations are generally excluded from this zone and limited to actions which meet the objectives stated above or improve salmonid habitat consistent with 14 CCR 916.9 subsections (a) and (c). The width of the Core Zone is 30 feet measured from the watercourse transition line or lake transition line. No timber harvesting is proposed within the 30 foot wide core zone. **TCF has elected to increase the required core zone from 30 feet to 50 feet.**

<u>Inner Zone A:</u> The primary objective for this zone is to develop a large number of trees for large wood recruitment, to provide additional shading, to develop vertical structural diversity, and to provide a variety of species (including hardwoods) for nutrient input. This is accomplished through the establishment of high basal area and canopy retention by retaining or more rapidly growing a sufficient number of large trees. Additional specific objectives include locating large trees retained for wood recruitment nearer to the Core Zone and maintaining or improving salmonid habitat on flood prone areas and CMZs when present. Timber operations within WLPZs are limited to those actions which meet the objectives stated above or to improve salmonid habitat consistent with 14 CCR 916.9 subsection (a) and (c).

The Inner Zone A generally encompasses the portion of the flood prone area from 30 feet beyond the WTL (Core Zone perimeter) up to 150 feet from the WTL. The minimum width of the Inner Zone A shall be the greater of the area from the landward edge of Core Zone to the landward edge of the Inner Zone B or 70 feet. The maximum width is 120 feet. **Within Inner Zone A harvesting is subject to the following additional restrictions:**

- The silvicultural method in this area is single tree selection.
- The post harvest stand shall have a minimum 80% overstory canopy cover.
- The post harvest canopy may be composed of both conifers and hardwood species and shall have at least 25% overstory conifer canopy.
- The post harvest stand shall retain the 13 largest conifer trees (live or dead) on each acre of the area that encompasses the Core and Inner Zones.
- Large trees retained shall be the most conducive to recruitment to provide for the beneficial functions of riparian zones (e.g. trees that lean towards the channel, have an unimpeded fall path toward the watercourse, are in an advanced state of decay, are located on unstable areas or downslope of such an unstable areas, or have undermined roots) are to be given priority to be retained as future recruitment trees.
- Harvesting is planned so that the QMD of the flood prone area timber stand will increase.

When no floodplain or Channel Migration Zone is present the maximum width of the WLPZ is 100 feet, the harvest restrictions in the core zone and inner zone A apply.

Inner Zone B: The Inner Zone B is applicable when there are very wide flood prone areas. The Inner Zone B encompasses the portion of the flood prone area from the landward edge of the Inner Zone A (i.e.150 feet from the WTL) to the landward edge of the flood prone area. The landward edge of the Inner Zone B (i.e. the landward perimeter of the flood prone area) shall be established in accordance with flood prone area. Timber operations are permitted in this zone when conducted to meet the goals of this section, including those for the Inner Zone as follows: The primary objective for this zone is to develop a large number of trees for large wood recruitment, to provide additional shading, to develop vertical structural diversity, and to provide a variety of species (including hardwoods) for nutrient input. This is accomplished through the establishment of high basal area and canopy retention by retaining or more rapidly growing a sufficient number of large trees. Additional specific objectives include locating large trees retained for wood recruitment nearer to the Core Zone and maintaining or improving salmonid habitat on flood prone areas and CMZs when present. Timber operations within WLPZs are limited to those actions which meet the objectives stated above.
Within Inner Zone B harvesting is subject to the following additional restrictions:

- The silvicultural method in this area is single tree selection.
- The post harvest stand will retain the 13 largest conifer trees (live or dead) on each acre of the Core and Inner Zones.
- Postharvest stand shall have a minimum 50% overstory canopy cover.
- The post harvest canopy may be composed of both conifers and hardwood species and will have at least 25% overstory conifer canopy.
- Harvesting is planned so that the QMD of the flood prone area timber stand will increase.

Outer Zone: There is no outer zone due to application of uneven aged silvicultural practices. If, in the future, we institute even-age harvest methods an Outer Zone will be implemented pursuant to the current WLPZ rules.

Slope Class	Class II-S WLPZ Zone Width (feet) Core/Inner Zones	Class III ELZ Width (feet)	Wet Area ELZ Width (feet)
<10%	0 / 50	30	30
10 - 30%	15 / 35	30	30
30 - 50%	15 / 60	50	50
>50%	15 / 85	50	50

Class II Watercourses:
All Class II WLPZs shall be composed of two zones regardless of the watercourse type: a Core Zone and an Inner Zone. The Core Zone is nearest to the water; the Inner Zone is contiguous to the Core Zone and is furthest from the water. The width of the Core and Inner Zones vary depending on the following three factors: (i) side slope steepness in the WLPZ, (ii) whether the watercourse is a Class II-S or Class II-L watercourse type, and (iii) whether the watercourse is within a watershed in the coastal anadromy zone or outside the coastal anadromy zone *(all watercourses within TCF ownership are within the coastal anadromy zone).*

Class II Large:
Core Zone: *30 feet in which no harvest may occur.*

Inner Zone: The widths of the Inner Zone is 70 feet and adjacent to the core zone forming a total zone of 100 feet for all class II L streams. Harvesting within the inner zone is allowed providing the 13 largest trees per acre are retained and at least 80% canopy is retained. Silvicultural systemsfor harvesting are limited to the use of commercial thinning or single tree selection.

Class II Standard:
Core Zone: Variable zone (0-15 feet) based on slope in which no harvesting can occur.

Inner Zone: Variable zone (35-85 feet) based on slope at least 50% of the total canopy covering the ground shall be left in a well distributed multi-storied stand configuration composed of a diversity of species similar to that found before the start of operations. The residual overstory canopy shall be composed of at least 25% of the existing overstory conifers.

Class III streams: Using the variable width Equipment Limitation Zone (ELZ) defined by the FPR, where there are no overstory retention requirements under the FPR, the Fund will retain at least 50 percent canopy, and a minimum of 25 percent overstory conifer.

[Note: conformance with all canopy requirements will be measured as an average across not less than a 200-foot lineal WLPZ segment—the same as the FPR.]

The Fund believes these three simple measures of increased retention (one per stream class) a) complement the project goals and the process and review requirements of the existing regulations; b) are efficient for foresters to implement in the field; and c) offer higher confidence that aquatic habitat conditions will improve.

In acquisition funding agreements for Big River and Salmon Creek, the Fund committed to management practices that, among other things, "establish riparian buffers that are wider than required under the Forest Practice Rules." The Fund's forest management policies meet that requirement by providing greater canopy retention within the WLPZ and increased basal area and canopy retention upslope from the WLPZs. A specific example of the wider buffer is the no-cut buffer along Class I streams which has been expanded from 30 feet to 50 feet from the stream—a significant expansion. Additionally, the predominant silviculture beyond the formal WLPZ buffers will be single-tree selection which substantially extends the effective riparian buffer width.

XVI. Harvesting Operations

One of the key planning aspects for timber harvest operations is choice of yarding method—ground or tractor-based and cable or skyline systems. The yarding method choice for a specific harvest unit should be based on the silvicultural system, and the site-specific topography and access. The two primary yarding methods most commonly employed are tractor yarding and cable skyline yarding. Tractor yarding includes tractors with winches and chokers, tractors equipped with grapples or rubber tired skidders with grapples or winches. Tractor yarding is generally used on gentle terrain up to 55% slope. Tractors may be used on steeper slopes where cable yarding is infeasible due to access problems or on long corners where deflection for skyline logging is inadequate. Cable skyline yarding consists of a running skyline or preferably a standing skyline with a carriage, either system should be capable of elevating the logs above the existing tree canopy. Cable logging is used on steep slopes, generally over 50%, where slopes are long and planer or concave. Cable yarding on convex slopes can result in a ground lead situation which can cause unnecessary damage to residual timber or the logging equipment. The key to successful cable yarding is to ensure that there is adequate deflection in the logging unit to suspend the logs above the ground and tree canopy.

The decision to use cable or tractor logging systems is generally an easy one to make. The coast range is very steep and highly dissected with many drainages which make for easy cable logging settings and the ridge tops are reserved for tractor logging. There is a range of slopes between 50-65% where either method may be judged to be adequate in the eyes of the forester laying out the timber harvest unit. Cable logging may be used on shallow slopes were the logs would otherwise be adverse skidded to a landing above the harvest area and conversely tractors may be employed where there are adequate roads and landings downhill of the harvest area. The decision to use one method over the other in this "gray" area is generally made by using the equipment that is required on the rest of the job for example a shallow slope may be cable logged if the rest of the job is predominately cable logging. Or tractors may be used on steeper slopes if there is so little steep ground that bringing in a cable yarding machine for a few acres is deemed infeasible or uneconomical. Tractor long lining is a common practice where winch lines are pulled down hill and the logs are winched up to the tractor sitting in a stationary position. This technique is generally used when the slopes are very short and do not justify the expense of a cable machine and the tractor itself does not operate on the steep slope. Other methods which are suitable for unevenage management techniques are helicopter or balloon yarding which are used when access is limited or there is no access because of excessive road construction or stream crossings requirements to get road access to a harvest unit.

Yarding method decisions are reviewed by the Senior Forester and are discussed in the field consultations. Yarding method and any unusual access situations are described in THPs and are also included in our more readily-available THP summaries.

XVII. Contractor Selection

TCF will utilize contractors in several roles in the management of these properties—from forestry and wildlife surveys to logging and road maintenance. There are several reasons for this—as a relatively new enterprise TCF is not in a position to take on significant staff obligations and many of the most experienced professionals already have contract businesses set up. Additionally we can not guarantee year-round work in some areas. We will strive to use the highest quality professionals available—from owl calling to bridge repair. At least initially we will put most logging jobs out to bid, although we will select the firm that offers the best combination of price, performance, and experience. Other contracts, such as for road maintenance and security, will likely be negotiated directly with the professionals who have the most experience in the area and want the work. Especially for logging, road, and security contracts, ensuring safe working conditions and selecting contractors with good safety records will be an important concern. Additional forestry project work (e.g. owl surveys, preparing and supervising a THP) will be drawn from the area's experienced consulting biologists and foresters. In those situations we will seek to utilize the consultant as a full team member to solicit their ideas on how to meet our objectives. In all roles we have a strong preference for local expertise because it helps support local communities and the timber-based economy. We are concerned about the relative lack of young professionals in the field and will seek to create opportunities that encourage viable business opportunities for young loggers and technicians. In all our efforts we will strive to pay a good and fair wage, to reward performance, and to encourage professional development.

XVIII Staff Training

The Conservation Fund has taken advantage of the high quality of local contractors and chosen to keep our staff relatively small. TCF recognizes that staff will need training in specific areas, appropriate to their positions. Training will be provided as deemed necessary by a supervisor as the staff person's responsibilities grow, or as requested by the staff person. TCF will train staff to encourage individual strengths. TCF recognizes that the SFI 2010-2014 Standard, Objective 16 and FSC US Forest Management Standard, C4.1b encourages employees to improve their skills in sustainable forestry practices through appropriate training and education sufficient to their roles and responsibilities. Each employee has an annually updated job description outlining individual responsibilities and participates in an annual performance review.

Staff Training Expectations

	Timberlands Manager	Registered Professional Forester	Forestry Technician	Office Manager	Forest Carbon Analyst
Participate in SFI Implementation Committee and other forestry associations	x				
Sustainable forestry principles and SFI & FSC standards	x	x	x	x	x
Best management practices: specific to streamside and road management	x	x	x		
Principles related to	x	x	x		

reforestation, invasive plants and animals, forest resource conservation and aesthetics					
Responsibilities under the US Endangered Species Act, Salmonid Protocol, NSO Protocol and Red Legged Frog Protocol	x	x	x		
Safety precautions	x	x	x	x	x
OSHA regulations	x				
Business Management	x				
Public Outreach	x			x	
Emerging Technologies	x	x	x	x	x
Forest carbon quantification and verification					x
Road engineering	x	x			

XVIV. Forest Certification

The Conservation Fund has committed to seeking dual certification under the Forest Stewardship Council and Sustainable Forestry Initiative programs (FSC-US Forest Management Standard version 1.0) and Sustainable Forestry Initiative (2015-2019 Standard), available at https://ic.fsc.org/united-states.298.htm and http://www.sfiprogram.org/sfi-standard/forest-management-standard/. The Conservation Fund supports the efforts of the SFI Implementation Committee (SIC) by actively participating in the California SIC meetings and programs and retains records of the SICs submittal of annual data to SFI, Inc. regarding inconsistent practices. An initial scoping audit was completed on the Garcia River Forest in May 2006. A full audit and annual surveillance audits were successfully completed on in all subsequent years, with a full recertification audit to take place every five years.

XVV. Community Engagement

TCF seeks involvement from the local community at several stages of its activities. A public meeting was held to review the management plan for BR/SC, much like a meeting was held in Point Arena to review the GRF IRMP prior to adoption. Interested parties are invited to participate in a tour of each THP either before or shortly after submission, and again following completion of the operation. In addition, TCF staff is available to respond to questions or concerns raised by the local community. TCF prepares and broadly disseminates an Annual Report that describes major activities on the properties, changes to policies, and monitoring results. Should a dispute arise between TCF and a local citizen, neighbor, partner organization, current or potential contractor, or other interested entity, TCF will first seek to resolve the dispute through open communication, prior to more formal dispute resolution through mediation or litigation. Records of disputes will be made available to the lead certification auditor. In all situations, TCF strives to be a good neighbor and fair employer, and will hold itself to high professional standards in its dealings with the local community, contractors, Native American tribes, public agencies, and all other interested parties.

PROGRAM ON HIGH CONSERVATION VALUE FORESTS, IMPERILED SPECIES, AND REPRESENTATIVE SAMPLE AREAS
The Conservation Fund's North Coast Forest Conservation Program
Primary author: Evan Smith
Original version December 2008; updated 2018

Document background

This program description was prepared to assist the audit team in evaluating compliance with the requirements of the SFI & FSC forest certification systems and to guide the forest planning and monitoring conducted by The Conservation Fund (TCF). This document references and expands upon the Integrated Resource Management Plans for each TCF North Coast Forest and "*Conservation Prospects: A review and analysis of existing conservation plans, land use trends and strategies for conservation on the north coast of California*." All plans are available in the reference documents section of the North Coast Program website-- https://www.conservationfund.org/projects/north-coast-forest-conservation-initiative/north-coast-reference-documents. While some of the material in this summary is duplicative of the management plans it provides additional detail that is of specific interest to FSC/SFI auditors; this is intended to be a stand-alone policy applicable across all properties (and any additional acquisitions in California).

Introduction

The Conservation Fund (TCF) is required to identify areas that because of significant conservation values should have special management practices. This requirement is imposed by TCF's internal forest management planning approach (see Forest Management Policies section IV, Critical Landscape Features) and by the requirements for sustainable forest management certification. For consistency purposes this document will primarily reference language from the Forest Stewardship Council (FSC) US Forest Management Standard, especially Principle 9; we prefer the term "features" over "forest" because many of the highest priority conservation elements are the non-forested features within a forested landscape. This discussion is also linked to Sustainable Forestry Initiative Standard, Section 2, Indicator 4.1.3. The basis for most of this program comes from two important conservation planning exercises, "*Conservation Prospects for the North Coast"* and the Conservation Action Planning assessment in the *"2006 Garcia River Forest Integrated Resource Management Plan,"* described in more detail below.

Conservation Prospects

In August 2005, after two years of research and review, TCF completed "*Conservation Prospects for the North Coast: a review and analysis of existing conservation plans, land use trends, and strategies for conservation on the North Coast of California*." This plan was prepared under a contract for the California State Coastal Conservancy. "*Conservation Prospects*" systematically identifies the highest conservation values for the region based on a broad set of past conservation plans and develops recommendations for future conservation efforts. The two principal recommendations are to:

- Move quickly to establish "working landscape" conservation management on large, strategically located forest and agricultural properties in resource-rich watersheds in Humboldt, Mendocino and Del Norte counties.
- Focus other fee or easement acquisitions on unique resources that are essential to conserving high-priority coastal resources, such as coastal estuaries, old-growth redwood forest stands, coho salmon refugia, floodplains, and California Coastal Trail segments.

In addition to these general recommendations, the report reviews and catalogs 154 individual conservation plans for the region and provides a detailed spatial synthesis assessment of the seven plans deemed to be the most broadly relevant and instructive. The seven plans were chosen on the basis of data quality, scientific principles, format, and mandate and consist of:

1. *California North Coast Ecoregion Aquatic Conservation Strategy Recommendations,* The Nature Conservancy of California, Fall 2003;
2. *California North Coast Ecoregional Plan,* The Nature Conservancy of California, June 2001;
3. *Completing the California Coastal Trail,* California State Coastal Conservancy, January 2003;
4. *Mendocino County Coastal Conservation Plan,* Mendocino Land Trust, April 2003;
5. *A GIS-Based Model for Assessing Conservation Focal Areas for the Redwood Ecoregion,* Conservation Biology Institute and Save-the-Redwoods League, 1999;
6. *Recovery Strategy for California Coho Salmon,* California Department of Fish and Wildlife, 2004; and
7. *Strategic Plan Update,* Pacific Coast Joint Venture, 2004.

The 13-page chapter of "*Conservation Prospects"* on the Mendocino Coast Hydrologic Unit (which contains all of the Mendocino County TCF properties) draws from 15 local plans in addition to the seven core regional plans. In general, "the Mendocino Coast HU is consistently one of the most highly valued regions of the North Coast" by the conservation plans synthesized. Specific features that are recognized as of high conservation value include pygmy forest, coastal dunes, coastal estuarine wetlands, seabird rookeries, spawning areas for anadromous fish, and old growth forests (note that redwood-Douglas fir and tanoak forests were not identified as high conservation value).

The report was developed over a 24 month period in collaboration with state agencies and conservation groups; 41 organizations or individuals provided technical review for the assessment. The report is frequently cited by conservation plans and initiatives on the North Coast.

Garcia River Forest Conservation Action Planning

Occurring nearly simultaneous with the development of "*Conservation Prospects*" was a much more targeted exercise in conservation planning for the Garcia River Forest (GRF) led by The Nature Conservancy and utilizing their "Conservation Action Planning" process (also known as "5-S"). As described in the 2006 GRF Integrated Resource Management Plan (Section II, Identification of Conservation Targets and Associated Indicators) this was "designed to help identify conservation targets, develop strategies to protect those targets, take action, measure success, and adapt." Among the numerous features evaluated, five were identified as Conservation Targets: anadromous fish bearing stream, redwood/Douglas-fir forest, oak woodland/grassland, non-riverine wetlands, and Northern spotted owl.

Each conservation target has identified indicators with quantitative monitoring metrics relating to distribution, viability, and quality. For example, the selected indicators for anadromous fish bearing streams include percent fines less than .85mm (spawning sites); percent fines less than 6.5mm (spawning sites); mean weekly average water temperature (Class I streams); mean pool shelter rating (Class I streams); primary pool frequency (Class I streams); riparian canopy cover (Class I streams). Nine additional indicators were identified for further evaluation.

The primary references used in the Conservation Action Planning process were:

- Low, Greg. 2003. *Developing Strategies, Taking Action & Measuring Success. Landscape – Scale Conservation: A Practitioner's Guide*. The Nature Conservancy, Arlington, Virginia.
- The Nature Conservancy. 2005. *Conservation Action Planning Workbook, Version 4b*. The Nature Conservancy. Arlington, Virginia.

The Conservation Action Planning process is the premier tool for conservation and restoration planning within a conservation biology framework. It has been used at thousands of sites across the world.

As part of the 2006 GRF Integrated Resource Management Plan (IRMP), the Conservation Action Planning process was led by Mark Reynolds and Jen Carah, ecologists with The Nature Conservancy. The GRF planning team included an additional twelve experts from the fields of forest management, land conservation, and watershed restoration. A well-attended public meeting to solicit comment on the draft plan was held in nearby Point Arena, CA, and numerous additional consultations were provided by recognized experts and the local community. The plan was approved by the State Coastal Conservancy, the California Department of Fish and Wildlife, and The Nature Conservancy.

The 2006 GRF Integrated Resource Management Plan was updated in 2018. The 2018 GRF Integrated Resource Management Plan maintains the conservation targets identified in the Conservation Action Planning process and has been reviewed by The Nature Conservancy and the State Coastal Conservancy for consistency with our conservation easement.

North Coast Forests Conservation Values

In order to document the conservation values of a prospective property, TCF prepares a Land Acquisition Evaluation and/or a conservation easement baseline report prior to commitment of acquisition funding from the state agencies and easement holders. Following acquisition, TCF prepares an Integrated Resource Management Plan for each forest. These documents include detailed descriptions of vegetation types and species occurrences, as well as more general information about physiographic features and local ecology. These documents prepared for each California North Coast forest have formed the basis of ongoing management activities, ecological monitoring and planning. Relevant information from these documents is excerpted below in the sections on specific conservation features.

HCVF definition from the FSC-US Forest Management Standard (v1.0)

FSC defines High Conservation Value Forests are those that possess one or more of the following High Conservation Values (HCVs):
1. HCV forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g., endemism, endangered species, refugia), including RTE species and their habitats;
2. HCV forest areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance;
3. HCV forest areas that are in or contain rare, threatened or endangered ecosystems;
4. HCV forest areas that provide basic services of nature in critical situations (e.g., watershed protection, erosion control);
5. HCV forest areas fundamental to meeting basic needs of local communities (e.g., subsistence, health); or,
6. HCV forest areas critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).

[note: this definition was updated by FSC in 2010, the change in the FSC HCVF definition does not result in changes to the TCF HCVF definition.]

TCF Definition of HCVF

The North Coast forests were acquired by TCF expressly because of their conservation value. The properties possess significant conservation values, including habitat for numerous endangered species. It could be argued that all of the North Coast should be considered High Conservation Value Forests, but more realistically only the most exceptional and sensitive areas of the landscape should be classified as HCVF. The TCF team identified those elements that deserve more than just recognition and protection as part of a conserved working forest but are truly critical conservation values at a significant regional level. Based on the analysis done as part of *Conservation Prospects* and the IRMPs, TCF has identified the following areas as High Conservation Value Forest features:

a) Oak woodlands and grasslands: regionally unique due to the low frequency of occurrence in the coastal forests but becoming more common as one moves east from the coast.
b) Pygmy cypress forest: regionally unique and occur only on podzolized (nutrient poor) soils found in the coastal marine terraces of Mendocino County.
c) Old growth coniferous forest: regionally unique and absent on TCF lands except for scattered individual old growth trees.
d) Salmonid spawning streams: regionally unique as Coho are on the decline in the Central California Coast Evolutionary Significant Unit, thus all anadromous streams are protected by regulation. In some instances, TCF has increased protection measures beyond the regulatory standard.

Grasslands and salmonid spawning streams are obviously not "forest," but occur within or on the edge of forests and are recognized as HCVF features because of their critical importance and sensitivity to management practices.

In addition to this list, many additional areas and elements were considered. All portions of the properties have some degree of ecological value—whether it is habitat for the Northern spotted owl or ability to support carbon storage. And some of the forests are used for recreation, public education, and to a limited extent, foraging. And there are many fine-scale elements that have significant conservation value—migratory birds, historic sites, etc. The above definition is designed to recognize those elements that are regionally-significant and deserve special management attention. The HCVF also considers the degree of threat—many of the above-listed elements are still vulnerable under current laws and regulations.

TCF Inventory of HCVF

Oak woodlands and grasslands. Oak woodlands and grasslands have been mapped by TCF via digitalization of 2012 aerial photographs, then confirmed by on the ground staff expertise.

Oak Woodland Acres
Big River Forest: 0
Salmon Creek Forest: 0
Garcia River Forest: 613
Gualala River Forest: 91
Buckeye Creek Forest: 268

Grassland Acres
Big River Forest: 0
Salmon Creek Forest: 0
Garcia River Forest: 369
Gualala River Forest: 115
Buckeye Creek Forest: 812

Currently we track 972 acres of oak woodlands and 1, 296 acres of grassland.

Pygmy cypress forest. Salmon Creek Forest contains the only known occurrence (on TCF properties) of this rare natural community type, which are limited to former marine terraces with thin, nutrient-poor, acidic soils underlain by a hardpan. TCF has mapped and ground-truthed during the Lower Salmon Creek THP that only 4 acres were identified as having pygmy cypress forest characteristics. This community type does not usually grade into commercial forest types; typically there is a fairly sharp demarcation, but field staff are knowledgeable of the characteristics of pygmy forest and will readily observe any additional stands if they are present. If field surveys reveal additional pygmy forest areas, they will be added to this inventory. Currently we track 4 acres of pygmy cypress forest.

Old growth coniferous forest. Unfortunately, due to the extensive logging of coastal Mendocino County, there are no old growth stands on TCF forests. Old growth stands are defined as having the majority of the canopy in trees established prior to 1800—even if harvest or other disturbance has occurred within the stand. Individual old growth trees do occur on these properties—although to a very limited extent. They usually result from the release in the early to mid-1900s of suppressed trees when the old growth overstory was removed. They are not mapped but are fully protected under the wildlife tree retention requirements (see TCF Forest Management Policies). Currently we track 0 acres of Old Growth.

Salmonid spawning streams. While there is excellent mapping of fish-bearing streams (Class 1 watercourses) and there is decent understanding of salmonid distribution within these watersheds, there has not been a detailed assessment of individual spawning areas. Precise location of spawning areas is not critical to the HCVF policies but will likely be the subject of future monitoring. Surveys by Department of Fish & Wildlife, The Nature Conservancy, and North Coast Regional Water Quality Control Board have indicated coho presence in North Fork, Signal, Blue Waterhole, and Inman creeks on the Garcia River Forest (as well as the mainstem), whereas steelhead are widely documented (assume they are using just about every Class 1 stream on our properties). On Big River, coho are documented in the mainstem, Two Log Creek, Laguna Creek, North Fork and the East Branch North Fork. Coho are documented along most of the length of Salmon Creek and Hazel Creek. On the Gualala River, coho are documented on the North Fork Gualala River and Dry Creek. The Buckeye Forest Baseline Report states that coho salmon have been identified on the forest but does not name specific streams. Accounts of Coho in the Gualala Basin are likely anecdotal. Presence/absence surveys in the Gualala Basin have not detected coho salmon since 2001, although they were historically present. Currently track 122 total miles of Class I streams.

Class I Stream Miles
Big River Forest: 26
Salmon Creek Forest: 11
Garcia River Forest: 39
Gualala River Forest: 17
Buckeye Creek Forest: 29

<u>TCF Protection Measures for HCVF</u>
General measures. The most significant threats to any HCVF element would be residential development, forest fragmentation, vineyard conversion or grazing—all have been mitigated by TCF's acquisition and the permanent conservation restrictions on the forests. This limits the number of potential threats to the much smaller subset of forest management, road building and/or maintenance, recreation, trespass and neglect. Appropriate protection measures for HCVF are incorporated in the TCF Forest Management Policies, as described below. New road building projects carefully reviewed by TCF staff (both because of its expense as well as the potential environmental impact) and are included in proposed THP's or Department of Fish and Wildlife projects such as Fisheries Restoration Grant Projects. Guidelines for road construction and maintenance are described in the TCF Road Management Plan. Recreation policies have been developed for these properties, to date we have a pedestrian and equestrian access permit system for Big River and Salmon Creek. Garcia is favored for hunting and a small number of permits to hunt are issued each year, primarily to neighbors. Trespass is a major concern on TCF forests, particularly as it relates to illegal marijuana cultivation. All the properties are actively patrolled by TCF staff and contractors and thoroughly gated to discourage trespass. Fortunately, marijuana cultivation is not common in pygmy cypress or oak woodlands and grasslands.

Sudden Oak Death (SOD) does occur on TCF forests and may pose a threat to HCVF oak woodlands. Tanoak infected with SOD is visible on all TCF ownership except Salmon Creek and ocular forest monitoring indicates that SOD is increasing in frequency. However recent observations of the oak woodlands did not reveal SOD in the true oaks. There is no effective and affordable treatment or vaccination against SOD in a forested setting, so treatment will consist of maintaining an ecologically balanced and healthy forest. For all these reasons, protection of the HCVF is well-integrated with the design and implementation of the projects. Additional specific references are provided below.

Oak woodlands and grasslands. TCF Forest Management Policies (Section IV) states, "All true oak (Quercus spp.) woodlands and native grasslands are to be preserved." In addition, the vast majority of the oak woodlands and grasslands on TCF forests are included within the Ecological Reserve Network (ERN) on the Garcia River Forest. Management of the ERN is described in the GRF IRMP but all management activities must be designed and implemented to further the ecological goals. In the case of oak woodland and grassland this means that prescribed fire or selective harvest to address conifer encroachment or to control the spread of Sudden Oak Death would be permitted.

Pygmy cypress forest. TCF Forest Management Policies (Section IV) states, "All pygmy forest is to be preserved." Salmon Creek contains the only known occurrence of this rare natural community type on TCF properties. The area northwest of the Lower Salmon Creek THP Unit A are to be protected from future harvest and monitored for potential impacts. Pygmy forest occurs along a gradient, according to soil and hydrological variations, and there may be pygmy characteristics within the adjoining managed forest. Unique pygmy features that are encountered within a harvest area would be retained under Forest Management Policies Section X, Retention Requirements.

Old growth coniferous forest. Unfortunately, this does not exist within the TCF ownership. Should any new stands be identified, or new forest be acquired, all old growth coniferous forest would be preserved. Individual old growth trees are preserved on TCF forests whenever they are encountered.

Salmonid spawning streams. Protection for salmonid spawning streams is provided for by the Forest Management Policies Section XIV, WLPZ Protection Measures, and includes measures related to upslope silviculture, road improvements, and increased riparian buffer protection. Additional details are available within the IRMPS, the Forest Management Policies and the GRF Site-Specific Management Plan approved by the North Coast Regional Water Quality Control Board.

TCF Monitoring of HCVF

Periodic monitoring of HCVF will be integrated into ongoing monitoring activities on the properties and will occur at different scales and timeframes as necessary. Two categories of monitoring will occur: 1) biophysical—related to the distribution and condition of the HCVF features, and 2) programmatic—related to the effectiveness of the protection measures.

Biophysical monitoring will consist of:

- Ongoing vegetation mapping as part of forest inventory updates and Timber Harvest Plan preparation, with updated forest stratification approximately every ten years.
- Ongoing rare plant surveys in the areas within and adjoining planned Timber Harvest Plans and Road Improvement or Decommissioning Projects.
- Occasional evaluations of Sudden Oak Death distribution and mortality.
- Aquatic habitat typing by The California Department of Fish and Wildlife have been completed on TCF forests, and are tentatively scheduled to be re-assessed approximately every ten years.
- EMAP aquatic monitoring on Garcia River Forest by The Nature Conservancy and the North Coast Regional Water Quality Control Board—initial assessments completed, re-assessments in approximately ten years.

- Annual summer season stream temperature monitoring at multiple sites on all properties (multiple partners).

Programmatic monitoring will consist of:

1) an annual evaluation of whether the HCVF features are being sufficiently protected and if there are any new threats to consider.

2) A long-term evaluation of the water quality and stream habitat condition response to TCF forest management and watershed restoration practices. This will be developed over the next decade based on observations in the habitat assessment and EMAP measurements (see the Garcia River Monitoring Program, Monitoring the Status and Trends of a Watershed Recovery Effort included in the 2018 GRF IRMP).

Representative Sample Areas. Ecosystem type definition

Identification and protection of Representative Sample Areas (RSA) are explicitly required as part of the FSC-US Forest Management Standard (C6.4) in order to ensure the conservation of ecosystem types that are not protected through HCVF or other requirements. [Definition from FSC Standard*: **Representative Sample Areas (RSAs)** are ecologically viable representative samples designated to serve one or more of three purposes: 1) To establish and/or maintain an ecological reference condition; or 2) To create or maintain an under-represented ecological condition (i.e., includes samples of successional phases, forest types, ecosystems, and/or ecological communities); or 3) To serve as a set of protected areas or refugia for species, communities and community types not captured in other Criteria of this Standard (e.g., to prevent common ecosystems or components from becoming rare)*]. In the context of the North Coast there are many ecosystem types and conditions present, from ocean shore to old growth forest. The TCF forests all occur within the Northern California Coastal Forest Ecoregion (NA0519), as defined by Rickets et al, "*Terrestial Ecoregions of North America: a conservation assessment*" (Island Press 1999). More traditional forest classification systems show similar categorization, e.g. Northern California Coast Section (263A) in "*Description of the ecoregions of the United States*" (Bailey, R.G., US Forest Service, 1995).

Northern California Coastal Forest Ecoregion conservation status

Rickets et al describe the Northern California Coastal Forest Ecoregion as a Class 1 ecoregion, or "Globally outstanding ecoregion requiring immediate protection of remaining habitat and extensive restoration." Urgent action priorities developed by the WWF include greatly increasing "…the number of certified forests where timber is being harvested sustainably," which is "…essential for maintaining the integrity of ecosystems outside protected areas." At 18.7% protected, the Northern California Coastal Forest Ecoregion is one of the most protected forest types in the world (Schmitt, C.B., et al. "*Global analysis of the protection status of the world's forest*," Biological Conservation, 2009). The Convention on Biological Diversity targets 10% protection of each ecoregion as necessary to maintain biological diversity, thus the Ecoregion can be considered well-protected.

The vast majority of the Northern California Coastal Forest Ecoregion is analyzed as part of "*Conservation Prospects*," which recognized two principal recommendations as conservation priorities

- Move quickly to establish "working landscape" conservation management on large, strategically located forest and agricultural properties in resource-rich watersheds in Humboldt, Mendocino and Del Norte counties.
- Focus other fee or easement acquisitions on unique resources that are essential to conserving high-priority coastal resources, such as coastal estuaries, old-growth redwood forest stands, coho salmon refugia, floodplains, and California Coastal Trail segments.

It does not recommend the additional preservation of redwood forest unless it contains some of the high value features (where they occur, those same features are protected within the TCF forests through the HCVF program).

Identification of Representative Sample Areas

For the purpose of this program we classify the following as Representative Sample Areas—Big River unit of the Mendocino Headlands State Park, Jackson State Demonstration Forest, Maillard State Reserve, and the Ecological Reserve Network of the Garcia River Forest. These are large-scale formally-protected landbases containing a diversity of representative natural habitat conditions.

There are countless habitat conditions and successional stages that could be considered for the purpose of defining Representative Sample Areas. The most significant of these, such as oak woodlands, are protected through the HCVF program described above. Less significant examples could include riparian alder stands and natural, early successional stands. Within the portion of the Northern California Coastal Forest Ecoregion that is vegetated with conifer forest there is relatively little spatially-explicit variation—almost everything is dominated by redwood, Douglas fir, Grand fir, hemlock and tanoak and is less than 100 years old. There are minor variations depending on the proximity to the coast. There is a naturally occurring belt of sugar pine (*Pinus lambertiana*) which extends from Mountain View Road southward into northern Sonoma County. This is unique to the north coast and our ownership. The sugar pine is managed concurrently with the other major forest types and sold commercially when market conditions are favorable. Other tree species do occur but are almost never a large component of a stand. Certain ecological processes create significant features to consider, for example forest fires and landslides can and do create successional pathways with some different characteristics.

The process of identifying RSAs within this somewhat indistinctive landscape becomes somewhat irrelevant when looking at the conservation status and management of surrounding lands. In addition to all TCF forests being permanently conserved, there are a number of other large landholdings with similar features which are also permanently conserved. For example, adjoining the Big River Forest is the Big River unit (7,334 acres) of the Mendocino Headlands State Park and the Jackson Demonstration State Forest (48,652 acres). Due to the shared management history, the State Park is almost identical in conditions to TCF's Big River tract, and is permanently protected with little to no harvesting or road building expected. Comparatively, the State Forest is thirty to fifty years more developed, with significantly older and denser forest conditions prevalent, and will be managed for both continued late-seral forest development as well as some modest level of harvesting (both even-aged and uneven-aged). The Garcia River Forest adjoins an old growth reserve and contains a 8,264 acre Ecological Reserve, which in addition to being permanently protected from development and conversion can also only be managed for late-seral and other desired ecological conditions. TCF's Garcia River Forest, Gualala River Forest and Buckeye Forest create a contiguous 50,000 acres of permanently conserved forestland. Looking beyond the protected lands, due to the significant land use and forestry restrictions imposed on the surrounding landscape a wholesale change in ecological patterns is unlikely.

As it relates to designating RSAs, it is possible that some existing but niche habitat type is unlikely to persist on the landscape. For example red alder stands less than 30 years old are very uncommon because red alder stands are almost exclusively located in riparian zones and due to the Forest Practice Rules (dating to the 1970s); new clearings in riparian zones are relatively rare (only triggered by flood scouring). They provide a unique and valuable wildlife habitat and enrich stream nutrient conditions, however it would likely be illegal to try to encourage the development of new alder stands and it would certainly be impractical to try to freeze in time the existing stands. The habitat types that are most likely to decrease in abundance are early successional stands, due to the decrease in even-aged management practices. However early successional stand conditions are still being perpetuated to some extent on private lands and were likely an almost non-existent component of the pre-European landscape. The ecological process least represented is probably fire, due to 50+ years of aggressive fire suppression. Reintroducing low-intensity ground fires is a long-term objective for TCF but will require a significant shift in forest structure and community acceptance. And despite the suppression efforts, fires still occur, as shown by recent fires in Mendocino County—so recently burned areas are not lacking and will continue to persist on the landscape. The more pervasive threat to habitat conditions and distribution will likely be climate change, which cannot be prevented through the designation of RSAs, and the extensive network of protected lands already provides the best hope for adaptation and species persistence.

In summary, numerous forest stand types and processes were considered for RSA designation, and the following summarizes the salient conclusions.

1. Old growth forests and Oak woodlands and native grasslands are important and would receive RSA designation if they were not already recognized and protected through the more-stringent HCVF designation.
2. Late-seral conditions are the highest priority feature in the coniferous forest, even when not occupied by Northern spotted owl or marbled murrelet. At the site-scale, protection of existing individual features is recommended by the California Department of Fish and Wildlife and occasionally required during Timber Harvest Plan review, as well as required in TCF's retention policies. At the landscape-scale, over 100,000 acres of similar coniferous forest in Mendocino County is managed for development and retention late-seral habitat conditions, which is in excess of conservation biology guidelines for maintaining biodiversity.
3. Young coniferous forest has not been identified as high wildlife or social importance and will continue to be created on the landscape through ongoing even-aged harvesting activities on private lands; therefore it is unnecessary to include in a RSA.
4. Hardwood riparian stands (of all ages) are gradually being succeeded by coniferous stands. They are a unique and valuable type but impractical to deliberately maintain as a RSA.
5. Fire is the most significant process that is under-represented on the landscape and burned conditions and features are probably under-represented compared to pre-European settlement conditions. TCF is taking steps to be able to re-introduce fire (and by extension, burned conditions) but is decades away from safe implementation.

To summarize, because of the widespread protected nature of the region, the extensive regulatory system restricting land use change and harvest practices, and the existing pattern of habitat conditions and ecological processes present on the landscape, our conclusion is that the designation of additional Representative Sample Areas is not necessary and would not be ecologically beneficial. This conclusion will be re-evaluated at least every ten years, with stakeholder input, as part of a planned update to TCF's Management Policies.

<u>2018 Re-evaluation of Representative Sample Area Program</u>

The following regional conservation plans were reviewed as part of the ten year re-evaluation of TCF's RSA program:

1. *California's Forests and Rangelands 2010 Assessment,* California Department of Forestry and Fire Protection, June 2010;
2. *Centennial Vision for Redwoods Conservation*, Save the Redwoods League, 2018;
3. *Conserving California's Coastal Habitats; A Legacy and a Future with Sea Level Rise*, The Nature Conservancy and State Coastal Conservancy, 2018;
4. *Conserving Landscapes, Protecting the Climate: The Climate Action through Conservation Program,* The Nature Conservancy and Sonoma County Agricultural Preservation and Open Space District, January 2016;
5. *A Freshwater Conservation Blueprint for California: prioritizing watershed for freshwater biodiversity* Jeanette K. Howard, et al., April 2018;
6. *Recommendations for the 2018 Farm Bill*, Forests in the Farm Bill Coalition, July 2017;

7. *SalmonScape: Priorities for Conserving California's Salmon and Steelhead Diversity*, The Nature Conservancy, August 2011.

The common six high priority issues identified in these regional conservation plans include:

- Water Quality and Quantity
- Forest Health/Invasive Species
- Forest Fragmentation/Parcelization/ Changing Ownerships
- Increase and Enhance the Benefits of Working Forests
- Climate Change
- Fire Management

Following the review of these plans and re-evaluation of our HCVF and RSA program, TCF maintains our previous outcome (analyzed and stated above) that because of the widespread protected nature of the region, the extensive regulatory system restricting land use change and harvest practices, and the existing pattern of habitat conditions and ecological processes present on the landscape, our conclusion is that the designation of additional Representative Sample Areas is not necessary and would not be ecologically beneficial.

Protection and management of Representative Sample Areas

Ongoing preservation and management of the Representative Sample Areas is the responsibility of the landowner, California State Parks Department, California Department of Forestry and Fire Protection, and The Conservation Fund, respectively. All properties are covered by management plans consistent with the public mission of the organization; in addition management plans and actions are reviewed by outside advisory groups. The adequacy of these protection measures will be re-evaluated at least every ten years, with stakeholder input, as part of a planned update to TCF's Management Policies.

Consultation regarding HCVF and RSAS

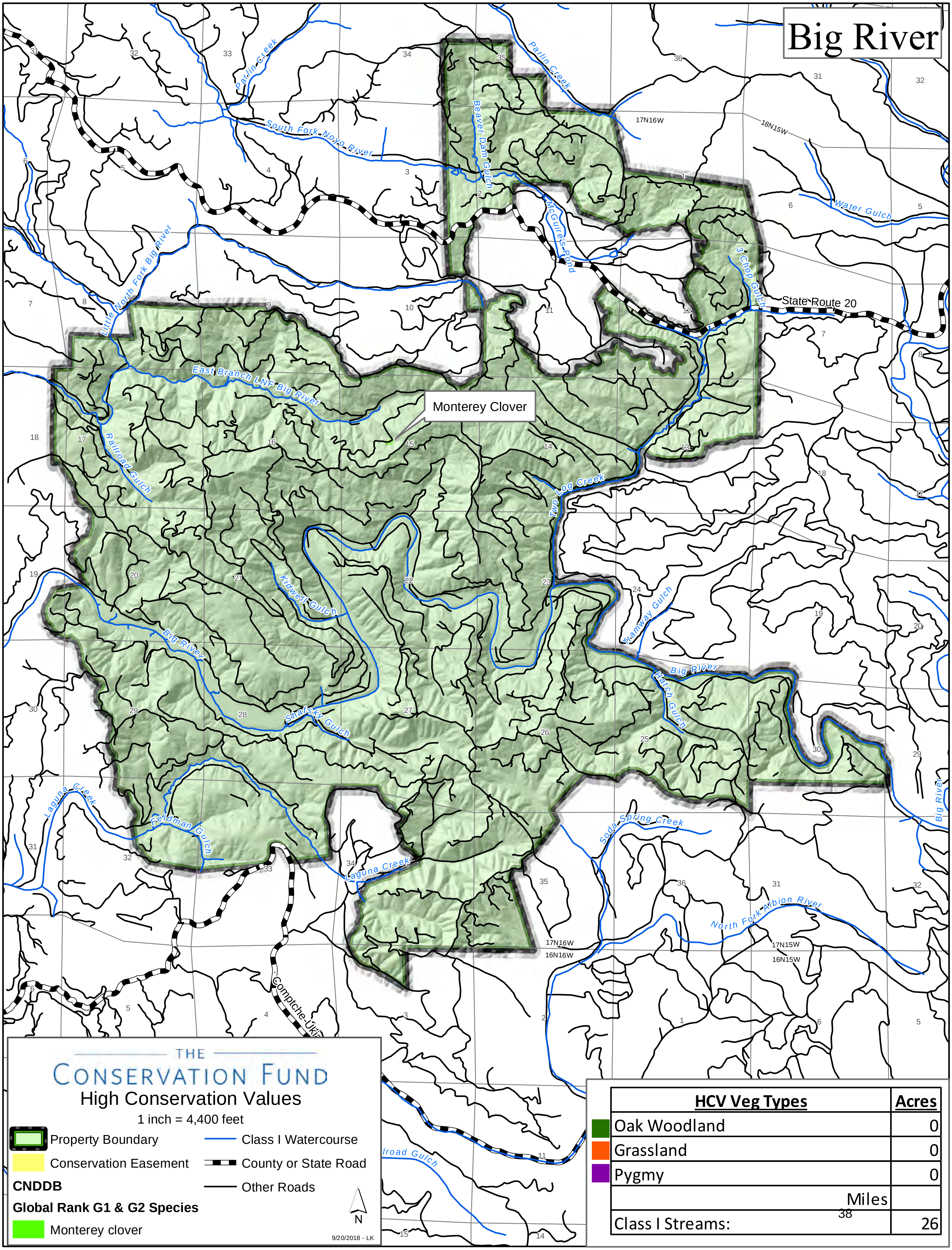
The FSC-US Forest Management Standard explicitly expects some level of stakeholder consultation as part of the HCVF and RSA identification and protection process. As described above, the identification of the four HCVF features was based on two well-respected conservation biology planning efforts which were openly developed, are publicly available and have been thoroughly reviewed by natural resource agencies, environmental organizations and the local communities. In addition the HCVF/RSA features descriptions and protection measures have been part of the TCF Policy Digest, which is a publicly available document that has benefited greatly from community and agency review, including by our Advisory Council. The most significant contributors to the policies include: Jen Carah (The Nature Conservancy), Linda Perkins (Sierra Club), and Alan Levine (Coast Action Group). The TCF Forest Management Policies are discussed as part of every THP field review (which includes both an internal staff and an open tour); the public tours draw a broad range of stakeholders, including students, neighbors, and local environmentalists. We have also benefited from the extensive HCVF and RSA consultation and analysis conducted by the Mendocino Redwood Company which manages an adjoining and much larger landbase and came to very similar conclusions regarding high priority features and protection measures.

Imperiled Species

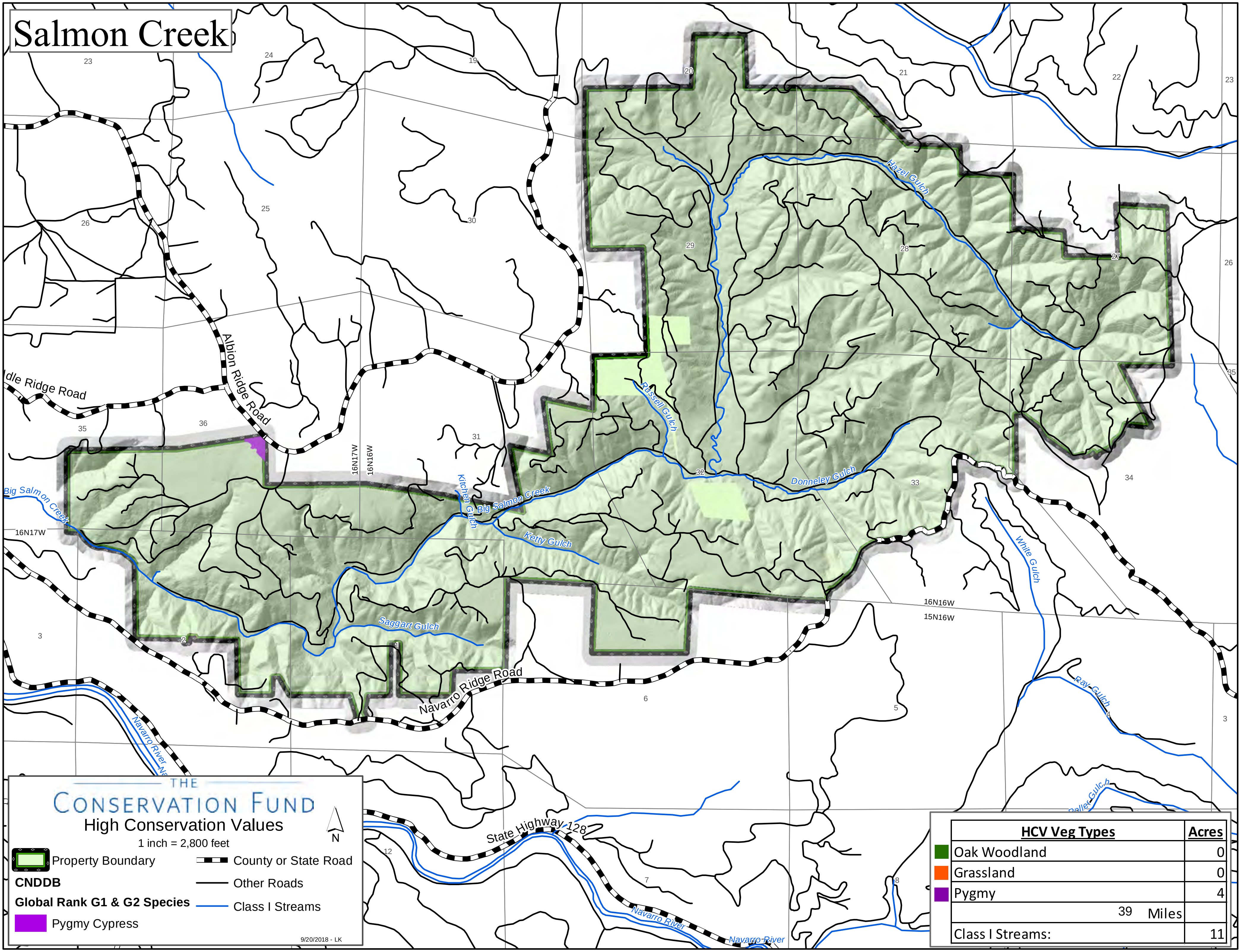
The SFI standard specifically requires identifying and protecting species that have been identified as Globally Critically Imperiled and Globally Imperiled (G1 and G2 status, respectively). The California Natural Diversity DataBase (CNDDB) maintains all recorded sitings of G1/G2 species, as well as other listed species and species of concern. The following G1/G2 species have been identified on TCF properties:

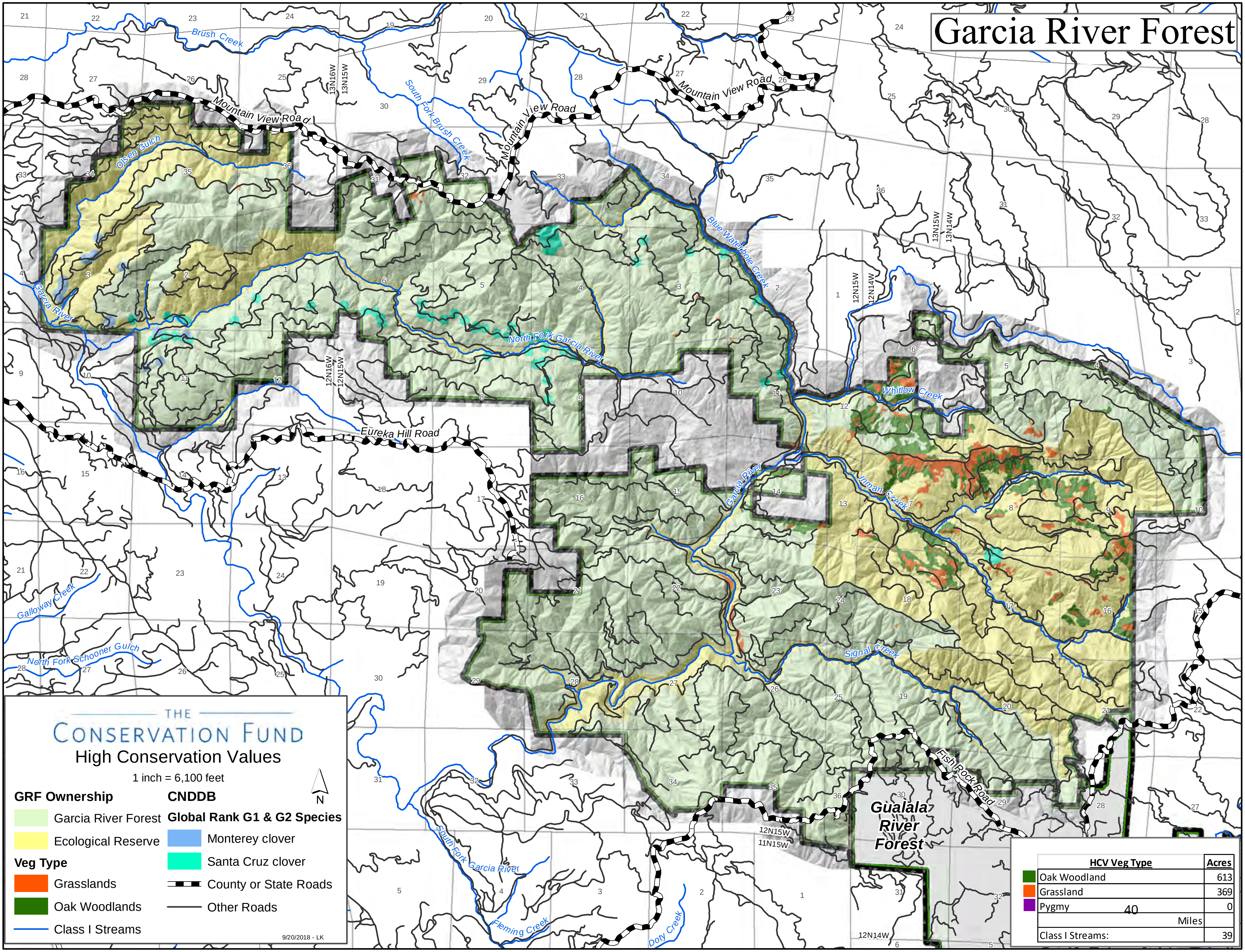
Species name	Common name	Location	Notes and protection measures
Trifolium trichocalyx	Monterey clover	Big River, in a road cut bank near the Elephant Seal and ELF THPs	This G1 and state and federally endangered plant was identified by TCF in 2011 prior to a road upgrade project. Per CDFW permit, the single location was fenced and protected, and will be monitored. It is the only location known outside of a handful of sites in Monterey County.
Agelaius tricolor	Tricolored blackbird	McGuires Pond, private forest adjoining Big River	The detection of this G2/G3 species is from a single day in 1992 and it has not been observed since. Given their preference for open riparian and field habitats they are unlikely to be found on TCF forest or impacted by TCF management.
Hesperocyparis pygmaea	Pygmy cypress	Salmon Creek, between the Lower Salmon Creek THP and the forest border	This G2 plant species is not state or federally listed. Within TCF ownership, it occurs in one stand, and is protected as part of the pygmy forest HCVF area.
Trifolium buckwestiorum	Santa Cruz clover	Garcia, Salmon Creek and Gualala, along mainline roads	This G1 species was detected by TCF botanists and has been confirmed along multiple sections of road. Per CDFW recommendations, several sites have been fenced for protection and all locations are monitored.
Trifolium Trichocalyx	Monterey Clover	Garcia River Forest	This G1 species was detected by TCF botanists and has been confirmed along multiple sections of road. Per CDFW recommendations, several sites have been fenced for protection and all locations are monitored.

There are a few other rare plants that may yet be found on the forest but given the extensive surveys by TCF botanists prior to any ground disturbing activity, it seems highly unlikely they will go undetected.

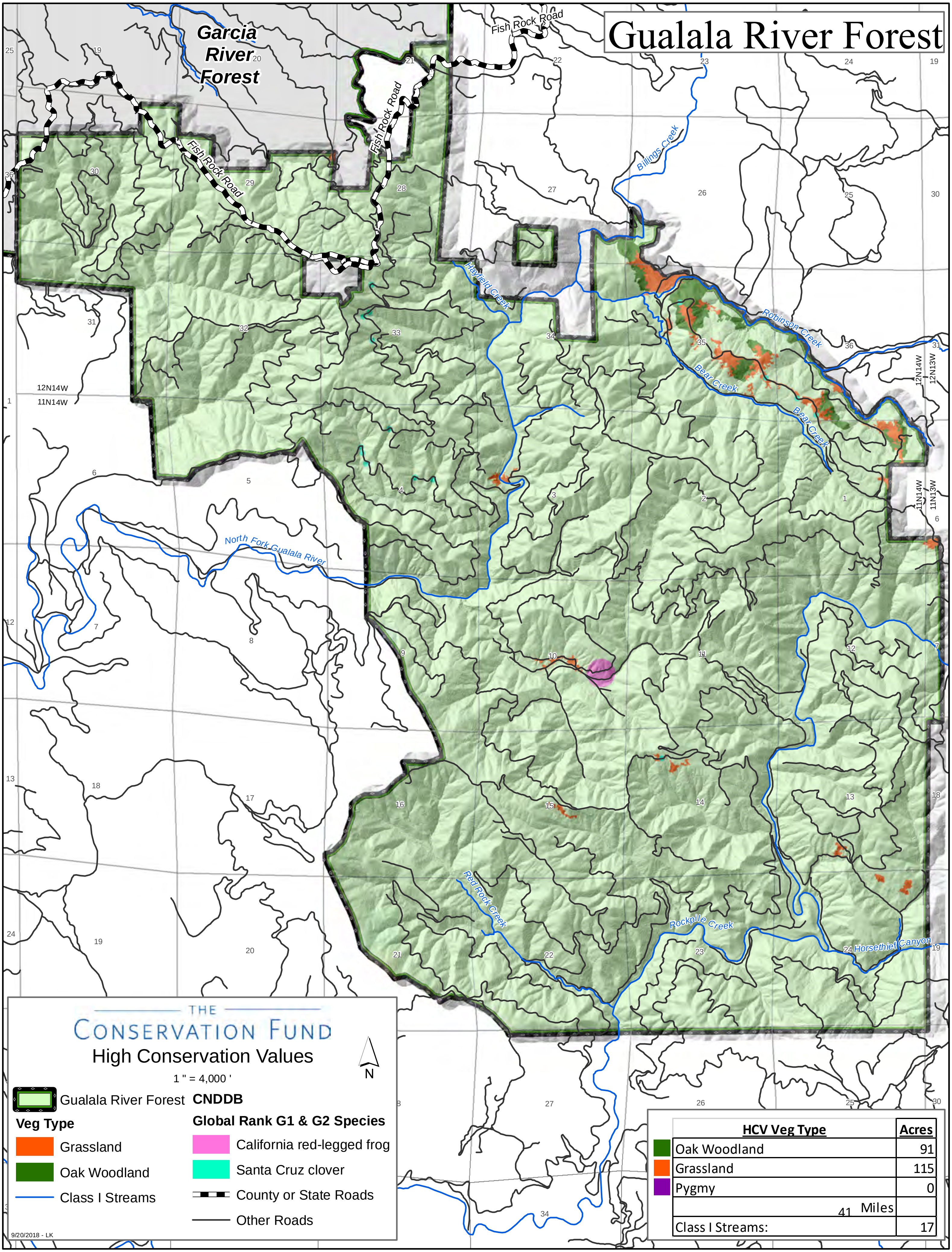


HCV Veg Types	Acres
Oak Woodland	0
Grassland	0
Pygmy	0
	Miles
Class I Streams: 38	26

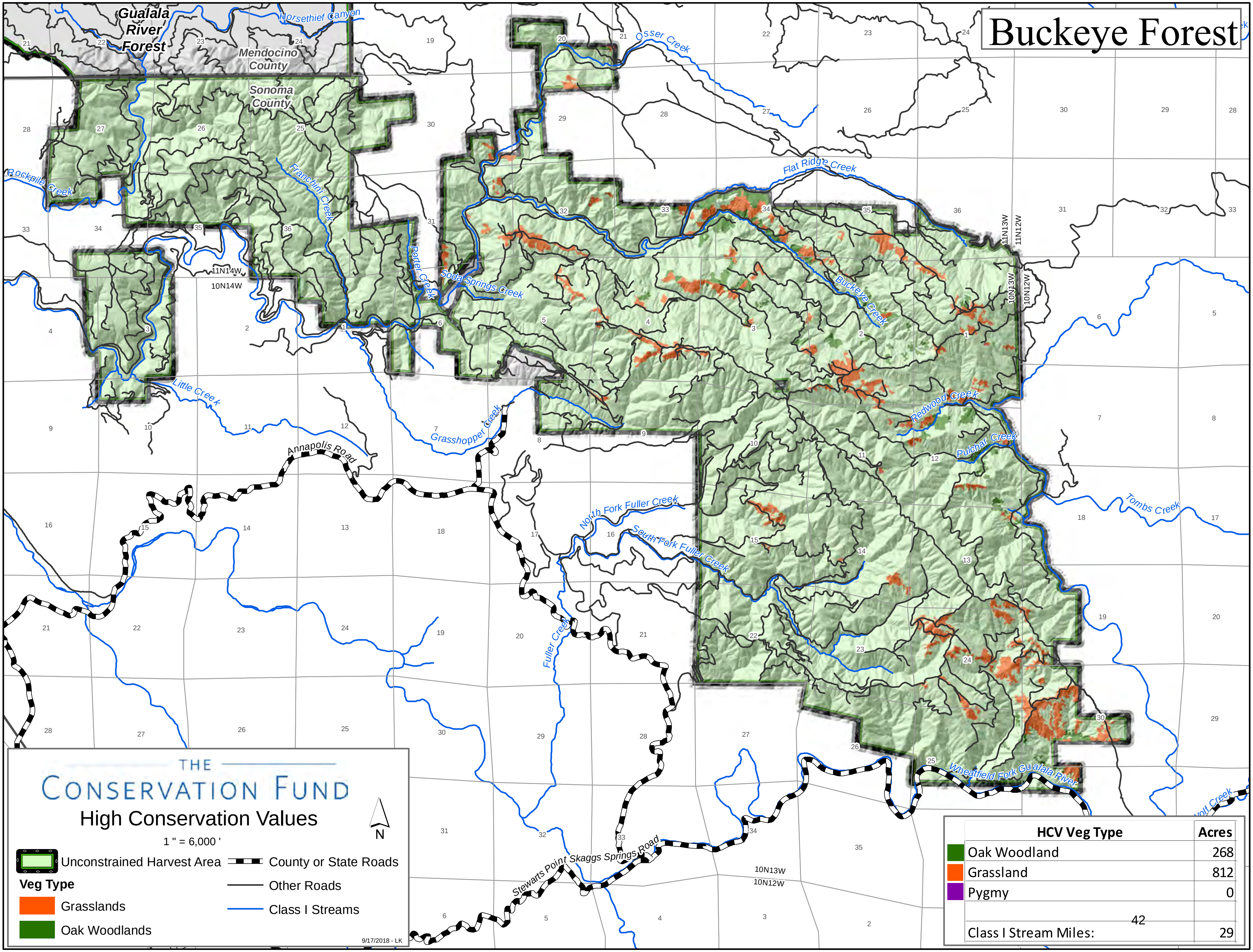

Salmon Creek
Albion Ridge Road
Navarro Ridge Road
State Highway 128
Big Salmon Creek
Kitchen Gulch
Kelty Gulch
Saggart Gulch
Russell Gulch
Donneley Gulch
Hazel Gulch
White Gulch
Ray Gulch
Navarro River
16N17W
16N16W
15N16W
THE CONSERVATION FUND
High Conservation Values
1 inch = 2,800 feet
N
Property Boundary
County or State Road
CNDDB
Other Roads
Global Rank G1 & G2 Species
Class I Streams
Pygmy Cypress
9/20/2018 - LK
HCV Veg Types
Acres
Oak Woodland 0
Grassland 0
Pygmy 4
39 Miles
Class I Streams: 11



HCV Veg Type	Acres
Oak Woodland	613
Grassland	369
Pygmy	0
	40 Miles
Class I Streams:	39



HCV Veg Type	Acres
Oak Woodland	91
Grassland	115
Pygmy	0
41 Miles	
Class I Streams:	17



Buckeye Forest
Gualala River Forest
Mendocino County
Sonoma County
Horsethief Canyon
Osser Creek
Rockpile Creek
Franchini Creek
Porter Creek
Soda Springs Creek
Flat Ridge Creek
Buckeye Creek
Little Creek
Grasshopper Creek
Redwood Creek
Pulchat Creek
Tombs Creek
North Fork Fuller Creek
South Fork Fuller Creek
Fuller Creek
Wheatfield Fork Gualala River
Wolf Creek
Annapolis Road
Stewarts Point Skaggs Springs Road
11N14W
10N14W
11N13W
11N12W
10N13W
10N12W
THE CONSERVATION FUND
High Conservation Values
1 " = 6,000 '
N
Unconstrained Harvest Area
County or State Roads
Veg Type
Other Roads
Grasslands
Class I Streams
Oak Woodlands
9/17/2018 - LK
HCV Veg Type | Acres
Oak Woodland | 268
Grassland | 812
Pygmy | 0
42
Class I Stream Miles: | 29

HERBICIDE APPLICATION AND HARDWOOD MANAGEMENT POLICY
The Conservation Fund's North Coast Forest Conservation Program
Principal authors: Madison Thomson and Scott Kelly
October 2012, revised October 2016

Overview

The Conservation Fund acquired the Garcia River Forest in 2004, Big River and Salmon Creek in 2006 and Gualala River Forest in 2011. The Buckeye Forest was acquired by Sustainable Conservation, Inc. in 2014 and is managed by The Conservation Fund. All of the forests have been harvested by previous landowners for forest products and some of the second growth stands have unnaturally high proportion of hardwoods, especially tanoak, as a result of the previous harvests.

Control of the tanoak composition within the forest is a priority for The Conservation Fund. The California Forest Practice Rules (14CCR 912.7(d)) require: "The site occupancy provided by group A species (conifer) shall not be reduced relative to group B species (hardwoods)." In 2016 Measure V was passed by the Mendocino County voters, which reads: "trees taller than five (5) meters, which have been intentionally killed and left standing for longer than ninety (90) days (except those that are left for the benefit of wildlife habitat) be considered a public nuisance. It makes the responsible party liable for any damage if: 1) it is within one-thousand (1,000) meters of a structure, a public or private roadway or fire lane, electrical or telecommunication poles or lines, or water sources such as rivers, creeks, ponds or lakes; or 2) it is within the CAL FIRE State Responsibility Area. Measure V declares that standing dead trees left over 90 days can be declared a public nuisance. Through our Sustainable Forestry Initiative (SFI) and Forest Stewardship Council (FSC) certification, we are obligated to prove compliance with FSC Principle #1 and SFI Principle #7 that state "certified properties must comply with applicable federal, provincial, state, and local forestry and related environmental laws, statutes, and regulations."

Reduction in the use of herbicides over time is an important objective to The Conservation Fund and alternatives to herbicide treatments have been and will continue to be evaluated. In addition, we will strive to stay informed as new research becomes available related to the efficacy and environmental impacts of various herbicides. The following document has been prepared to outline our herbicide application and use policies to control tanoak and exotic invasive species on the north coast forest properties.

Tanoak Management

Hardwood species, including tanoak, pacific madrone, chinquapin, California bay and alder, are an important ecological component of north coast forests. Hardwood mast is an important source of food for a variety of wildlife species and the trees often possess a variety of structural attributes (basal hollows, cavities, large limbs, etc) which are extremely valuable for wildlife habitat. However, past management practices have resulted in an unnaturally high abundance of hardwoods, specifically tanoak in many areas that historically were dominated by conifers. As such, TCF is committed to pursuing management practices that reduce the tanoak component, increase conifer site occupancy, and transition our forests toward a more historically appropriate species composition while retaining high quality hardwood stands and individual trees for wildlife habitat.

Tanoak's unique physiological attributes allow it to be a component of north coast forests at a variety of successional stages. Tanoak is extremely shade tolerant meaning that it can persist and grow at relatively low light levels. Because of this characteristic, tanoak regeneration is often ubiquitous in the understory of stands with moderate to high overstory crown cover. Redwood and Douglas-fir are less shade tolerant than tanoak and regenerate poorly under partial canopy. When overstory trees are removed through timber harvest or natural disturbances, the tanoak in the understory "releases" and grows upward to occupy the vacated growing space. As this occurs, redwood and Douglas-fir regeneration and growth is often hindered. Tanoak also sprouts vigorously when cut or damaged, allowing it to rapidly colonize sites after fire, logging, and other disturbances. Because of tanoak's ability to sprout and grow in shade or low light conditions, many stands across TCF ownership that were once conifer dominated now possess an unnaturally high composition of tanoak due to repeated overstory harvests with no tanoak control treatments.

The common approaches to tanoak control are: direct herbicide treatment of the tree or sprouted stump, manual felling also known as "high stumping" or logging. To date herbicides have been The Fund's primary method of tanoak control but other methods have been tested and used by the Fund and described below.

Hardwood reduction activities (without any commercial timber harvest) may also be pursued in areas outside Timber Harvest Plans where stands are overstocked with hardwoods.

Many tanoak dominated stands on our tracts were treated with Imazapyr or Triclopyr by previous owners. Those treatments were successful in that they reduced hardwoods and allowed for improved conifer growth but were broad in scope killing all hardwood species at the expense of other forest values. The herbicide application policies described below are intended to reduce tanoak while considering other forest values such as wildlife habitat, aesthetics and fire danger and also reducing our reliance on herbicide use for tanoak control in the future. We expect that as the forest matures and the conifer canopy closes that hardwood reduction treatments will no longer be needed, but this is a process that may take multiple entries or 30-40 years.

Depending on the structure and composition of a given stand, there are a variety of approaches that we may take toward tanoak management. The following is a summary of management policies that we use to drive the decision making process on a stand by stand basis. These generalized policies are subject to change as new information becomes available and the results of previous tanoak reduction projects become apparent.

- All true oak (Quercus spp.) woodlands and individual trees are to be preserved.
- Where the post-harvest tanoak basal area would exceed 30 square feet of basal area per acre (averaged across the stand), hardwoods shall be controlled through manual falling or

herbicide treatment through direct basal injection (hack-and-squirt) to provide a post-harvest tanoak basal area of 15-30 square feet per acre. (This may take more than one entry to achieve).

- In stands with a moderate tanoak component where conifers are well established in the overstory, selective falling of tanoaks to release existing conifers will be employed. While the tanoak stumps will likely resprout, the conifers should have established dominance and will eventually shade-out most of the sprouts. In this type of incremental treatment (selective falling), clumps of tanoaks and tanoaks, which do not compete with desirable conifers, will be retained.
- In stands with a significant tanoak component which also possess a substantial conifer component in equal and lower crown classes, selective herbicide treatments will be employed. Stands that fall into this category generally have over 75 square feet of tanoak basal area/acre and over 75 square feet of conifer basal area/acre. Tanoak trees that are directly competing with healthy, established conifers will be targeted for treatment. Those tanoaks that are not directly competing with established conifers will be retained. Selective falling of tanoaks can cause excessive damage to residual conifers when numerous hardwood trees are cut. Because of this, herbicide will generally be the primary method of tanoak reduction in stands with both significant tanoak and conifer components.
- In stands with a significant tanoak component and minimal conifer stocking, a more broad scale herbicide treatment coupled with conifer planting will be employed. With this type of treatment, the majority of the tanoak in a given stand will be treated and conifer seedlings will be planted either shortly before or shortly after tanoak treatment.
- Tanoak logging may be pursued as an alternative to herbicide in certain cases if a market for tanoak logs develops and the tanoak can be harvested without damaging the residual conifers. Even where hardwood logging is utilized, there may be a need for post harvest herbicide treatment in order to control tanoak sprouting and prepare the site for conifer regeneration.
- The Big River and Salmon Creek tracts posses a number of young plantations (less than 15 years old) that were established by the previous landowner. In these stands, tanoak reduction will be accomplished in conjunction with pre-commercial thinning using brush or chain saws. In addition to tanoak, other brush species such as Blue Blossom, and small trees are cut in order to create growing space for the healthiest, best formed conifer specimens. Mechanical thinning is generally preferred to herbicide application in these stands due to the greater control of spacing and species composition.

The herbicide primarily recommended for use of tanoak control is imazapyr. The primary application method will be via frilling or "hack and squirt." Using this method, a series of cuts are made around the stem of the tree and the herbicide is applied directly to the tree's vascular tissues. This application method greatly reduces the total quantity of herbicide required and minimizes the risk of drift onto non-target species and other resources. Additional herbicides for tanoak control may be considered in the future as they are developed and tested. The following is a list of guidelines that are to be followed with

FRILLING OR HACK AND SQUIRT herbicide applications:

- All applications must be by a licensed pesticide applicator with a good safety track
- record and in compliance with EPA-approved label recommendations.
- Detailed contract specifications shall be provided to minimize risk of over- application or misapplication.
- Frilling or Hack and Squirt shall not occur within 100 feet of any property line herbicides will be applied within 50' of neighborhood property lines.
- Work will be closely supervised by TCF staff or consulting foresters.
- Notification signs will be posted in logical locations at least 30 days prior to applying herbicides.
- Records on all applications will be compiled by TCF staff, submitted to the county and available upon request.
- The effectiveness of treatments will be monitored by TCF staff.
- No hardwood species other than tanoak shall be treated
- Retain all hardwoods (>18" DBH) per acre. Exceptions to the general retentions guidelines may be adopted on a site specific basis if in the opinion of the project forester the general guidelines are not adequate to reduce the hardwood component to a level low enough to allow conifer regeneration and growth.
- There will be no hardwood control with herbicides in Class I, II or IV WLPZs or within 25 feet of a class III watercourse; manual falling or girdling of small hardwoods may be used within these restricted areas as part of a riparian shade enhancement project designed to increase conifer site occupancy and growth.

The results of different tanoak control techniques will be monitored over time and our policies will be revised as new information becomes available. We recognize that because of soils and aspect some sites are naturally dominated by tanoak and we will avoid tanoak reduction activities in these stands. Tanoak reduction projects will be focused on the more productive sites with evidence of past conifer dominance (i.e. stumps, suppressed conifer regeneration).

Invasive Exotic Species
Invasive exotic species such as French Broom, Jubata Grass and various thistles have been introduced onto the properties as a result of past management activities, primarily by contaminated equipment. Controlling the spread of these invasive species is a priority for the Fund. Herbicide are the primary tool used for the control of invasive exotics but other methods such as manual removal are also employed. Specifically on Salmon Creek, French Broom and Jubata Grass are removed annually by hand with the cooperation of the "Salmon Creek Project Team" In areas with extreme infestations of exotics, such as those found on Big River, we believe that herbicide application is the safest and most cost effective alternative for the control of those species.

Various precautions are taken with all herbicide applications to ensure that adverse impacts to the environment and human health are minimized. The following is a list of guidelines that are to be followed with **FOLIAR** herbicide applications:

- All applications must be by a licensed pesticide applicator with a good safety track
- record and in compliance with EPA-approved label recommendations.
- Detailed contract specifications shall be provided to minimize risk of over- application or misapplication.
- Indicator dye will be used to enable better monitoring, and applications areas will be
- flagged in advance,
- No foliar herbicides will be applied within 50' of neighborhood property lines.
- Work will be closely supervised by TCF staff or consulting foresters.
- Notification signs will be posted in logical locations at least 30 days prior to applying herbicides.
- Records on all applications will be compiled by TCF staff, submitted to the county and available upon request.
- The effectiveness of treatments will be monitored by TCF staff.

There will be no herbicide application in Class I, II or IV WLPZs or within 25 feet of a class III watercourse.

ROAD MANAGEMENT POLICIES
For The Conservation Fund's North Coast Forest Conservation Program
Primary author: Scott Kelly
May 24, 2007, revised September, 2012, 2014

Introduction

The Conservation Fund owns approximately 73,000 acres in Mendocino and Sonoma County, California. The tracts consist of the 24,000 acre Garcia River Forest, the 12,000 acre Big River Forest the 4,000 acre Salmon Creek Forest, the 13,900 acre Gualala River Forest and the 19,552 acre Buckeye Forest. The Garcia River Forest was acquired by The Conservation Fund in 2004; the previous landowner conducted some minor road maintenance activities and remediation projects however the forest land and roads have been essentially inactive since 1998. The Conservation Fund acquired the Big River and Salmon Creek forests in 2006 from Hawthorne Timber Company in Fort Bragg who were actively managing the forest for timber production. The Conservation Fund acquired the Gualala River Forest in 2011 and the Buckeye Forest in 2013 the previous landowners conducted some minor road maintenance activities and remediation projects however the forest land and roads have been essentially inactive since 1998. A 17 acre vineyard and pond were developed on the Buckeye Forest in the early 2000' however no other management activities have occurred. The Conservation Fund intends to actively manage the timber resources on all five properties to improve stocking and growth across the ownership and to actively manage the road system and riparian conditions to improve watershed health and use by anadromous fish. Therefore, it has become a priority to improve and maintain access to the timberlands from the existing road system.

It has been documented that forest roads can contribute significant sediment to streams. Increased stream sediment can result in cemented gravels reducing salmonids ability to spawn and/or inhibiting salmonid fry emergence. High sediment levels can also cause pool filling and associated reduction in pool habitat. Extreme sediment loads can cause stream temperatures to be elevated due to the reduction in stream depth. Near stream roads can also reduce stream shading where the road is very wide or very close to the stream. Reduced stream shading has been linked to increased water temperature which stresses juvenile salmonids.

The Garcia River, Gualala River and Big River have been identified by the EPA and are on the 303(d) list of impaired waterbodies. The listed stressors include sediment and temperature. The Gualala is also listed for Aluminum on the mainstem downstream of The Fund's property. Placement of a waterbody on the 303(d) list acts as the trigger for developing a sediment control plan, called a TMDL, for each water body and associated pollutant/stressor on the list. At this time the Garcia River is the only river that has an action plan for the TMDL and many of the sediment reduction activities in this document have been adopted to conform to the Garcia TMDL and are implemented throughout the ownership.

Recent management practices by TCF and previous landowners have reduced road related stream sedimentation and improved long-term road stability. Specifically many bridges and multi-plate culverts have been installed to replace standard culverts on class I streams. Class II watercourse crossings have been rock armored and new culverts buried to grade. Watercourse and Lake Protection Zone (WLPZ) roads have been rocked or otherwise improved to reduce stream sedimentation caused by near stream roads. Many other forest roads have been rocked and drained by outsloping or use of rolling dips. The use of ditch reliefe culverts is being minimized to reduce the potential for culvert failure and road maintenance costs.

Objectives

The Conservation Fund is committed to continue this trend of road improvement over time and has developed and will continue to refine this Road Maintenance and Improvement Plan to:

1) Reduce sediment inputs resulting from the existing road network as well as reduce inputs from new roads.
2) Develop proactive measures to help reduce stream sedimentation as a result of road runoff and cooperate with regulatory agencies involved with timber harvest planning.
3) Develop a timeline for road maintenance activities.
4) Act as a guide to foresters who are actively developing timber harvest plans or other projects on the properties.

Planned road maintenance will be in conformance with The Conservation Funds overall forest management goals. The Conservation Funds immediate goal for new properties is to maintain access through grading and maintaining existing mainline roads. These roads form the core of the road system and provide access for fire suppression, log hauling, wildlife surveys, future road improvement and abandonment projects and other management activities. It is expected that maintenance and improvements of secondary roads will be carried out in conjunction with Timber Harvest Plans or as part of larger Watershed Improvement projects.

Timeline

It is The Conservation Fund's goal is to develop a road system which provides access to the property for timber harvest, fire protection and wildlife resource monitoring while reducing annual maintenance activities and expense and potential watershed impacts. It is expected that the property will generally be managed with unevenage silvicultural systems and a 10-20 year re-entry period. Most road improvement projects will generally be done in conjunction with THP's and therefore the timeline to rotate through the property with road upgrades will be similar as the overall harvest schedule (within the first 20 years). Projects which require a 1603 stream alteration permit and do not otherwise qualify as an emergency repair will necessarily be conducted in conjunction with timber harvests or another CEQA project.

The Conservation Fund will conduct property wide assessments of all the roads on each tract using the road inventory and assessment system developed by Pacific Watershed Associates and others. The assessments will be used as a planning tool to prioritize sites for repair and to assist in the evaluation procedure for road decommissioning.

Road Maintenance and Improvement Guidelines

The purpose of this section is to aid resource professionals to identify forest road attributes that will assist in determining whether a road should be maintained in its current configuration, reconfigured with upgraded drainage structures or decommissioned. Some of the primary objectives and constraints identified during land management planning were: 1) Improve fisheries and wildlife habitat. 2) Maintain or improve the current level of access. 3) The landowner is willing to bear higher management costs in the future that arise from reconfiguring the roads if it results in other operational and environmental benefits.

To reduce sediment delivery from the road surfaces emphasis will be placed on increasing the number of drainage points along roads and reducing the potential for diversion at culverted watercourse crossings. On low gradient roads (0-4% grade) roads will be primarily drained by outsloping with occasional dips or ditch relief as necessary. On higher gradient roads (5-10+% grade) roads will be drained primarily with rolling dips in combination with outsloping and inboard ditch relief culverts as necessary. It is expected that most roads will be improved so as to be drained by a combination of out sloping with rolling dips. However ditch relief culverts cannot be completely abandoned and will be used where necessary. To reduce sediment from watercourse crossings up to 3 criteria will be met: 1) New culverts and culverts proposed for replacement will be sized to meet the 100 year storm event. 2) New or replaced culverts will be installed such that the culvert is at stream grade and deep enough that a critical dip can be constructed to provide protection against stream diversions. 3) A trash rack or stake shall be installed upstream of the culvert to catch or turn debris prior to reaching (and blocking) the pipe.

New roads will be designed with gentle grades wherever possible and long rolling dips will be constructed into the road or the road shall be outsloped to relieve surface runoff. Where possible watercourse crossings will be designed such that road grades dip into the crossing and then climb out of the crossing, eliminating the need for abrupt critical dips. Crossings will be rock fords or temporary crossings on secondary roads which see only periodic activity to reduce maintenance requirements. Minor crossings on permanent roads can be converted to rock fords over time.

The Handbook of Forest and Ranch Roads prepared by Weaver and Hagans 1994 will be used as a guideline for all proposed road construction and improvement projects. Specific projects and locations will be mapped and site specific prescriptions for each project will be included in the appropriate THP, TMDL, SSMP or other guiding document.

<u>Road Abandonment Plan</u>
There are three criteria to consider in determining which roads can be abandoned. The first is focused on environmental considerations. Roads located near (within the WLPZ) of a class I or class II stream or constructed on unstable slopes such as active landslides or headwall swales are likely candidates for abandonment due to their potential contribution to in-stream sediment. Road construction across headwall swales and unstable slopes can result in mass wasting events, delivering large amounts of sediment to the watershed. They pose an ongoing maintenance problem caused by constant bank sloughing which block roads and plug ditches and culverts.

The second criterion is that roads to be abandoned must not cut off or substantially reduce access to areas where future management is anticipated. In the case where a road has been determined to be undesirable due to its location but access is still required the landowner is obliged to maintain the existing road or find another route. Reconfiguring the road network is a difficult, time consuming and costly task and will have long term effects on management activities. The likely result is that any new road system will be designed for yarder logging and to minimize the total road mileage.

The third criteria is that road abandonment does not result in the construction of a replacement road that is environmentally unsound. Removing a road from a stream zone with the intent of moving upslope can require that the landowner make a value judgment between, for example, a near stream road and a road constructed on steep slopes with multiple watercourse crossings. Improving existing roads with rock surfacing, rolling dips and oversized culverts or bridge installation is generally the least costly alternative compared to relocating a road system and should be considered when no clear beneficial alternative is available.

In areas with excess roads it may be desirable to abandon or decommission roads or reduce their status to “temporary” to reduce potential sediment delivery. Temporary roads and decommissioned roads are similar in that permanent and temporary watercourse crossings are removed for an indefinite period of time. Road decommissioning differs from abandonment in that a decommissioned road may be rebuilt at a later date if in the opinion of the land owner it is the least damaging alternative.

The economics of road abandonment also contributes to the decision making process. Unfortunately it is not practical to use a “one size fits all” prescription for road abandonment. Some roads, which appear to be poorly located, may have to remain in place because they service a larger area with good arterial roads. While it may be physically possible to relocate a road it may not be in the best interests of the landowner to do so due to the excessive cost involved . The types of roads which will be a priority to evaluate as potential candidates for abandonment are listed below.

1. Roads that parallel watercourses and dead end in landings are good candidates for abandonment or repair because of their proximity to streams and their lack of arterial roads. These are the highest priority because they can be abandoned or decommissioned without impact to future management.
2. Roads that cross unstable areas or headwall swales can be abandoned if alternate routes exist to both ends of the subject road. Roads crossing unstable areas are deemed to be the second priority for abandonment because there are fewer roads on unstable slopes than WLPZ roads and the management implications and fieldwork necessary to make an informed decision will delay the decision making process.
3. Long term plans should include abandonment and replacing or upgrading roads that are poorly located but are necessary in the short term for forest management.

It is felt that proper implementation of this plan will reduce the potential for excess runoff and diversions common to forest roads. Over the long term the reduction in stream sedimentation will improve salmonid habitat conditions and reduce yearly maintenance costs.

CERTIFIED PRODUCT CHAIN-OF-CUSTODY PROGRAM
For The Conservation Fund's North Coast Forest Conservation Program
March 1, 2010, revised September 2012

Note to Licensed Timber Operators, Log Haulers, and Log Buyers

This document is being provided to you because it is required by The Conservation Fund's certification under the Forest Stewardship Council standard for forest management and chain-of-custody for logs. The purpose of this policy is to ensure that wood products which originate on our properties are appropriately accounted for and do not become inappropriately labeled. All logs generated on our Mendocino properties are certified under the Forest Stewardship Council US Forest Management Standard (v.1.0) and Sustainable Forestry Initiative Standard (section 2). Use of the Forest Stewardship Council logo or other origin claims is restricted to those facilities that have undergone an independent certification of their compliance with the Forest Stewardship Council Chain-of-Custody standard. The Conservation Fund's participation in this program should not impose any additional burdens on our contractors and customers other than standard log security and accounting. If you have any questions about this policy, please contact Scott Kelly at (707) 272-4497.

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Forest Certification Status

The Conservation Fund's North Coast timberland (Garcia River, Big River, and Salmon Creek, Mendocino County, California) were certified as sustainably managed by the Forest Stewardship Council and the Sustainable Forestry Initiative on October 12, 2007. The Gualala River Forest was certified in 2012. Buckeye Forest, Sonoma County, California will be certified in 2014. Audits are conducted annually to ensure continued eligibility and are available at http://www.conservationfund.org/our-conservation-strategy/focus-areas/forestry/north-coast-conservation-initiative/north-coast-forest-reference-documents/

Section 1, Control System Documentation

1.1 The Conservation Fund has implemented a documented control system in order to responsibly track log sales under Generally Accepted Accounting Principles (GAAP) and to address the Principles of Chain-of-Custody control as set forth by the FSC.

1.2 The Conservation Fund's designated Chain of Custody Control Administrator is Scott Kelly, the senior forester responsible for, among other things, log sales and harvest administration. Scott Kelly is responsible for education of employees and contractors, as well as for implementation of the documented control system for Chain of Custody of FSC-certified wood products sold by The Conservation Fund from its properties in Mendocino County, California.

1.3 Scott Kelly is assisted in this documentation by Margery Hoppner, staff accountant, who manages the log sale accounting process and reconciles trip tickets, scale records, mill receipts, and contractor payments.

1.4 A sample Trip Ticket and Log Sales Record are attached at the end of this document. Instructions for the trip ticket are provided to the log hauler. Instructions for the Log Sales records are contained in The Conservation Fund's accounting procedures manual.

Section 2, Confirmation of Inputs

2.1 The Conservation Fund is engaged in the business of selling logs and does not purchase logs or any other FSC-certified wood products. Therefore, confirmation of inputs is not applicable, except that The Conservation Fund will be responsible for ensuring that log decks in the forest contain only logs originating on that property and that log trucks exiting the property only contain logs that originated on the property.

2.2 It may be required for The Conservation Fund or its partners to purchase small quantities of conifer logs for installation in streams as restoration projects. Those logs are intended for permanent installation and will not be considered an input for the purpose of Chain of Custody accounting.

Section 3, Separation/Demarcation of Inputs

3.1 The Conservation Fund has a system for ensuring that FSC-certified products are clearly identified. The Conservation Fund timber harvest and log sale activity is only conducted for The Conservation Fund's properties, all of which are certified. Thus, there are no non-FSC products involved.

3.2 Physical separation/segregation of certified and non-certified products is achieved by not involving any non-certified logs in The Conservation Fund's activities. There are no inputs (either certified or not), thus no non-certified logs will ever be brought on the property and mixed with certified logs.

3.3 Logs are identified as certified through paperwork supplied by The Conservation Fund to the purchasing mill.

Section 4, Secure Product Labeling

The Conservation Fund does not use on-product labels during the sale of logs. The Conservation Fund accepts the responsibility to ensure that the FSC Logo Pack and labels are not used by unauthorized users or for any unauthorized use.

Section 5, Identification of Certified Outputs

Certified products are identifiable by field marking and trip ticket paperwork that clearly identifies the purchaser and seller of the logs. The certified status of the logs is communicated in writing (through the log sales agreement and by sharing this document) by The Conservation Fund to the purchaser.

The Conservation Fund operates an accounting system that records log species, volume, and grade information for all log deliveries. This includes reconciliation between the trip tickets provided by the LTO and log hauler, scale records provided by the scaling bureau, and payment receipts provided by the purchasing mill.

Payment is issued by the purchasing mill upon receipt (and scaling) according to the terms of the log sales agreement. Because no invoices are issued it is incumbent on The Conservation Fund to communicate the certified status of the logs to the purchaser (which is done through this document and the log sales agreement). A copy of The Conservation Fund's Chain of Custody certificate will be provided to the purchasers upon request.

Section 6, Record Keeping

6.1 The Conservation Fund maintains appropriate records of all log sales (which is the same as outputs of certified products) in accordance with Generally Accepted Accounting Practices (GAAP).

6.2 The Conservation Fund's records are sufficient to satisfy a financial auditor or an independent assessor seeking to trace back any given certified product output pool or load back to the specific certified forest of origin.

6.3 The Conservation Fund's records are sufficient to allow an independent assessor to determine the rate of production of certified logs from the certified forest, as well as to determine the certified product delivered to each manufacturing facility.

6.4 All records related to certified products sold by The Conservation Fund will be kept for a minimum of five years.

Section 7, Training

7.1 The Conservation Fund will supply this procedure to all contractors and explain the COC procedures.

7.2 The Conservation Fund will include this COC procedure as an exhibit in all timber sale contracts, and train all contractors, buyers and loggers on the procedure.

7.3 The Conservation Fund will maintain a database of all personnel who have received the COC procedure and related training.

7.4 Distribution of the procedure and related training will take place with all new contractors and loggers at the beginning of a new contract or sale. Personnel who are already familiar with the procedure will receive it in each additional contract.

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TEMPLATE -- TRIP TICKET:

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150

DATE _____/_____/_______ TRUCK NO./ DRIVER _______________

TRACT NAME ___________________ THP NAME _____________________

LOGGER _______________________ SOURCE CODE ________________

FSC/SCC COC-00102N
FSC 100%

BUYER ________________________ DESTINATION ___________________

OF LOGS RW___ DF___ WF___ ww___ HW___ OTHER______________

RECEIVED BY_____________________________________ DECK NO.____________

White - Logger Canary - Trucker Pink - Mill Goldenrod - Owner

COMMITMENT TO SAFETY AND HEALTH OPERATING POLICY,
The Conservation Fund's North Coast Forest Conservation Program
Primary authors: Evan Smith and Scott Kelly.
November 28, 2011, revised September, 2012

Commitment to Safety and Health

A. Safety and Health Policy

The Conservation Fund (TCF) is firmly committed to maintaining a safe and healthful working environment across all its offices and programs. This document guides TCF activities on its California timberlands to ensure safe operations. To achieve this goal TCF has implemented a comprehensive Injury and Illness Prevention Program. This program is designed to prevent work place incidents. The designated Safety Coordinator is responsible for monitoring the performance of each team member to ensure compliance in conducting an affective Injury and Illness Prevention Program.

Special statement on forestry-related risk--The field of forest management inevitably involves travel, heavy equipment, challenging terrain, and variable weather conditions—all serious contributors to risk. All employees and contractors should be cognizant of those risks and develop the judgment to evaluate conditions and act in a safe manner. Driving to and from the forest is probably the most dangerous activity we engage in—it is very important that we slow down and pay attention. The most important piece of safety equipment is what sits under the hardhat, behind the safety glasses, and between the ear plugs—use your brain! Every team member is responsible for thinking about the safety of themselves and everyone else present. TCF's North Coast program is a loosely-organized team of employees, contractors, consultants, partners, and volunteers—we rely on these individuals to exercise good safety skills. It is critical that we be cognizant of the conditions around us and the safety preparedness of those around us and those that might visit the site later. We owe it to ourselves and the families of those we work with to conduct all our activities safely.

Each individual is responsible for their own safety at the work place. The safety coordinator can assure that programs and policies are in place to provide for a safe working environment however it is the responsibility of the individual to implement the safety policies and make their own working environment as safe as possible.

Specific policies—

1. *No alcohol or drug use on the property.*
2. *Maintain a daily log of where people are working and an emergency contact system in the event of an emergency or someone not returning in a timely fashion. Each employee has been issued a SPOT GPS device, which tracks an employee's location and allows an emergency signal to be sent. This device has essentially replaced the daily log.*
3. *Remind visitors and tour participants of potential risks and necessary precautions.*

4. *Annual safety training will be developed for everyone that works in the woods if it is not already part of their professional licensing requirements (eg Licensed Timber Operator).*
5. *First Aid Kits are available in the TCF office and vehicles.*
6. *Indications of illegal marijuana cultivation will not be investigated by field staff but reported to the property's security patrol who will report it to law enforcement personnel.*

B. Vehicle Operation

Driving to and from the forest is probably the most dangerous activity we engage in it is very important that we slow down and pay attention while operating company vehicles on the street or on company lands. Driving in the forest exposes the driver to narrow winding gravel roads which can be very slick when wet and require extra caution when operating a motorized vehicle.

- All persons operating a vehicle on company property are required to possess a valid driver's license.
- All persons operating an ATV or other off road vehicle shall have received proper training from a certified ASI Rider Course Instructor or equivalent. To enroll in an ATV Rider Course, call the national, toll-free enrollment number, 1-800-887-2887.
- Use common sense, do not drive in dangerous conditions or terrain beyond your ability to safely operate the vehicle, when in doubt, slow down or walk.

C. Chainsaw Operation

Staff is required to read the owner's manual carefully before operating a chain saw. Wearing proper safety equipment and protective clothing is required. When using a chainsaw be sure to keep the cutting area clear of spectators, note any overhead hazards, including hanging tree limbs and utility lines, keep the chain clean, sharp and lubricated, keep both hands on the saw handles, and let the saw come to a complete stop before reaching for the chain or blade. For further safety regulations regarding chainsaw usage please consult http://www.osha.gov/OshDoc/data_Hurricane_Facts/chainsaws.pdf

D. Herbicide Application

Only Certified Pesticide Applicators may apply herbicides. Staff will read and follow all chemical label directions. Apply herbicides at minimal levels in accordance with the label and targeted to specific weed problems. Wearing proper safety equipment and protective clothing is required. A notice of intent must be submitted to Mendocino County 24 hours prior to application; a pesticide use report must be filed by the 10th of the month; herbicides should be contained and not be allowed to drift unto a neighboring property; and immediately notify Mendocino County Agriculture Commissioner of any changes to our permit. To promote transparency and communication, TCF will post signs in the forest at the locations where herbicides are proposed for use 30 days prior to their

application. For more information please consult
http://www.epa.gov/oppfead1/safety/resource.htm

E. Personnel Safety

Many minor injuries such as cuts, scratches, bee stings, and ankle sprains can be prevented by wearing proper safety equipment or protective clothing. When working in the woods around heavy equipment all personnel shall wear hardhats and boots. Long pants are also required while working in the forest. Other recommended personal safety items include:

- Eye Goggles
- Ear Plugs
- Long sleeve shirt
- Gloves
- Tecnu or other poison oak prevention treatments.

F. Contractor Safety & Training Policy

The Conservation Fund shall only employ contractors that have good safety records and up-to-date training. Specifically, only Licensed Timber Operators in good standing may conduct timber harvesting operations and only Certified Pesticide Applicators may apply herbicides. Prior to the start of each work project (e.g. logging job, road opening, weed control treatment, etc) the Safety Officer will conduct a discussion of the safety concerns and ensure contractors are aware of TCF's safety expectations. For professions that do not have formal licensing requirements that address safety, such as consulting biologists and botanists, The Conservation Fund will emphasize the importance of accident avoidance and communication and seek to resolve any safety concerns they may have.

G. Company Housekeeping Policy

Good housekeeping is a critical part of the safety program. Keeping work areas neat and clean reduces the risk of on the job injuries. Well organized work areas increase the ability of employees to perform their jobs efficiently and safely. In addition a clean workplace is a source of good morale, improved quality and partner satisfaction. Each employee is responsible for keeping his or her work area neat and orderly. Housekeeping inspections may be conducted as part of regularly scheduled or impromptu safety inspections.

II. PERSON(S) WITH AUTHORITY AND RESPONSIBILITY FOR IMPLEMENTING THE PROVISIONS OF THIS INJURY AND ILLNESS PREVENTION PROGRAM (IIPP)

The North Coast Timberlands Manager shall serve as the Safety Coordinator, with authority and responsibility for implementing the provisions of this program.

Responsibilities assigned to the Safety Coordinator, Site Supervisors, and Employees are described in general on the following pages.

All employees and contractors of TCF are responsible for working safely and maintaining a safe and healthful work environment. It is a condition of employment.

The North Coast Timberlands Manager will assume the overall responsibility for this program as the Safety Coordinator. These duties include:

- Ensuring that adequate financial, personnel and material resources are available, including identifying safety leaders for projects and training needs.

- Ensuring employees receive specific training for each task they are expected to perform, and whenever new processes or chemicals are introduced into the workplace.

- Leading by example.

- Recognizing safe work practices as part of performance reviews.

- Encouraging employee involvement.

- Investigating and correcting any unsafe action or condition reported to them.

- Holding employees accountable for poor safety performance by utilizing re-training and company disciplinary procedures.

All TEAM MEMBERS (employees, contractors and lead partners) will be responsible for the implementation of this program at his/her work area. These duties include:

- TAKING PERSONAL RESPONSIBILITY FOR THEIR OWN SAFETY AND THE SAFETY OF OTHERS.

- Understanding that working safely is a condition of employment.

- Participating in developing safety rules, procedures, and improvements.

- Obeying safety rules, procedures and work practices.

- Wearing all required Personal Protective Equipment (PPE).

- Reporting all injuries, no matter how minor, to their supervisor immediately.

- Reporting all "near-misses" and hazardous conditions to their supervisors.

- Participating in the safety effort by demonstrating an understating of training received and the ability to perform tasks safely.
- Participating in tailgate and general safety meeting.
- Learning to manage “self-safety” by developing proactive (prevention) skills in decision-making.
- Communicating safety suggestions to supervisors or contract representatives.

III. **SYSTEM FOR ENSURING THAT ALL WORKERS COMPLY WITH SAFE AND HEALTHY WORK PRACTICES:**

A. Informing employees of the provisions of our Injury and Illness Prevention Program (IIPP):
B. Recognizing employees who perform safe and healthful work practices.
C. Training employees whose safety performance is deficient; and
D. Disciplining employees for failure to comply with safe and healthful work practices.

IV. **SYSTEM FOR COMMUNICATING WITH EMPLOYEES:**

A. Safety Meetings

TCF requires frequent tailgate meetings with individual work-groups to discuss safety issues and resolve problems. At a minimum, employees will be exposed to ½ hour per month of safety training/discussion. Also, tailgating will be held whenever work conditions change – e.g. foresters moving from burning to marking trees, contractors working at a mill site in an area which affects employees, special construction or maintenance projects are taking place, etc. to alert and/or remind employees to potential hazards.

B. Training

All employees will receive an overview of the IIPP during their initial orientation and can review a copy provided by their supervisor. Additional training, such as First Aid and Interagency Wildland Fire Certification, will be made available on an as needed basis. Employees and contractors that desire additional training should notify their supervisor or the Safety Officer.

C. Written Communications

TCF produces informational memos and handouts covering various safety topics. These sources of communication are posted for review by all employees. They include safety inspection reports and safety committee meeting minutes.

TCF's written IIPP is also assessable to all employees.

D. Anonymous Notification Procedures

TCF has a system of anonymous notifications whereby an employee who wishes to inform TCF of work place hazards may do so anonymously by notifying Safety Coordinator in writing or over the phone. The Safety Coordinator shall investigate, or cause to be investigated, all such reports in a timely manner.

V. HAZARD IDENTIFICATION

TCF will identify and evaluate work place hazards when the program is first established; whenever new substances, processes, procedures, or equipment are introduced to the work place that represents a new occupational safety and health hazard and whenever TCF is made aware of a new or previously unrecognized hazard.

A. General Elements To Identify and Evaluate Work Place Hazards
   1. Review of applicable General Industry Safety Orders and other safety orders that apply to the operation.
   2. Review of industry and general information (including Material Safety Data Sheets for chemicals used) about potential occupational safety and health hazards.
   3. Investigation of all incidents and unusual events that have occurred at these facilities.
   4. Periodic and/or scheduled inspections of general work areas and specific work stations.
   5. Evaluation of information provided by employees.

B. New Safety and Health Concerns

It is a requirement of all employees and contractors to notify the Safety Coordinator and provide appropriate documentation (location, MSDS, potential hazards, etc.) regarding any new substance, process, or equipment prior to its introduction to the workplace.

C. Employee Reporting of Hazards

Employees are required to immediately report any unsafe condition, unsafe action or other hazard that they discover in the work place to their supervisor or any safety committee member. No employee will be disciplined or discharged for reporting potential work place hazards or unsafe conditions.

Employees who wish to remain anonymous may report unsafe conditions as described above.

VI. PROCEDURE TO INVESTIGATE OCCUPATIONAL INJURY OR ILLNESS

A. Employee Responsibility

Employees shall immediately report all injuries occurring at work, no matter how slight, to their supervisor.

B. Supervisor's Responsibility

It is the Supervisor's responsibility to complete an Incident Investigation Report and, IF THE INJURED NEEDS TO GO TO A MEDICAL PROVIDER OFF-SITE, TO ACCOMPANY THE INJURED. The Supervisor will immediately alert the Safety Officer of any injuries requiring treatment other than first aid.

C. Incident Investigation Procedure
Incident where a hazard or condition persists after the occurrence of an incident, incidents where there is a potential for recurrence, and incidents where the Safety Officer judges that procedural or training deficiencies may have contributed to the incident will be investigated.

They may be investigated by the supervisor and employee only, an appointed investigator, or an incident review team depending on the nature and/or severity of the incident.

Employees have the right to an independent investigation by someone other than their supervisor if they feel additional investigation is necessary. All incidents will be investigated at the time of occurrence, or as soon thereafter as possible, but in no case later then twenty-four hours.

When appropriate, these investigations may include complete statements from the employee(s) involved, any witnesses to the injury and the injured employee's supervisor. A copy of all Incident Investigation Reports will be forwarded to the Safety Officer for review. Employees who do not cooperate with incident investigations will be subject to TCF's disciplinary policy.

VII. PROCEDURE TO CORRECT UNSAFE OR UNHEALTHYCONDITIONS, WORK PRACTICES, AND WORK PROCEDURES IN A TIMELY MANNOR BASED ON THE SEVERITY OF THE HAZARD.

A. Workplace Hazards

The causes of all incidents will be documented and reviewed immediately. Corrective actions including condition repair/modifications, retraining or disciplining for unsafe actions will be initiated immediately. Safety procedures will be reviewed, if necessary, by the combined efforts of the affected employees, supervisors and safety manager and or safety committee. Training programs and safe job operating procedures will also be modified, if appropriate, to prevent reoccurrence.

B. Imminent Hazards

When an imminent hazard exists which cannot be immediately abated without endangering employees and or property, all exposed employees will be removed from the area except those necessary to correct the existing condition. Employees needed to correct the hazardous condition shall be provided with the necessary training and Personal Protective Equipment. All such actions taken and dates they are completed shall be documented.

VIII. PROVISIONS FOR TRAINING AND INSTRUCTION

A. Policy

Awareness of potential health and safety hazards as well as knowledge of how to control such hazards is critical to maintaining a safe and healthful work environment. TCF is committed to instructing all employees in safe and healthful work practices. To achieve this goal, TCF shall provide training to each employee with regard to general safety and emergency procedures. Training shall also be provided by the effected employees' supervisor for any hazard or safety procedure specific to the employees work assignments as mandated by regulations or company safety programs. Records of all training shall be maintained in employee files.

B. When Training Will Occur.

1. When the program is first established.
2. To all new employees.
3. To all employees given a new job assignment for which training has not previously been received.
4. Whenever new substances, processes, procedures or equipment which represent a new hazard are introduced into the workplace.
5. Whenever TCF is made aware of a new or previously unrecognized hazard.
6. Whenever an employee, through observation or investigation is found deficient, they will be retained.

Supervisors must familiarize themselves with the safety and health hazards to which employees under their immediate direction and control may be exposed. Supervisors *shall be responsible to provide their employees with safety training to minimize or eliminate such exposure.*

C. Areas of Training

All areas or items identified in the IIPP.

All areas or items identified as specific to the performance of any task.

IX. RECORDS OF THE STEPS TAKEN TO IMPLEMENT AND MAINTAIN THE PROGRAM

Records of scheduled and periodic inspections to identify unsafe conditions and work practices, including person(s) conducting the inspection, the unsafe conditions and practices that have been identified and the action taken to correct the identified unsafe conditions and work practice. These records shall be maintained for at least one year. Documentation of safety and health training for each employee, including employee name or other identifier, training dates, types of training, and training providers. This documentation shall be maintained at least one year.

Social Benefit/Impact Assessment Memo
The Conservation Fund's North Coast Forest Conservation Program
Primary authors: Jenny Griffin and Evan Smith
Original: August 25, 2008; Updated September 2012

social: L socialis, fr. socius companion, ally, associate; akin to L sequi to follow. Of or relating to human society, the interaction of the individual and the group, or the welfare of human beings as members of society (Websters Seventh New Collegiate Dictionary, 1972).

The Conservation Fund's North Coast Forest Conservation Program endeavors to have a very positive impact in our local community. This is due in part to our charitable mission as a non-profit organization, which is broader than just environmental protection, and references economic development and education. It is also explicitly addressed as part of the Garcia River Forest Integrated Resource Management Plan:

"The Plan identifies and describes in detail the following general management goals:

- *Improve ecological conditions by increasing the viability of selected "conservation targets" identified during the planning process.*
- *Generate sufficient revenue to cover the costs of property taxes, on-site maintenance, management and restoration projects and, potentially, generate net revenues for other conservation initiatives.*
- *Practice continual improvement through adaptive management based on monitoring of ecological, financial and social values.*
- *Support the local business community by utilizing local contractors and suppliers.*
- *Engage the local community by providing compatible public access, educational and recreational opportunities."*

We pride ourselves on being very cognizant of and sensitive to the potential social impacts (positive and negative) of our forest management activities and the role we play in the community.

We have identified five primary social elements as integral to our program and organize our evaluation of potential social impacts/benefits around these elements. We have not had a formal prioritization of these elements—all are important for our evaluation and monitoring. The five elements, and examples of how they are addressed, are:

- Creative arts (eg. College of the Redwoods and Mendocino Art Center photography and painting workshops, elementary school writing and art projects, etc.)
- Economic/financial (e.g. employment, log sales, carbon sales, etc.)
- Recreational (e.g. interpretive walks, passive recreational access, Boy Scouts and Sierra Club hikes, Audubon trips, etc.)
- Science/education (e.g. EMAP project, UC Davis research, Humboldt State and other surveys, SONAR projects, PWA workshops, stakeholder tours, etc.)
- Spiritual (e.g. open space values, Children and Nature programs, Leopold and Thoreau philosophy-based programs, and access/utilization by Native tribes)

We consider social benefits as an integral part of our management planning. The social elements are assessed and described in various sections of our forest management plans, which include policies on such issues as recreational access, scientific monitoring priorities, and preference for local goods and services. In addition to management planning, our operational decision-making also includes evaluation of potential social impacts—ranging from maintaining a viable logging industry to resolving the concerns of a neighbor. Our forest management policies have very clear requirements for community engagement and local procurement—we require that every timber harvest plan and major watershed restoration project have publicly available summaries and provide opportunities for field tours before and after operation. We continually ask for feedback from the local community through tours and informal meetings and routinely adjust programs or projects to address concerns. As described above, having a positive impact in the community is a program objective; we evaluate our success at meeting this objective as part of our annual operations review. The discussion and results of the annual operations review then inform the next year's workplan and as appropriate will be included in updates to the management plans.

As part of our annual monitoring, we publicly report (via the Annual Review) our data on key activity metrics. Most relevant to this topic is reporting on local economic contribution, participants in our public access program, and number of public tours we host. In addition to these three metrics that seem to best track the community interest, we usually also include short features on specific harvests, restoration projects, or safety issues. We also keep a log of any criticisms the program receives and how those are resolved. These metrics and concerns are also reviewed annually by the local Advisory Council.

APPENDIX I

The Conservation Fund Option A

Plan to Determine Long Term Sustained Yield

Scott Kelly, North Coast Timberland Manager, RPF 2408

Version 3/26/14

Contents

Tables

Figures

1. Introduction

This document is intended to describe the sustainable management and harvest levels for The Conservation Fund's timberlands in Mendocino County, California. In 1973 the California Board of Forestry and Fire Protection (the Board) adopted the Z'berg-Nejedly Forest Practices Act authorizing the development and implementation of the Forest Practice Rules (FPRs) which govern timber-harvest-related activities on private and non-federal public forestlands in California. In 1994, the Board passed a series of regulations that require timberland owners to demonstrate "Maximum Sustained Production of High Quality Timber Products" (MSP) by either, (1) submitting an "Option A" timber harvest plan, (2) preparing a sustained yield plan ("Option B"), or (3) following a set of prescriptive silvicultural requirements ("Option C"). The three options for meeting the MSP requirement are named after Forest Practice Rules sections 913.11 (a), (b), and (c), respectively.

The Conservation Fund (TCF) currently owns and operates 53,403 acres of redwood and Douglas-fir forest land in Mendocino County, California, made up of the following tracts of land:

- Garcia River Forest, 23,769 acres, acquired in 2004
- Big River Forest, 11,707 acres, acquired in 2006
- Salmon Creek Forest, 4,213 acres, acquired in 2006; and additional adjoining 177 acres purchased in 2011
- Gualala River Forest, 13,537 acres, acquired in 2011.

All properties are permanently protected from development through conservation easements (held by The Nature Conservancy for Garcia and Gualala) and an Offer to Dedicate (held by the Wildlife Conservation Board for Big River and Salmon Creek). As described further below, this Option A is set up with separate descriptions and calculations of LTSY for each property to provide greater transparency regarding our management and operations. TCF anticipates that it will occasionally own other properties as part of its conservation real estate business that it does not anticipate conducting forest management operations on, those properties will not be included in the Option A.

TCF has elected to submit an Option A per California Forest Practice Rules 14CCR 913.11, which addresses management effects on timber resources, while considering watersheds, fisheries, wildlife, recreation, and employment. MSP is demonstrated by modeling specific silvicultural regimes while considering non timber resources such as stream zones, wildlife habitat requirements, visual resources and conservation easements. The results are termed The Long Term Sustained Yield.

In preparing this document we strove to follow the Guidelines for completing an Option A as described in the California Forest Practice Rules (14 CCR 913.11 (a)) by presenting an analysis of the following forest resources across TCF's ownership:

- Forest growth and harvest levels considering the proposed harvest regimes,
- silviculture implemented to realize the stated goals of the plan,

- consideration of non-timber forest values, including Watercourse and Lake Protection Zones, wildlife habitat retention, recreation, and visual considerations as they relate to the long term sustainability of the forest, regional economic vitality and employment and aesthetics.

1.1 Description of The Conservation Fund Forestlands

Orientation. The Conservation Fund owns and operates 53,403acres of redwood and Douglas-fir forest in four properties located between Fort Bragg and the Sonoma County border. The lands are segregated into four discrete management units which were acquired through four separate acquisitions. The Garcia River Forest was acquired in 2004. The Big River and Salmon Creek Forests were acquired in 2006, and the Gualala River Forest was acquired in 2011. The 177 acre Hardell property was also acquired in 2011 and is managed as part of the Salmon Creek Forest. The goal of the acquisitions is to protect the land in perpetuity from development or timberland conversion and maintain them as working commercial forests managed for timber production, wildlife habitat preservation and enhancement, as well as limited recreation. Funding for the purchases was made possible through low interest loans, grants from the Wildlife Conservation Board and State Coastal Conservancy, and private contributions from The Nature Conservancy, TCF and other organizations.

Location. TCF's forestlands are situated in the coast range of California from Highway 20 and west of Highway 101 extending south to the Sonoma County line. The Big River Forest (11,707 acres) is primarily within the Big River watershed adjacent to and south of Jackson Demonstration State Forest and Highway 20. Salmon Creek (4,204 acres) is in the Big Salmon Creek watershed bounded by Albion Ridge Road on the North and Navarro Ridge Road on the South. The Garcia River Forest (23,780 acres) is primarily within the Garcia River Watershed, bordered by Mountain View Road on the north and Fish Rock Road on the south. The Gualala Forest (13,542 acres) is south of and adjacent to the Garcia Forest and is bounded by Fish Rock Road on the north and the Sonoma County Line on the south.

Geology. The topography of TCF’s forestlands ranges from gently sloping marine terraces along the Mendocino coastal plain in the western portions of the Big River and Salmon Creek Forests, to increasingly steep, rugged terrain in the eastern part of the Garcia and Gualala Forests. The Geology of the Coast Range is underlain by a variety of marine sandstones known as the Franciscan Formation. The geomorphology of the coastal mountains has been strongly influenced by two on-going processes: tectonic uplift and fluctuations in sea level. The landscape was especially affected during historic periods of low sea levels, when the coastline was farther west. During these events, streams down-cut and form deeply incised valleys with steep-sided inner gorges. Once sea level rises (as at present) and the coastline advances, streams aggrade, the deep coastal valleys partially in-fill and estuaries formed at the mouths of larger streams.

Climate. Average daily temperatures range from a high of 66.5 degrees (Fahrenheit) during July to a low of 43.6 degrees (Fahrenheit) in December. Annual precipitation ranges from 50 to 80 inches, primarily occurring in the winter.

Forest types. Redwood *(Sequoia sempervirens)* and Douglas-fir *(Pseudotsuga menziesii)* are the dominant conifer species on the forests. Other conifers present include sugar pine (*Pinus* *lambertiana*), grand fir *(Abies grandis),* western hemlock *(Tsuga heterophylla),* and Knobcone/Monterey Pine hybrid pine. Hardwoods comprise a substantial secondary component and are represented principally by tanoak *(Lithocarpus densiforus* var. *densiflorus)* and madrone *(Arbutus menziesii).* The mixture of species shifts with distance from the coast, harvest history of the area, exposure, and soils. Redwood is dominant in the western portions of the properties with Douglas-fir and hardwood increasing from west to east. Some of the inland areas would be classified as Douglas-fir series by Sawyer and Keeler-Wolf (1995), and Holland (1986).

Unique ecological communities. As part of TCF's management planning process we have identified unique areas that are reserved from harvest. The Mendocino Pygmy Cypress Forest is a unique ecological community that occurs only in coastal Mendocino County and within the TCF ownership is only present on the Salmon Creek Forest. The California Natural Diversity Database (CNDDB) recognizes it as a community that is "rare and worthy of consideration" (2003). The pygmy forest series covers approximately 7 acres in Salmon Creek. It is reserved from harvest modeling for the purpose of calculating LTSY.

True oak stands composed largely of black oak (*Quercus kelloggii*) Oregon white oak (*Quercus garryana) and* Shreve's oak *(Quercus parvula var. shrevei*) are present on the Garcia River Forest and, to a lesser extent, the Gualala River Forest. Per the TCF management policies for wildlife habitat retention, true oak stands, individual true oak trees and California Chinkapin (Chrysolepis chrysophylla) will be retained (protected from harvest) wherever possible. Known true oak stands are reserved from harvest modeling for the purpose of calculating LTSY. Currently we track 613 acres of Oak Woodlands on the Garcia River Forest and 91 acres of Oak Woodlands on the Gualala River Forest in our GIS database.

In addition to these unique ecological areas, we also reserve from harvest planning certain riparian buffers and Northern Spotted Owl Activity Centers, as described further in Section 4: Non Timber Resources.

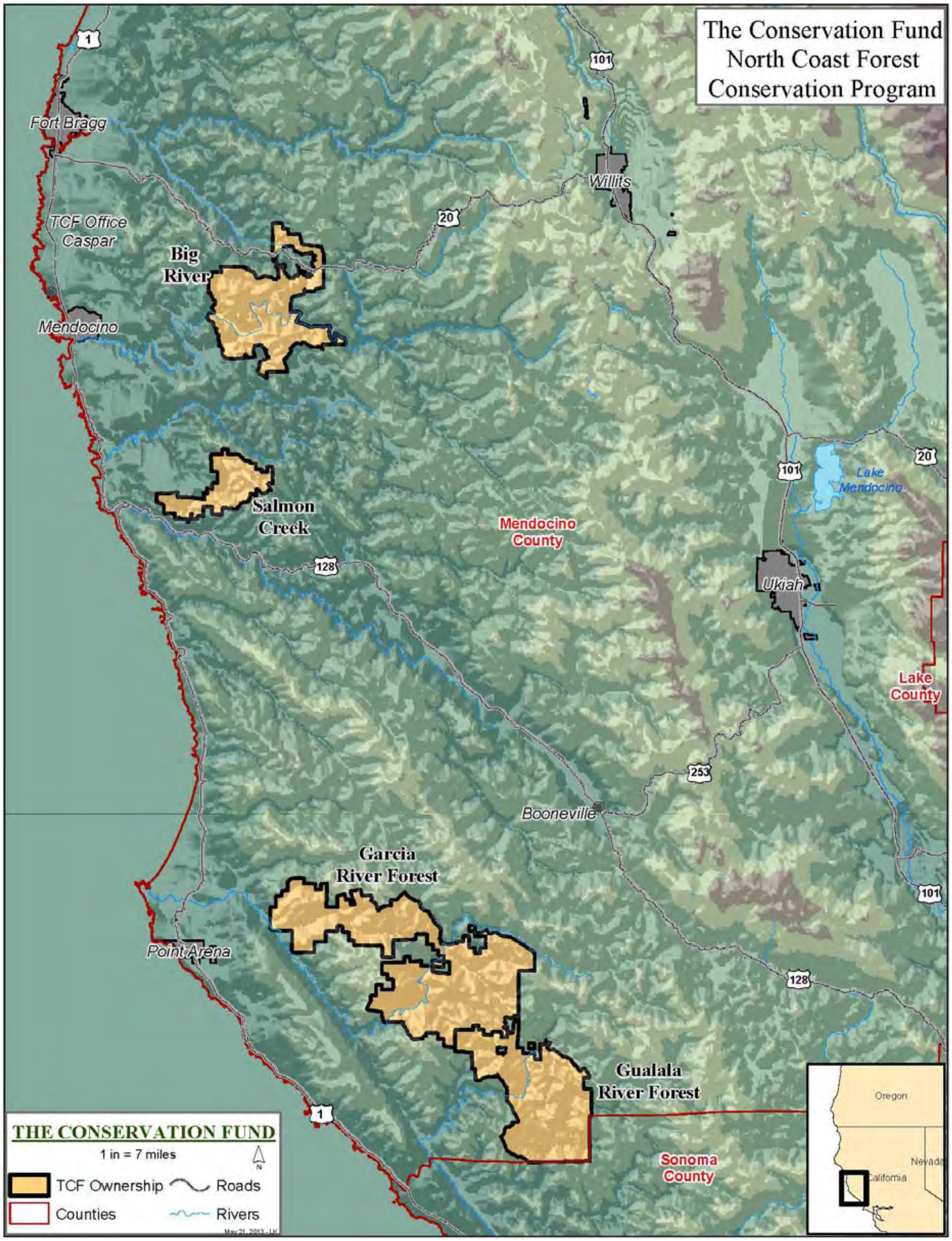


Figure 1: Location Map

Harvest History. All of TCF's ownership has been managed for forest products since the late 1800's or early 1900's. Early harvest efforts started at the mouths of watersheds and progressed upstream and up-slope to the ridgelines. Initial logging activities generally clearcut the old growth forests, then burned the slash while the logs were still on the ground before yarding them downhill to the river systems. Oxen were used to pull logs to mills or river systems. The rivers often served as the transportation routes to the mills and splash dams were commonly used to transport logs downstream on Big River. Subsequent entries into the forests further inland were commonly accomplished with steam donkeys and railroads. During the 1940s, crawler tractors replaced steam donkeys to yard logs and trucks replaced railroads to transport logs to the mills.

Improvements in technology and markets, coupled with tax laws in the 1940s and 1950s that encouraged landowners to remove 70% of their conifer stocking resulted in harvests that removed the larger, healthier trees leaving inferior trees and poorly stocked forests. Since that time the forests have been regrowing and harvested with variable intensities often in response to changes in ownership which necessitated harvesting to "pay for the land". Until the passage of the Z'Berg Nejedly Forest Practice Act in 1973, and the subsequent development of the Forest Practice Rules, little effort was made after harvest to ensure that harvested areas were restocked. The resulting forests consisted of unnaturally high densities of competing vegetation, primarily tanoak. This condition limited the ability of redwood and Douglas-fir to grow and achieve historic stocking levels in some stands.

Recent Harvests. More recent harvests by previous landowners on Salmon Creek and Big River have utilized the clearcutting regeneration method which has produced a variety of well-stocked 5-30 year old plantations. The selection regeneration method, where used, has resulted in unevenage or uneven size class forests with tree ages ranging from approximately 1-120 years of age. Recent harvests by the previous landowners on the Garcia and Gualala Forests predominantly utilized shelterwood removal or seed tree removal prescriptions which have resulted in young even-aged stands ranging from 30-60 years of age. Though conifers dominate the forests overall, tanoak and other hardwood species dominate some of the younger stands and lower quality sites found in the Garcia and Gualala Forests. Past silviculture has been market driven and has also influenced the species distribution. Historically, redwood has been preferentially selected for harvest. Therefore the forests contain a higher percentage of Douglas-fir than would be expected to occur naturally or in the absence of a market driven harvest regime.

Current Management. All of TCF's California holdings are managed to increase conifer stocking through uneven-aged silviculture, with sustainable harvest levels and significant environmental protections. Harvests typically consist of single-tree selection with some group selection and transition silviculture, supplemented with the occasional pre-commercial thinning or hardwood reduction treatment. The intent of our silviculture is to maintain and improve conifer stocking and volume as well as wildlife habitat conditions for both terrestrial and aquatic species. By the end of the planning horizon the target stocking for Big River and Salmon Creek is 50 MBF/acre, for Garcia River and Gualala River forests the target stocking is 35 MBF/acre. The targets were chosen based on observed timber productivity for each tract, major species composition, and initial stocking. Big River and Salmon Creek are predominantly redwood site class II with average starting stocks of 21.2 MBF/acre and 27.9 MBF/acre respectively, whereas Garcia and Gualala are predominantly Douglas-fir site class III with average starting stocks of 10.7/MBF/acre and 8.6/MBF respectively. Timber harvests will be designed such that they meet the stated silvicultural goals in an economically and socially responsible manner. Management plans and policies for each property are publicly available and regularly reviewed by a local advisory council. All of TCF's forestry operations are designed to be in conformance with all applicable law as well as the protocols of the Sustainable Forestry Initiative (SFI) and the Forest Stewardship Council (FSC). Both SFI and FSC require that our forest practices utilize best management practices, utilize silvicultural practices which are sustainable, and preserve and protect valuable fish and wildlife habitat as well as other high conservation forest values such as pygmy forests. The overall goals of SFI and FSC are complimentary to TCF's overall forest management strategy including the requirement for a conservation easement restricting timberland conversion. In addition to SFI and FSC certification, TCF has four forest carbon offset projects verified and registered using the Climate Action Reserve (CAR) Forestry Offset Protocols (versions 2.1 and 3.2). As a result TCF can sell carbon offsets generated by the forests' sequestration of CO_2. TCF is audited annually by independent third party auditors both for the SFI and FSC forest certification programs and the CAR forest carbon offset program. TCF's ability to sell carbon offsets is dependent on our ability to demonstrate that we are voluntarily harvesting less than the allowable maximum volume per year as defined by the Forest Practice Rules. This Option A will complement TCF's desire to demonstrate sustainable harvest practices while providing for other forests values. More information is available at http://www.conservationfund.org/our-conservation-strategy/focus-areas/forestry/north-coast-conservation-initiative/

1.2 Maximum Sustained Production of High Quality Timber Products

As described in 14 CCR 913.11(a), MSP is achieved by meeting the requirements outlined below.

(a) *Where a Sustained Yield Plan (14 CCR § 1091.1) or Nonindustrial Timber Management Plan (NTMP) has not been approved for an ownership, MSP will be achieved by:*

(1) *Producing the yield of timber products specified by the landowner, taking into account biologic and economic factors, while accounting for limits on productivity due to constraints imposed from consideration of other forest values, including but not limited to, recreation, watershed, wildlife, range and forage, fisheries, regional economic vitality, employment and aesthetic enjoyment.*

(2) *Balancing growth and harvest over time, as explained in the THP for an ownership, within an assessment area set by the timber owner or timberland owner and agreed to by the Director. For purposes of this subsection the sufficiency of information necessary to demonstrate the balance of growth and harvest over time for the assessment area shall be guided by the principles of practicality and reasonableness in light of the size of the ownership and the time since adoption of this section using the best information available. The projected inventory resulting from harvesting over time shall be capable of sustaining the average annual yield achieved during the last decade of the planning horizon. The average annual projected yield over any rolling 10-year period, or over appropriately longer time periods for ownerships which project harvesting at intervals less frequently than once every ten years, shall not exceed the projected long-term sustained yield.*

(3) *Realizing growth potential as measured by adequate site occupancy by species to be managed and maintained given silvicultural methods selected by the landowner.*

(4) *Maintaining good stand vigor.*

(5) *Making provisions for adequate regeneration. At the plan submitter's option, a THP may demonstrate achievement of MSP pursuant to the criteria established in (b) where an SYP has been submitted but not approved.*

Long Term Sustained Yield (LTSY) is defined in the California Forest Practice Rules (14CR 895.1) as "the average growth sustainable by the inventory predicted at the end of a 100-year planning horizon." This Option A outlines such an approach to harvesting, related growth and overall inventory levels over the 100-year period.

The LTSY considers growth from all forested stands that are eligible for harvest. As described in more detail below, stands which are not eligible include a) class I and class II stream "no harvest" buffers as required by the California Forest Practice Rules and TCF's Integrated Resource Management Plan, b) NSO core habitat retention areas surrounding known NSO activity centers, c) oak woodlands, and d) areas designated as "no harvest" by a conservation easement which includes a 300 foot wide buffer between Mendocino Headlands State Park and TCF's Big River Forest. The LTSY was calculated with the use of FORSEE, a growth simulator for the redwood and Douglas-fir regions of coastal California that relies on the CRYPTOS growth and yield model.

The planning approach in this Option A reflects forest management and planning considerations, harvesting practices and silvicultural prescriptions that are compliant with the California Forest Practice Rules, adhere to the Forest Stewardship Council's Pacific Coast Standards, adhere to Sustainable Forestry Initiative standards, and are compatible with TCF's wildlife habitat management strategies and forest management policies. TCF's wildlife management strategies are discussed in detail in section 4. The intent of our silviculture is to maintain and improve conifer stocking and volume as well as wildlife habitat conditions for both terrestrial and aquatic species. Timber harvests will be designed such that they meet the stated silvicultural goals in an economically and socially responsible manner.

1.3 Plan Organization

LTSY for The Conservation Funds California holdings is calculated independently for each forest and combined to develop the total LTSY. This is advantageous for TCF and CALFIRE because it allows for greater transparency and in the event there is a change in RCF ownership pattern LTSY will not need to be re-calculated for the remaining forest. If a change in ownership occurs we will either calculate the individual LTSY for the new property or subtract a property out of the Option A without requiring major changes to the base document and calculations. LTSY will be presented for each forest along with the specific constraints and silvicicultural prescriptions particular to the forest. Although not anticipated, a partial sale of one or more forests exceeding 10% of the total ownership will trigger the need to recalculate the LTSY, similarly, a land purchase would also require that LTSY be recalculated.

This plan will present our inventory growth and yield methodology and findings, general silvicultural constraints and guidelines, constraints from wildlife, range and forage and other forest values as well as regional economic vitality.

1.4 Adaptive Management

This plan is subject to changes based on change in our ownership pattern, catastrophic events such as fire, or change in inventory due to inventory updates. The inventory will be updated approximately once every 10 years or as necessary to maintain our desired level of accuracy. The new inventory will be compared to our initial calculation of LTSY as well as our growth and regeneration estimates. Any necessary adjustments to the LTSY will be explained and amended to this Option A.

2. Summary of Inventory and Growth and Yield Methods

2.1. Overview of inventory methodology

TCF uses a stratified random sample to calculate the initial volume estimate on each property. TCF's timber inventory data is derived from two levels of forest stratification. First, the ownership is divided into four Management Units, based on the four individual properties. Second, within each Management Unit, timber stands are identified, which are groups of trees with similar tree heights and canopy densities. For the Big River and Salmon Creek properties, stands were identified using algorithms that analyze data derived from digital aerial photography and LiDAR imagery and recorded through a Geographic Information Systems database. Compared to the traditional stand-typing methodology (which works very well in even-aged forests), this quantitative approach offers greater ability to capture variability in uneven-aged mixed species forests where stands are less well defined. The stands are then assigned a vegetation label based on tree height, tree density and the coefficient of variation of height. In general, stands are between 5 and 30 acres although some stands are larger. For more details on this stand delineation and forest stratification methodology, see Golinkoff, J. S. 2013.

An example of the final stand delineation and stratification process is shown in Figure 2 below.

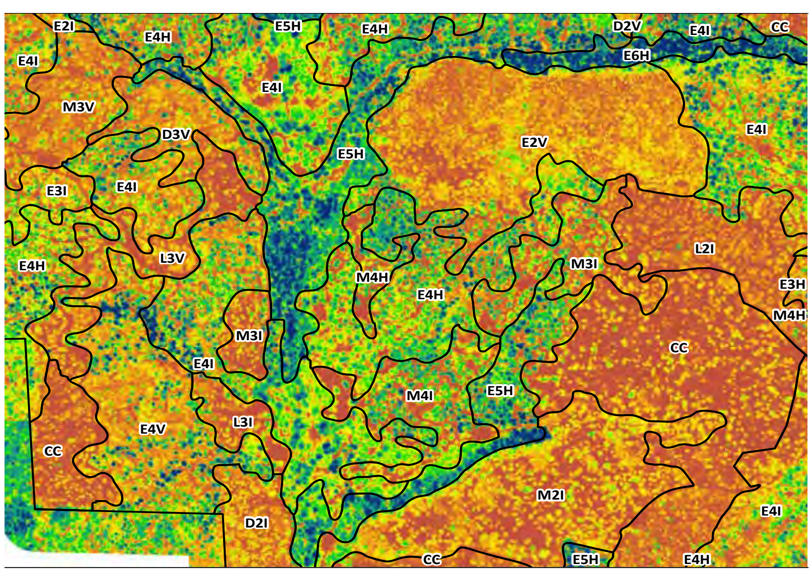


Figure 2: Example of final stand delineation and stratification.

The first letter of the strata is % Canopy Cover (O,L,M,D,E) O=open 0-20%, L=low 21-40% etc. The second letter is mean height of the dominant trees (1,2,3 etc) in 25' height increments. The third letter is the coefficient of variation of height which is an indicator of stand structure. (H=homogenous, I=intermediate and V=variable). CC is for recent Clearcut where the regeneration has not reached 25' in average height. For example an M3V stand has moderate canopy cover, the average height of 75 feet and the canopy ht is variable. M3V stands are young and have variable heights and are the kind of stands expected to develop from an older clearcut or shelterwood removal harvest.

A different approach to inventory was used on the Garcia and Gualala Forest due to their heterogeneous forest conditions and poorly defined stand boundaries resulting from past management. Micro stands or cells were used on the Garcia and Gualala Forests to stratify the forest. A cell is a small area between 1/10th and 1/2 acre in size in which the tree size and canopy condition is known through LiDAR data. The cells are then assigned a unique vegetation label based on tree height, tree density, and species composition which is the basis for the stratified sample. Once the cells are established with strata assigned to each cell, variable radius plots were installed within randomly selected cells (one plot per cell) to obtain estimates of conifer and hardwood stocking, volume, downed wood and conifer and hardwood regeneration. Plots are allocated to each stratum in order to meet statistical confidence targets. Unsampled cells are assigned tree lists based on the average cell within their stratum. All of the forests, Big River, Salmon Creek, Garcia River and Gualala River included in this Option A have an estimate of net conifer volume with at least 10% accuracy at the 90% confidence level. TCF's current inventory estimates are based on approximately 1,900 sample plots distributed across all four properties.

The cells were used in the inventory to account for stand variability; the cells were then grouped by tree height, tree density, and species composition (if known). The stands were then given a strata label based on those attributes identical to the system used in the cell nomenclature. The FORCEE model uses the stands to derive the harvest schedule presented in this Option A. A more detailed discussion of timber stand delineation can be found in Appendix A: "Big River and Salmon Creek Forest Stratification" and appendix B: "Garcia and Gualala Forest Stratification and Sampling Design".

2.2. Methodology to Determine Maximum Sustained Production

TCF used the FORESEE (4C) growth and yield simulator in combination with our inventory data and management prescriptions to make projections of forest growth and inventory over time. The model allows TCF to test different management scenarios over time and space to develop a comprehensive harvest plan which meets the silvicultural, environmental, social, and economic goals of TCF. Maximum Sustained Production (MSP) is calculated for the next 100 years by modeling forest growth and harvests with constraints on certain stands such as riparian corridors, NSO core areas and special prescriptions in some of the conservation easement areas. This modeling connects spatial timber stand information in TCF's GIS database to tree lists in a Microsoft Access databases. Each stand has a tree list which assists in inventory estimates and guides the activity in the growth and yield model. Information generated for each stand includes the following information:

- **Vegetation Type / Stratum** – Each stand is given a stratum label based on average tree height, variation of tree height, and crown closure. The strata are the basis for the stratified sampling design and are used to calculate volume and basal area for each stand.

- **Volume and basal area for conifer and hardwoods species** – Volume and basal area are calculated for each stand based on the inventory results. Inventory sampling intensity is based on the coefficient of variation within each stratum.
- **Site Class** –The Soil Survey Geographic database (SSURGO) was used to make an initial determination of site class. In addition a minimum 3 site trees were measured for each strata to validate the SSURGO site index. Site index was calculated for each species and then converted to the corresponding site class. The SSURGO data was generally in agreement with our findings therefore TCF's model uses the SSURGO site data. The average site class for each strata is assigned to all stands of similar strata in which site data was not specifically collected
- **Timing** – Harvest timing is based on the initial stand condition, pre-designated harvest cycles (for old clearcuts) and minimum harvest volume to trigger the initial and subsequent entries.

A stand is only considered for harvest if it satisfies the timing and volume requirements designated by the management prescriptions, described below and input into the model. Stand constraints are then evaluated which may affect the silvicultural regimes available for a particular stand. Silviculture in unconstrained stands is chosen by the model based on a hierarchal approach starting with selection as the preferred silviculture and working down through transition, commercial thinning, variable retention and finally rehabilitation. Some stands do not meet any of the criteria and consequently are grown forward with no harvest and are reviewed again by the model during the next harvest cycle.

Both growth and harvesting simulations occur using the 4C growth model. 4C runs within a Microsoft Access database and calls routines that grow tree lists forward. TCF's planning used an iterative approach to identify a blend of silvicultural methods, tanoak reduction, harvest levels, and re-entry interval that achieve TCF's management objectives.

2.2.1 Management Objectives

Some of the important management objectives and policies considered in TCF's modeling are:

- **<u>A non-declining inventory at the ownership level.</u>** For each property, overall harvest volume should be less than growth volume for a sufficient enough period of time to significantly increase conifer volume. By the end of the 100 year planning period harvest will increase to approach 100% of growth in the unconstrained (unrestricted for NSO, WLPZ, etc) forest and will represent MSP. When including the constrained acres, inventory increases significantly across all time periods.
- **<u>Reliance on uneven-age management techniques</u>.** TCF's long-term silvicultural objective is to primarily use single-tree and group selection. Harvests on less mesic (dryer) sites, which have a greater component of Douglas fir and sugar pine, may necessitate some variable retention harvests, in order to achieve successful natural regeneration.
- **<u>Restoration of forested stands with high levels of tanoak competition</u>.** In order to achieve adequate conifer stocking levels for future growth and management many stands, especially on the Garcia and Gualala forests, will require some form of tanoak reduction and control to occur concurrently with timber harvests. TCF currently uses a combination of techniques to control tanoak; Imazapyr applied by the "hack and squirt" technique is most commonly used to control

tanoak individual tree felling to release conifer seedlings and saplings is also used to control tanoak stocking levels.

- **<u>Development and maintenance of desired habitat conditions</u>.** The development and maintenance of desired conifer stocking and structural conditions in the forest will result in an increase in available forest habitat over time through the development increased forest cover and large tree habitat as indicated by an increase in volume and basal area over the 100 year planning horizon.
- **<u>Appropriate management of sensitive areas such as riparian corridors and NSO habitat</u>** Stands constrained by riparian corridors and sensitive species habitat or conservation easement have been identified and the silviculture regime is selected to accommodate the constraint. In some cases, the constrained harvest area will not be harvested.

2.3. Site Occupancy, Stand Vigor, and Regeneration

Ensuring adequate site occupancy, maintaining good stand vigor, and making provisions for adequate regeneration are important to TCF and necessary for ensuring Maximum Sustained Production (MSP). TCF's retention and restocking guidelines are designed to create future healthy stands for continued timber production and improved wildlife habitat. Silvicultural regimes are designed to ensure timber stand health and vigor is maintained or improved by targeting diseased or suppressed trees first.

For forest modeling tanoak is scheduled for reduction within each of the silviculture regimes if it exceeds 30% of the total pre harvest basal area. When tanoak is ”removed” the post-harvest tanoak stocking was not allowed to exceed 30 ft^2 per acre for selection and transition silviculture and was not allowed to exceed 15 ft^2 per acre for Variable Retention or Rehabilitation silviculture. These hardwood retention levels were chosen to ensure that hardwoods are a component of our stands and supply necessary mast and structural diversity for wildlife habitat. It is our goal to restore the majority of tanoak dominated stands to a conifer-hardwood species mix that more closely resembles the conditions that existed prior to the commencement of commercial logging activities. Tanoak reduction strategies to be used in the field may vary by stand structure and the applied silviculture, these are discussed in section 3.3.3. True oak stands occur on the Gualala and Garcia Forests containing black oak (*Quercus kelloggii*) Oregon white oak (*Quercus garryana) and* Shreve's oak *(Quercus parvula var. shrevei*) which are restricted from conversion management. On all of TCF ownerships individual true oaks, madrone, alder, chinquapin, California bay and other less common hardwoods species shall be retained wherever possible.

3. Silviculture

The silviculture modeled in this Option A was developed to reflect the provisions of the individual property management plans and the TCF Policy Digest. In addition the silviculture and harvest schedule was designed to meet the target carrying capacity, expressed as volume per acre, of the forests. The carrying capacity of Big River and Salmon Creek was set to 50 MBF/acre, Garcia River and Gualala River forests were set to 35 MBF/acre. These targets were chosen to ensure a reasonable level of stocking was maintained which would result in adequate wildlife habitat throughout the forest and yield adequate harvest volumes. To achieve the volume targets, basal area targets were set for each stand.

Stands with more than 225 ft^2 of BA at the start of the planning period have a target stocking rate of 250 ft^2 of BA at the end of the 100 years. Stands with less than 225 ft^2 of BA at the start of the planning period have a target BA stocking rate of 200 ft^2 BA. It was determined through an iterative process that this combination of harvest and growth constraints results in a reasonable harvest level while leaving enough standing inventory to allow the forest to recover and add additional volume prior to the next entry.

TCF's primary goals are:

- To increase forest stocking over time through carefully applied selective harvesting which results in increased total growth and value of the residual stand as described above.
- Maintain or improve wildlife habitat and water quality by using selection silviculture.
- Contribute to the overall economic viability of the forest products industry by providing predictable employment for forest workers and raw products to the local saw mills.
- Generate revenue through sales of timber and carbon offsets to repay debt, cover operating expenses, invest in property improvements and provide return to funding partners.

There is an emphasis in our management plan(s) on uneven-age management and tanoak reduction to achieve the stated goals. Table 1 below shows the percentage of acres treated by each modeled silvicultural system by period for all of the Forests combined. The model utilizes stand level data generated from our inventory to choose silvicultural prescriptions on a hierarchal basis, selection being the preferred silviculture then transition followed by variable retention and rehabilitation. The modeled output does not choose all available silvicultural systems, however TCF anticipates the need to use all silvicultural systems at some time depending on site specific stand conditions. The modeling results presented in this plan demonstrates that TCF's general approach to achieve MSP is valid; they are not however presented as a concrete plan of action. TCF foresees the need deviate from the planned silviculture from time to time to account for site specific conditions and inherent stand variability. Therefore TCF shall be allowed to deviate from the modeled silvicultural output by a maximum of 10% of the harvested acres per forest on any 5 year rolling average. Reasons for silvicultural deviations may include: insufficient stocking, disease, damaged or decadent forest conditions, intolerant species, difficult site conditions or the need to improve the quality or quantity of important wildlife habitat . Deviations for silvicultural experimentation and investigations are allowed provided they are explained and justified in the THP.

Table 1: Modeled Siviculture treatments by percent of total acres harvested.

Year	WLPZ1	WLPZ2	Ecological Reserve Selection- GRF	Standard Selection	Transition	VR40	VR60	sum %	Sum acres
2014-2018	0.5	12.5	6.6	69.2	11.2	-	-	100.0	7,830.3
2019-2023	0.4	1.6	14.1	83.0	0.9	-	-	100.0	6,637.3

Year	WLPZ1	WLPZ2	Ecological Reserve Selection- GRF	Standard Selection	Transition	VR40	VR60	sum %	Sum acres
2024-2028	2.4	10.6	12.8	73.6	0.5	0.2	-	100.0	7,813.1
2029-2033	9.7	7.1	10.4	72.7	0.0	-	-	100.0	9,578.0
2034-2038	4.8	6.6	9.9	78.6	0.0	-	-	100.0	10,115.2
2039-2043	5.1	1.9	12.8	80.3	0.0	-	-	100.0	7,829.4
2044-2048	8.7	10.4	9.4	71.4	0.2	-	-	100.0	10,642.0
2049-2053	2.0	2.6	9.4	85.8	0.1	-	-	100.0	10,644.5
2054-2058	3.3	8.2	10.9	77.6	-	-	-	100.0	9,168.1
2059-2063	7.6	5.8	6.6	80.0	0.0	-	-	100.0	9,457.5
2064-2068	5.0	9.3	3.5	82.1	0.0	-	-	100.0	8,507.6
2069-2073	4.8	2.3	1.6	90.9	0.3	-	-	100.0	9,012.2
2074-2078	8.2	10.9	2.4	78.5	-	-	-	100.0	10,095.3
2079-2083	6.5	3.4	1.8	88.4	-	-	-	100.0	7,867.7
2084-2088	6.3	9.7	0.5	83.5	-	-	-	100.0	7,728.3
2089-2093	9.7	6.6	0.5	83.2	-	-	-	100.0	8,629.0
2094-2098	7.3	10.7	0.4	81.6	-	-	-	100.0	7,415.1
2099-2103	8.3	3.9	1.1	86.7	-	-	-	100.0	5,688.9
2104-2108	13.6	17.2	0.9	68.2	-	-	-	100.0	6,376.6
2109-2113	7.7	3.7	0.1	88.5	-	-	-	100.0	7,055.1

For modeling purposes the harvest and retention guidelines specified in the forest practice rules were used for all silviculture systems except in the case of single tree selection and group selection where the modeled retention generally exceeds the minimum retention requirements specified in the rules. Future THPs will comply with the Option A, the enforceable retention standards for Selection and Group Selection shall be stated by the submitting RPF in the THP. Unless stated otherwise in the THP, a timber stand shall be considered stocked if the stand meets the post-harvest stocking standards as required by the Article 3 of the FPR.

3.1. Uneven-aged Management

Uneven-aged management is utilized to establish or maintenance of a multi-aged, balanced stand structure, promote the growth of trees throughout a broad range of diameter classes, and encourage natural reproduction. Typical silvicultural systems in uneven-aged management include single tree selection and group selection. Over time, uneven-aged management systems develop trees in at least three age or size classes. Periodic timber harvest in these stands will remove selected individual trees from all age classes or small groups of trees in order to promote the growth of the remaining trees and to create an opportunity for new trees to regenerate and occupy the site.

A majority of the area devoted to timber production will be managed using uneven-aged silvicultural systems. Within the redwood region, this is the most common system utilized by non-industrial forest landowners and others intent upon maintaining forest cover for wildlife habitat and visual quality.

RPF's submitting THP's utilizing selection silviculture will demonstrate compliance with this Option A by incorporating into the plan the following information:

- The site class.
- The average pre harvest conifer basal area and BF volume per acre for each THP or harvest block within THP's.
- The enforceable minimum BA retention standard shall be stated in the THP. The minimum BA must meet or exceed the minimum requirements stated in 14 CCR 913.2(a)(2)(A) for the first decade the Option A is in effect.

Deviations from the harvest cycle constraint by site class will be allowed for up to 10% of each THP or harvest block to allow RPF's to make logical harvest units.

3.1.1. Single Tree Selection

Single tree selection will be utilized to create growing space for younger trees through the development of small openings resulting from removing individual trees. The openings generally range in size between 1/100th and ¼ acre openings within the stand. Single tree selection leads to stands with continuous forest cover, small gaps between trees, and a diversity of tree sizes and ages. With this silvicultural system, the intent will be to enter each timber stand every 10 to 15 years to remove lower quality or defective trees, thin the dominants and co-dominants, and provide openings to accelerate the development of leave trees and a new age class.

Most stands to be managed under the selection system are essentially even-aged, single-canopy 2nd or 3rd growth stands that were initially clearcut and may have had one or more harvests following the initial entry. Thus, it will take multiple entries to achieve the balanced age and diameter distribution we are seeking.

For a stand to be considered for selection harvesting it must contain at least 125 sq ft of basal area. TCF has modeled the removal of a minimum of 25 sq ft of BA of trees between 8-48 inches. Fifteen square feet of basal area were retained from harvest from the largest trees in the stand. The maximum allowable harvest was 1/3 of the conifer BA and/or up to 40% of the standing volume whichever is less. Reentry cycles are determined by site class, site II and better lands are modeled with a ten year harvest cycle and site III lands are modeled with a 15 year harvest cycle. The site class is used as the trigger which indicates the earliest available date a stand can be reentered. In addition to meeting the site class constraint stands must have at least 25 sq ft more basal area than it had prior to the previous entry, this requirement is the primary driver for increasing inventory over time.

3.1.2. Single Tree Selection- Garcia River Forest Ecological Reserve

The Ecological Reserve (ER) Area on the Garcia River Forest is designated for late seral stand recruitment. The ER is composed of approximately 8,000 acres of forest land including TCF's entire ownership within the Inman Creek watershed, a high priority Coho stream. In addition to the standard class I WLPZ there is an additional 100 feet of RMZ and on all class I streams except the mainstem of the Garcia which has an additional 200 foot RMZ. The RMZ is considered part of the Garcia Forest Ecological Reserve and shall be managed as such. To facilitate late seral stand recruitment, harvesting will be essentially thinning from below with some thinning of co-dominants to improve spacing. Defective trees and trees with complex crowns will be left on site to promote the development of a multi storied canopy. TCF has modeled 2 complete entries in the reserve then harvesting was terminated because we believe that the stand will have the appropriate BA, tree size, spacing and structural elements to be left free to grow after 2 harvests.

For a stand to be considered for selection harvesting it must contain at least 125 sq ft of basal area. TCF has modeled the removal of a minimum of 25 sq ft of BA of trees between 8-48 inches. Fifteen square feet of basal area were retained from harvest from the largest trees in the stand. The maximum allowable harvest was 1/3 of the conifer BA and/or up to 40% of the standing volume whichever is less. The minimum reentry cycle is 20 years and a stand must have at least 40 sq ft more basal area than it had prior to the previous entry before it is eligible for harvest again. Class I stream zones within the Ecological Reserve are modeled using the High Retention Single Tree Selection method described below and are restricted to 2 entries on a 20 year harvest cycle.

3.1.3. High Retention Single Tree Selection: Class I inner zone "A" and Class II Inner zones

The goal of the High Retention Selection is to protect and maintain the stream riparian zone and enhance water quality. WLPZ1 require 80% canopy retention and the 13 largest trees per acre be retained, per 14 CCR 916.9(f)(2)(B) and 916.9(g)(2)(B)). The TCF harvest model removes trees subject to these constraints. The canopy and stocking requirements within the WLPZ's shall be in conformance with the forest practice rules unless exceptions are made in the THP per 14 CCR 916.9(v). No other site specific reporting is required by submitting RPF's for WLPZ1 silviculture.

3.1.4. Moderate Retention Single Tree Selection: WLPZ2 , Standard class II zones

The harvest and growth constraints for the Moderate Retention Selection are identical to single tree selection with the following addition: at least 50% of the canopy covering the ground shall be retained per 14 CCR 916.5(e). The TCF harvest model removes trees subject to these constraints. The canopy and stocking requirements within the WLPZ's shall be in conformance with the forest practice rules unless exceptions are made in the THP per 14 CCR 916.9(v). No other site specific reporting is required by submitting RPF's.

3.1.5. Group Selection

Stands managed under the group selection system will consist of small forest patches or harvest groups. The resulting stand will be composed of various age classes and developmental stages concentrated within each group. For modeling purposes, there is no distinction between group selection and single tree selection the growth and harvest constraints for groups are the same as Individual tree selection.

To date groups have been used used when the average volume per acre is low and individual tree selection is uneconomical, stands dominated by Douglas fir or in stands with high hardwood competition. By concentrating harvest volume within groups TCF feels that harvesting costs can be reduced especially in low volume per acre cable yarding areas. In poorly stocked areas groups are useful in establishing regeneration of redwood and Douglas-fir which require direct sunlight to thrive. Groups are placed in all forest stand conditions to avoid the potential for high grading by targeting the best volume areas and, in the case of hardwood dominated areas, restore the site to conifer. To date, TCF's policy has been to supplement regeneration within group openings by planting conifer seedlings if in the opinion of the project forester planting is the best way to secure conifer regeneration. The location of group harvest areas will be on a site specific basis determined by the project RPF. Factors to include when considering groups will be volume per acre, tree species, stand stocking and vigor and current market conditions.

3.1.6. Transition

Transition harvests are designed to transition a stand from an even age state to an uneven-age condition over time. For our purposes, transition harvest will be used in young/small even-age stands resulting from clearcuts or shelterwood removal harvests that will benefit from some selective harvest of individual trees to release the conifers and increase growth and windfirmness of the residual stems. Small openings may be created to promote the development of another age class. Transition harvests will often be coupled with some form of hardwood reduction.

Transition silviculture includes the alternative prescription "Transition with Groups". This silviculture is analogous to group selection and is designed to improve stocking levels of younger age classes and reduce hardwood competition.

For a stand to be considered for transition harvesting it must contain at least 75 sq ft of basal area and no more than 124 sq ft of basal area. TCF has modeled the removal of a minimum of 25 sq ft of BA of trees between 8-48 inches. Fifteen square feet of basal area were retained from harvest from the largest trees in the stand and a total of 50 square feet was retained to meet minimum stocking requirements. Reentry cycles are determined by site class, site II and better lands are modeled with a ten year harvest cycle and site III lands are modeled with a 15 year harvest cycle. The site class is used as the trigger which indicates the earliest available date a stand can be reentered. In addition only one transition harvest is modeled per stand therefore stands harvested using transition silviculture must meet the minimum requirement for single tree selection prior to subsequent entries.

The minimum BA retention standard shall be stated in the THP. The minimum BA must meet or exceed the minimum requirements stated in 14 CCR 913.2(b) for the first decade the Option A is in effect.

TCF's current management is very similar to the management proposed in this Option A. The following table shows TCF's past and proposed THP's with silvicultureal treatments and yarding systems.

Table 2: TCF Management Practices 2007-2013

Property	THP Number	County	Tractor Selection	Cable Selection	Tractor Group Selection	Cable Group Selection	Tractor Transition	Cable Transition	Tractor Seed Tree Removal	Cable Seed Tree removal	Tractor Rehabilitation	Cable Rehabilitation	Tractor VR	Cable VR	Oak Treatment
Garcia River	1-11-109	MEN	94	60	22	82									
Garcia River	1-11-023	MEN	107		412										43
Garcia River	1-06-135	MEN	85	100			4	89							
Garcia River	1-07-035	MEN		370											
Garcia River	1-08-039	MEN	72	37		65		147							
Garcia River	proposed	MEN	200	**135**											
Garcia River	1-08-094	MEN						255			15				90
		MEN													
Salmon Creek	1-06-099	MEN	46	34	43	114			257	59					
Salmon Creek	1-07-191	MEN	219	206											
Salmon Creek	1-10-005	MEN	48	63											
		MEN													
Big River	1-07-060	MEN	105	52											
Big River	1-07-083	MEN	52	11			25		47				56	31	87
Big River	1-08-037	MEN	45	90		48	121	93	23	75					199
Big River	1-09-020	MEN	271	155			12	17							71
Big River	1-09-044	MEN	201				33								
Big River	1-09-097	MEN	100	279			65	47							152
Big River	1-10-030	MEN	271	190											37
Big River	1-11-009	MEN	144	12											
Big River	1-11-057	MEN	71	213	17	87									79
Big River	1-11-114	MEN	154	269	9	15	33								111
Big River	proposed	MEN		236											
Big River	proposed	MEN		196											

3.2. Intermediate Treatments

3.2.1. Commercial Thinning

Commercial thinning is the removal of trees in young growth stands to maintain or increase average stand diameter of the residual crop trees, promote timber growth, improve forest health and control species composition by removing low value forest species. TCF will occasionally use commercial thinning in young even-age stands resulting from prior clearcuts or shelterwood removal harvests.

For a stand to be considered for commercial thinning it must contain at least 75 sq ft of basal area and they must have at least 50% of the conifer basal area in trees less than 14” DBH. TCF has modeled a retention of 100 trees per acre 4” DBH and greater. Reentry cycles are determined by site class, site II and better lands are modeled with a ten year harvest cycle and site III lands are modeled with a 15 year harvest cycle. The site class is used as the trigger which indicates the earliest available date a stand can be reentered. A stand may be eligible for transition or selection harvest after the commercial thin harvest.

The pre and post-harvest stocking requirements listed in 913.3(A) or 913.3(B) shall be the enforceable standard for THP’s.

3.3 Special Prescriptions

3.3.1 Variable Retention

Variable retention (VR) is the only even age final harvest system that is anticipated for use by TCF. VR is used to regenerate a new age class on a stand level. Variable retention retains mature trees in a variable configuration. A new even-aged stand is grown beneath or between the retained trees. Retained trees may occur as scattered individuals, in groups, or in combination. Mature trees are retained to improve or maintain habitat value, watershed function, and aesthetic value. VR offers the opportunity to meld the continuous canopy concept of uneven-aged management with larger openings to allow for sufficient sunlight to promote a second age class beneath and between the existing overstory. Per TCF current policy, VR will likely be used sparingly and on sites that are more suited for Douglas-fir and sugar pine. Research from the Pacific Northwest, (Johnson and Franklin 2013) indicates that early successional ecosystems important to some song birds (e.g. olive sided flycatcher) may be missing, VR harvest simulate the early Successional stages of forest development and may be an important component of future management. TCF anticipates at least one THP including VR harvest on each property in the near future.

The pre and post harvest stocking requirements listed in 913.4(d) shall be the enforceable standard for THP’s.

3.3.2 Rehabilitation

Rehabilitation will be occasionally utilized for those stands that do not meet the minimum stocking standards set forth in 14 CCR 912.7 and are capable of growing conifers. Generally, these are stands that are currently hardwood dominated but were once conifer dominated as evidenced by conifer stumps, location, or soil type. Under the rehabilitation prescription, hardwood stocking will be reduced through mechanical removal or herbicide application and conifer seedlings will be planted in the vacated growing space.

The pre and post harvest stocking requirements listed in 913.4 (b) shall be the enforceable standard for THP’s.

3.3.3 Tanoak Reduction

Hardwoods, specifically tanoak, are naturally occurring in the redwood region and are a minor component of a well-managed coastal conifer forest. Typically, hardwoods comprise 10-30% of a stand’s basal area. However, as a result of past management practices, tanoak has become the dominant species or is a significant portion of the forest basal area in some stands. Tanoak is both extremely shade tolerant and sprouts vigorously after being cut or damaged. Because of these physiological traits, once established tanoak is capable of out competing conifers for light and nutrients. Tanoak control will be a necessary part of many silvicultural treatments to ensure that tanoak does not become the dominant tree species within a stand after a commercial harvest has occurred. In the growth model tanoak is "harvested" if it represents represents more than 30% of the total stand BA a target BA of 30 ft ^{2} between 2 and 20" DBH.

In practice selective "harvesting" of tanoak is the method of control most often used in TCF's THP's. Selective harvesting is the application of Imazapyr or manual felling of tan oak trees such that suppressed conifers are released through the harvest of the tanoak. This method is preferred because it directly benefits suppressed conifers, reduces chemical use and is effective when used for manual tanoak control. In addition selective tanoak harvesting reduces dead and down material and helps maintain forest canopy cover for wildlife habitat. When selectively harvesting tanoaks the residual tanoak basal area is less important than effective tanoak removal, a THP shall be considered in compliance with 14CCR 912.7(d) when the selective tanoak control method is specified in a THP.

The herbicide primarily recommended for use of tanoak control is imazapyr. The primary application method will be via "hack and squirt." Using this method, a series of cuts are made around the stem of the tree and the herbicide is applied directly to the tree's vascular tissues. Additional herbicides for tanoak control may be considered in the future as they are developed and tested. No hardwood species other than tanoak shall be treated. Mandatory tanoak retention guidelines are listed below.

- Retain all tanoak 20" DBH and larger. These large hardwoods are of the highest value to wildlife because they tend to be the most prolific mast producers and they possess more desirable structural attributes than smaller trees. Exceptions to the general retentions guidelines may be adopted on sites with very high numbers of large tanoaks if retention of all 20" and greater tanoak will not result in sufficient sunlight and growing space for young conifers.
- There will be no tanoak control with herbicides in Class I, II or IV WLPZs or within 25 feet of a class III watercourse. Manual felling or girdling of small tanoaks less than 20" may be used within WLPZ's as part of a riparian shade enhancement project designed to increase conifer site occupancy and growth on a site specific basis.

Additional TCF policies on forest chemical use, monitoring, and reporting are available; this section focuses solely on the growth and yield considerations. As markets permit, we may choose to harvest tanoak, which will be subject to the same retention requirements as mentioned above. The results of different tanoak control techniques will be monitored over time and our policies will be revised as new information becomes available.

3.3.4 Timber Stand Improvement – Pre-Commercial Thinning and Conifer Release

Pre-commercial Thinning (PCT) is a thinning of smaller trees where merchantable sawtimber is not derived from the thinning operation and the cut material is left on site. PCT is undertaken to increase spacing or release desired conifer trees and control species composition by cutting surrounding inferior conifers or hardwoods. It is designed to direct growth to the remaining trees, generally those with the best form or growth potential. Young conifer stands (typically 5-15 years old) are thinned to prescribed stocking levels, in an effort to produce a desired combination of tree species and density.

Release operations can be used where thinning is not feasible and involves releasing individual trees, or groups of trees, from immediate competition by eliminating over-topping or closely surrounding vegetation. This practice results in increased growth of the remaining trees and is a also a means of controlling tanoak, brush, and invasive weed species. Release is a non-commercial practice, generally utilizing direct stem injection of herbicides or manual felling.

Timber stand improvement activities will be modest in scope (200-400 acres/year for the whole ownership). For this reason timber stand improvement activities are not directly modeled in the Option A and are not expected to result in an increase in growth that would be significant at the ownership scale.

3.4 Even-aged Management

Clearcutting, seed tree removal and shelterwood removal are not modeled for this Option A. However, they may be used in the event of severe damage resulting from natural causes such as fire, wind, or bears to capture mortality and regenerate the site. The pre and post harvest stocking requirements listed in 912.7(b)(1) shall be the enforceable standard for THP's.

4 Non-Timber Forest Resources

Non-timber forest values considered in the calculation of Maximum Sustained Production (MSP) include the conservation and improvement of wildlife and fisheries habitat and attention to various legal restrictions specific to the properties including conservation easements. These considerations impact the determination of LTSY through the application of silvicultural prescriptions that are appropriate for the level of sensitivity in each stand. Community concerns such as viewsheds and recreational opportunities are thought to be minimal and our standard selection silviculture will mitigate those impacts.

The major non-timber forest values factored into determination of LTSY are:

- Protection and enhancement of riparian zones to improve fisheries habitat and water quality; and
- Recruitment and retention of NSO core areas as well as structural and compositional attributes to maintain and improve Northern Spotted Owl habitat and other terrestrial wildlife habitat in general.

In addition to the requirements of the Forest Practice Rules, TCF in cooperation with CDF&W has initiated a large woody debris (LWD) enhancement program on most of its property to accelerate wood production in the stream channel to improve habitat for coho salmon and steelhead trout. To reduce sediment inputs into streams and provide increased riparian canopy cover TCF adopted a 25 foot no harvest buffer on class I and class II stream on the Garcia River Forest in 2007 and a 50 foot no harvest buffer on class I streams on Big River and Salmon Creek. These buffers are utilized in combination with the Anadromous Salmonid Protection Rules adopted by CALFIRE in 2011. The Conservation Fund is also proactively upgrading our road system to reduce sediment inputs into streams. To date we have upgraded almost one hundred miles (at a cost of about $3 million) and we expect our current level of road improvement activity to be maintained.

To promote the maintenance and development of wildlife habitat, TCF has implemented various levels of hardwood reduction to achieve conifer release and maintain forest cover where possible. The following paragraphs describing wildlife tree retention and recruitment are excerpted from TCF's management policies as revised January 2013.

4.1 Wildlife Trees, Recruitment Trees, and Snags

Target: four per acre on average across stand. The following criteria have been developed to assist field foresters to recruit suitable wildlife trees. Trees shall be retained from any of the following groups until a minimum of four recruitment trees per acre have been identified.

- **Snags:** Retain all snags, (all should be retained but only those greater than 18-inch DBH and 20 foot height shall count towards the retention targets).
- **Conifers greater than 48-inch DBH***:* Retain or recruit a minimum of two and not more than four 48" trees per acre for recruitment (unless old growth). In the event there are less than two 48" trees per acre, two trees per acre from the largest size class shall be designated for recruitment from the harvest area.
- **Old-growth trees:** Retain all old growth. Old growth is defined as any conifer tree greater than 200 years old that exhibits outward signs of being old or decadent: such as rounded or flat crown, dead top, excessive branching, or platy bark.
- **Raptor nest trees (active or likely to be re-used):** Retain all.
- **Any hardwood except tanoak:** Retain all.
- **Tanoak:** Retain all tanoak 20" and greater unless site specific conditions exist as justified by the project forester
- **Murrelet habitat trees:** Retain all. Typically large diameter Douglas-fir or other conifer with at least one mossy branch platform capable of supporting an egg: at least 6" in diameter, nearly horizontal, within the canopy of the stand but lower than the surrounding tree tops within 100' radius, covered directly above by at least 50% canopy, and allowing ready flight access and landing paths.
- **Den trees:** Retain all den trees which are defined as trees which have a cavity greater than three inches in diameter and greater than ten feet above ground
- **Trees with basal hollows or other significant features:** Retain all trees with basal hollows defined as trees with significant burn scars protruding 1/3 or more into the bole of the tree, as well as retain all trees with acorn granaries, significant or unusual lichen accumulation, signs of deformity, decadence, unusual bark patterns, or other unique structure or features, eg large excessive branching or flat tops.

4.1.1 Retention Tree General Guidelines

- Wildlife trees or large trees marked for retention are not intended for future harvest and should be retained throughout the planning period. The project forester may "trade" designated retention trees if other more suitable retention trees develop over time.

- Marking of the wildlife trees (with paint or tags) is intended to communicate the recognition of the importance of that stem to future foresters, agency reviewers, and the public.
- In areas with insufficient wildlife trees (less than 4 trees per acre), snags may be created by girdling. For the next 20 years some preference for snag creation and wildlife tree recruitment will be given to cull trees and whitewoods (because of their low financial value) even though they may have a shorter lifespan as a snag compared to redwood.
- All retention is subject to operational considerations; the felling of any tree is permitted when necessary for operator safety, road right of way, or yarding corridors.
- Targets shall be assessed across the entire harvest stand, not on an individual acre basis.
- Preference shall be given for spatial grouping of wildlife trees (clumps of downed wood, snags, and/or wildlife trees).

All of the foregoing requirements and guidelines are subject to further review and amendment as the science and practice of forest management evolves and new research is developed and applied. Because of past practices, some portions of the forests do not have sufficient wildlife features and the initial targets set forth above are intended to guide the long-term retention and recruitment of these features, recognizing it may take two decades or entries to achieve the target distribution.

4.2 Ecological Reserve

The Ecological Reserve was established on the Garcia River Forest in 2006 and is comprised of approximately 8,000 acres set aside for the development of late seral stage forest. Its establishment was required by the terms of the California State Coastal Conservancy's grant to acquire the property. The Ecological Reserve is primarily within the Inman Creek watershed and an interconnecting network of watercourse buffers and other smaller reserve areas which capture the forest biodiversity across the Garcia River Forest ownership. Silviculture within the Reserve is described in section 3.1.2, tanoak control may be used to maintain conifer dominance in harvest areas, however pre commercial stand manipulation is not anticipated. The reserve network is displayed on the GRF map in Section 10.

4.3 Anadromous Salmonids

TCF forestlands are bisected by approximately 87 miles of class I stream capable of supporting anadromous fish. Protecting and improving fisheries habitat is a priority for TCF and its partners. Fishery and riparian corridor protection measures are defined in the Forest Practice Rules. Other restrictions imposed by our management plans or conservation easements may be more restrictive that the FPR's. For modeling purposes the streams and riparian corridors are buffered per the forest practice rules and other TCF constraints as applicable. The buffers are described in detail in table 12, Appendix C. In total approximately 1,743 acres are excluded from harvest and an additional 4,561 acres have harvest restrictions totaling approximately 12% of the forest. Field surveys for each THP may supersede the current modeling. Because of recent LIDAR analysis we are confident in the accuracy of our stream GIS layer and do not anticipate any large changes.

4.4 Northern Spotted Owls

The USF&WS listed the Northern Spotted Owl (NSO) as threatened under the Endangered Species Act in 1990. Each NSO territory is provided a 100 acre core area in which timber harvest is severely limited or prohibited. The Conservation Fund currently tracks 24 NSO territories with activity centers on the properties. For modeling purposes each NSO territory with an activity center on TCF ownership is given a 100 acre core area consisting of the "best" habitat surrounding the nest site. NSO which reside off property are buffered with a 1,000 foot radius and that portion of the radius which falls within TCF ownership is considered a “no harvest” area, in a total of 2,737 acres or approximately 5.1% of the forest is restricted from harvest. NSO territories and corresponding core areas may change yearly and will likely change over time in response to environmental conditions, competition from barred owls or mortality. These changes are not expected to effect the calculation of LTSY.

4.5 Range and Forage

The dominant vegetation type on TCF’s ownership is redwood/Douglas-fir forest. Tanoak and Pacific madrone are the major hardwood species both of which produce significant mast for forage by birds and mammals. Other major conifer species include sugar pine and grand fir whose cones are favored by grey squirrels. Redwood cambium is favored by bears, porcupines and grey squirrels in some areas where other forage is lacking. Brush species favored for wildlife foraging include blackberry, thimbleberry, huckleberry and various grasses and clovers which occupy permanent openings in the forest. It is felt that the species component and percent occupancy will not change due to our management techniques. As openings are created desirable forage species will occupy the site temporally. There are no management activities proposed which would prevent or discourage forest forage species.

Grasslands occur on the Garcia and Gualala forests, some of them are natural with native grasses and some may be relics of conversion attempts earlier in the century either by homesteaders or Native Americans. Native American fire management also had a role in the current distribution of grasslands on the ownership. Grasslands are used by the black tail deer for forage, and feral pigs till up grasslands in search of grubs and mushrooms. TCF’s policy is to maintain the native grasslands and is considering a plan to reintroduce fire to help maintain the grasslands and promote the growth of the native grasses.

5 Regional Economic Vitality and Employment

Since its inception in 1985, The Conservation Fund (TCF) has focused on programs which further both environmental and economic goals. TCF believes that maintaining a strong balance between conservation and economic vitality will in the long run benefit our projects and partners while preserving land in perpetuity. TCF’s goal is to maintain the forest as a commercially viable working forest while simultaneously reinvesting proceeds from the sale of timber and carbon offsets to reduce sediment inputs from roads and improve salmonid and wildlife habitat. TCF believes this strategy helps to maintain the current economic forest products economy and keeps forestland out of development or conversion to non timber resources (which would increase the cost of county services and decrease the viability of the forest industry).

Employment

Within the local area, TCF currently employs 3 full-time foresters and 10 part-time employees or contractors. This group includes our forestry staff and security, contract wildlife biologist, geologists, botanists and other professional foresters. In addition to direct employment, TCF purchases products with approximately 35 vendors and engages in contracts with approximately 53 contractors, most of which are located in Mendocino County. TCF’s forest operations support approximately 50 additional part time jobs. These are primarily logging and log hauling, road construction and reconstruction, and biological studies which support the forest operations.

Historically the majority of the jobs and revenue generated in Mendocino County have come from the timber and fishing industries. Both industries have suffered a severe decline in the last few decades with no clear replacement of the economic inputs.

Forestry jobs, such as those generated by TCF's property management activities, are especially important to the North Coast regional economy. The north coast is in transition to a more diversified economy with fewer forest jobs and increased tourism related service industry jobs. However, on average, North Coast service jobs pay less than forest based jobs. As calculated by the California Department of Forestry and Fire Protection, mean annual wages in 2003 were $19,700 for the tourism sector and $31,721 for timber industry occupations (III-42).

One measure typically used to determine the economic impact of forestry activities is "number of jobs created." TCF maintains a field office in Caspar, California to support the North Coast Forest Conservation Program, providing full-time and part-time employment for local residents. The local office is supported by various staff (legal, human resources, accounting, real estate, etc.) at the main office in Arlington, Virginia.]

Table 3: Direct and Indirect Annual Employment (6 year average)

Employee Group	Number
TCF full-time employees	4
TCF part-time employees	2
Contractors	53
Vendors[1]	35

Although the number of local employees is small, the number of local jobs generated directly by the program is significantly greater since TCF retains many different contractors each year (see Table 1) to perform services on the properties. In selecting contractors, TCF strives to hire local individuals and small businesses. In addition, program activities indirectly support local businesses and related industries by purchasing services from a total of 35 local vendors that have supplied the program since 2006.

As shown in Table 3, North Coast Forest Conservation Program payments for contractual services from 2006-2012 totaled over $2.5 million. The equivalent number of contractor jobs generated by these service payments is estimated based on the mean annual wage of $31,721.

Table 4: Contractual Service Annual Payments (6 year average).

Contract Type	Payment
Logging & trucking	$1,129,194.33

[1] Vendors include non-contractual payments for a range of goods and services from field and office supplies to appraisals, utilities, vehicle expenses, etc.

Contract Type	Payment
SFI, FSC, CAR Certifications	$19,940.33
Inventory & carbon(local)	$68,714.33
Inventory & carbon (fees)	$136121.67
Firefighting	$22,033.83
Professional Services	$1,198,547.33
TOTAL	**$2,574,551.83**
ESTIMATED JOBS	**81.16**

Additional indirect jobs and employment in associated industries, such as milling and lumber sales, are not included in these figures, but also important to the local economy

5.1 Direct and Indirect Economic Impacts

Select direct and indirect economic impacts of the North Coast Forest Conservation Program are summarized in Table 4. Direct economic impacts are "the initial, immediate economic activities (jobs and income) generated by an industry". For the Program, these include the local employment and contractual service payments described in the section above. A significant portion of the Program's direct economic impacts are produced by sustainable logging activities. Unfortunately, recent declining timber prices have affected harvest levels, reducing the quantity of contract payments as harvest levels from the properties has been uneven flow in response to market conditions.

Table 5: Select Direct and Indirect Annual Economic Impacts (6 year average).

Impact Types	Impact Dollar Amount
Direct Impacts	
Contractual service payments	$2,574,551.83
Vendor service payments	$60,670.33
Vendor materials payments	$99,477.17
Permits (DFG & Water Board)	$11,316.00
Timber taxes (State)	$36,326.17
Property taxes (County)	$107,263.67
ANNUAL TOTAL	$2,889,605.17
ANNUAL $/ACRE	$65.57

Economic impacts are "production, employment and income changes occurring in other businesses/industries in the community" as the supply inputs. For the Program, these include payments to vendors for materials and services, and taxes paid. The Program's activities from 2006-2012 have generated $218,000 in timber taxes for the State of California and $644,000 in property tax revenues for Mendocino County. Since 2006, the annual direct economic impacts of TCF's North Coast Forest Conservation Program have averaged approximately 2.9 million dollars annually.

6 Monitoring

The Conservation Fund is in a continual process of improving its knowledge about the forests it manages. The projections described in this Option A serve as a baseline that will be used to make management decisions in the future as we gain experience with the silvicultural prescriptions that have been modeled. It is anticipated that some adjustments may be made to reflect actual (measured vs modeled) growth or other unforeseen changes. In addition to the current inventories and assumptions under which the Option A is based, TCF expects to re inventory all of the forest tracts subject to this option A. Property inventories are expected to be conducted approximately once every 10 years. conduct regular forest inventory updates. In addition to the property wide inventory TCF will continue to measure and monitor the following forest metrics:

- Continual measurement of permanent growth plots
- Sample post-harvest stands
- Experiment with different vegetation management alternatives
- Monitor and inventory some wildlife metrics such as NSO and instream habitat
- Monitor pre-commercial thinning and hardwood reduction success

The periodic inventory updates will be used to check the accuracy of the option A and used to verify the current growth model or re-calculate LTSY. The permanent plots will be used to calibrate or verify our growth assumptions within the growth model. Actual harvest silviculture and acreage will be tracked and compared to the model outputs in the Option A.

The following information will be supplied to CALFIRE on an annual basis:

- Harvest volume and acres by even-aged, uneven-aged, and variable retention silviculture and acres treated for hardwood reduction
- Any ownership changes
- Any changes of forest conditions due to catastrophic events that result in a net change of more than 10 percent of TCF's net conifer volume

7 Harvest Schedule

The harvest schedule projects growth and development of each forest for the next 100 years. Specifically the harvest schedule projected future stand conditions and harvest, growth and inventory levels.

In this TCF Option A plan harvest scheduling was accomplished using the FORSEE growth model, our forest inventory database and a GIS database. Every unique stand was assigned an initial entry period based on the date of the previous entry or past silviculture. For example stands which were previously selected were unavailable for harvest for 10 years following the last entry; stands which were previously clearcut were unavailable for harvest for 40 years following the date of the clearcut entry. One of TCF's primary goals with our forest management is to improve forest stocking and maintain a high level of stocking over time. Therefore, in addition to the silvicultural rules, TCF has developed a set of global harvest constraints unique to each forest, which prevent the harvest model from harvesting every available stand every period. The global constraints control BA and volume removal for each stand and control the rate at which volume removal increases overtime until such time as the modeled harvest does not exceed growth. This results in a relatively steady increase in forest stocks until the constraints are released. The table below shows the global constraints for each forest.

Table 6: Global Harvest Constraints

Global Harvest Constraints						Harvest Cycle (Years)	
Forest	Initial harvest level: MBF/Yr	rate of increase in harvest	Maximum Allowable BA harvest	Maximum Allowable BF harvest	Year Restrictions Lifted	Site Class I & II	Site Class III & IV
BR	3.5	1.5%	25%	35%	2034	10	15
SC	1.5	1.5%	25%	35%	2034	10	15
GRF	1.5	3%	33%	40%	2079	10	15
GUAL	1.5	3%	33%	40%	2114	10	15

The harvest cycle was constrained by site class and lower sites were given a longer harvest cycle. Site class I-II is modeled with a 10 year harvest cycle and site class III and IV is modeled with a 15 year harvest cycle. To accommodate the variation in harvest cycle by class, 5 year planning periods were used in which each stand became eligible for harvest every 5 years subject to environmental constraints and harvest timing constraints.

7.1 Harvest Schedule Deviations

As mentioned above silvicultural treatments were determined by the model using stand data developed from the inventory or growth model. Based on this data the model chose selection silviculture over 90% of the time as the harvest method, however we expect some deviation on the ground from the inventory and modeling assumptions. The modeling results presented in this plan demonstrates that TCF's general approach to achieve MSP is valid; they are not however presented as a concrete plan of action. TCF foresees the need deviate from the planned silviculture from time to time to account for site specific conditions and inherent stand variability. Therefore TCF shall be allowed to deviate from the modeled silvicultural output by a maximum of 10% of the harvested acres per forest on any 5 year rolling average. Allowable prescriptions will include selection, transition and commercial thinning. In the event that onsite conditions dictate that evenage management be used only variable retention or rehabilitation harvests are allowed. Evenage management shall be restricted to 500 acres per 5 year planning period on the Garcia River Forest, 300 acres per 5 year planning period on Big River and Gualala River Forests, and 100 acres per 5 year planning period on the Salmon Creek Forest.

The Garcia River Forest has a large acreage in the Conservation Easement known as the Ecological Reserve (ER) in which the ER silviculture is slightly different from the Standard Selection silviculture. The decision to enter the ER will be based on site specific factors such as stocking, disease or damage, or market conditions. These factors can be difficult to model therefore TCF shall be allowed to deviate freely between the ER silviculture and the standard selection silviculture as long as the total acres harvested per period do not change by more than 10%. TCF will maintain GIS records of all harvests to ensure that the harvest cycle restrictions respected. Catastrophic events such as fire, insect attack or floods may initiate changes in the proposed plan and those changes will be disclosed in THP's or Emergency Notices filed with CALFIRE.

8 Long Term Sustained Yield Tables and Charts

LTSY was calculated for each forest for a 100 year planning horizon. The calculation of LTSY considered for unconstrained timber stands and limited harvesting in riparian zones. Areas designated as "no harvest" due to wildlife or water quality constraints were omitted from the LTSY calculation. The following tables and charts display data related to the calculation of Maximum Sustained Production. All data displayed is the result of the 4C growth and yield model.

8.1 Salmon Creek Forest

The Salmon Creek Forest (4,389 acres) is primarily within the Big Salmon Creek watershed. The calculated LTSY over the one hundred year planning horizon is 2,766 MBF/year.

Table 7: LTSY Acres

Forest	Total Acres	Class I WLPZ No Harvest	Class I WLPZ Restricted Harvest	Class II WLPZ No Harvest	Class II WLPZ Restricted Harvest	NSO	Pygmy	LTSY Acres
Salmon Creek	4,389	124	123	66	238	731	7	3,100

Table 8: Growth and Yield Over 100 Year Planning Horizon.

	Salmon Creek All Acres MBF Totals						Salmon Creek Unconstrained MBF Totals					
Period	**Pre-Harvest Standing**	**Harvested**	**Post-Harvest Standing**	**Growth**	**Growth / Year**	**Harvest as a % of Growth**	**Pre-Harvest Standing**	**Harvest**	**Post-Harvest Standing**	**Growth**	**Growth / Year**	**Harvest as a % of Growth**
2014-2018	133,489	8,269	148,021	22,800	4,560	**36%**	81,918	7,726	90,193	16,000	3,200	**48%**
2019-2023	148,021	8,552	162,292	22,824	4,565	**37%**	90,193	8,322	97,911	16,041	3,208	**52%**
2024-2028	162,292	9,457	175,093	22,257	4,451	**42%**	97,911	8,945	104,460	15,494	3,099	**58%**
2029-2033	175,093	9,654	187,910	22,471	4,494	**43%**	104,460	9,636	110,306	15,482	3,096	**62%**
2034-2038	187,910	14,017	196,186	22,293	4,459	**63%**	110,306	13,975	111,452	15,121	3,024	**92%**
2039-2043	196,186	6,298	212,723	22,835	4,567	**28%**	111,452	6,288	120,683	15,519	3,104	**41%**
2044-2048	212,723	11,155	224,221	22,654	4,531	**49%**	120,683	11,067	124,845	15,229	3,046	**73%**
2049-2053	224,221	13,939	232,593	22,311	4,462	**62%**	124,845	13,938	125,697	14,790	2,958	**94%**
2054-2058	232,593	10,600	244,257	22,263	4,453	**48%**	125,697	10,551	129,831	14,685	2,937	**72%**
2059-2063	244,257	8,683	258,030	22,456	4,491	**39%**	129,831	8,609	136,052	14,830	2,966	**58%**
2064-2068	258,030	9,112	271,404	22,487	4,497	**41%**	136,052	9,065	141,842	14,855	2,971	**61%**
2069-2073	271,404	13,988	279,566	22,150	4,430	**63%**	141,842	13,984	142,373	14,516	2,903	**96%**
2074-2078	279,566	13,041	288,391	21,866	4,373	**60%**	142,373	13,014	143,615	14,256	2,851	**91%**
2079-2083	288,391	6,815	303,632	22,055	4,411	**31%**	143,615	6,811	151,282	14,477	2,895	**47%**
2084-2088	303,632	5,083	320,880	22,331	4,466	**23%**	151,282	4,985	161,106	14,809	2,962	**34%**
2089-2093	320,880	13,985	328,886	21,991	4,398	**64%**	161,106	13,975	161,652	14,521	2,904	**96%**
2094-2098	328,886	14,073	336,613	21,800	4,360	**65%**	161,652	13,987	162,066	14,401	2,880	**97%**
2099-2103	336,613	13,695	344,377	21,459	4,292	**64%**	162,066	13,692	162,491	14,118	2,824	**97%**
2104-2108	344,377	11,955	353,592	21,170	4,234	**56%**	162,491	11,929	164,464	13,903	2,781	**86%**
2109-2113	353,592	10,480	364,142	21,030	4,206	**50%**	164,464	10,478	167,818	13,832	2,766	**76%**

Table 9: Growth and yield/acre over 100 year planning horizon

Period	Salmon Creek MBF/acre Results					
	Pre-Harvest Standing (All Acres)	Pre-Harvest Standing (Unconstrained Acres)	Harvest (All Harvested Acres)	Harvest (Unconstrained Acres)	Post-Harvest Standing (All Acres)	Post-Harvest Standing (Unconstrained Acres
2014-2018	32.1	26.4	7.4	7.7	35.6	29.0
2019-2023	35.6	29.0	13.8	14.0	39.0	31.5
2024-2028	39.0	31.5	11.5	13.3	42.1	33.6
2029-2033	42.1	33.6	9.9	10.2	45.1	35.5
2034-2038	45.1	35.5	10.5	11.1	47.1	35.9
2039-2043	47.1	35.9	10.7	11.0	51.1	38.9
2044-2048	51.1	38.9	8.9	10.0	53.9	40.2
2049-2053	53.9	40.2	11.0	11.3	55.9	40.5
2054-2058	55.9	40.5	9.1	10.5	58.7	41.8
2059-2063	58.7	41.8	13.1	13.8	62.0	43.8
2064-2068	62.0	43.8	9.3	11.1	65.2	45.7
2069-2073	65.2	45.7	13.1	13.5	67.2	45.8
2074-2078	67.2	45.8	11.1	12.8	69.3	46.2
2079-2083	69.3	46.2	12.1	13.0	72.9	48.7
2084-2088	72.9	48.7	8.5	11.7	77.1	51.9
2089-2093	77.1	51.9	15.0	15.7	79.0	52.1
2094-2098	79.0	52.1	15.2	18.5	80.9	52.2
2099-2103	80.9	52.2	15.4	16.0	82.7	52.3
2104-2108	82.7	52.3	12.0	14.5	84.9	53.0
2109-2113	84.9	53.0	16.1	17.1	87.5	54.0

Table 10: Acres Harvested By Silviculture.

	Salmon Creek Silvicultural Acres by Period									
Year	WLPZ1	WLPZ2	Standard Selection	transition	VR40	VR60	Commercial Thin	Conifer Release	Rehab	Sum
2014-2018	9	18	594	0	0	0	0	0	0	**620**
2019-2023	19	132	660	0	13	0	0	0	0	**824**
2024-2028	13	12	945	0	0	0	0	0	0	**970**
2029-2033	1	82	1,258	0	0	0	0	0	0	**1,341**
2034-2038	1	18	571	0	0	0	0	0	0	**591**
2039-2043	17	125	1,110	0	0	0	0	0	0	**1,252**
2044-2048	9	25	1,232	0	0	0	0	0	0	**1,266**
2049-2053	26	133	1,003	0	0	0	0	0	0	**1,162**
2054-2058	12	26	623	0	0	0	0	0	0	**661**
2059-2063	28	133	819	0	0	0	0	0	0	**980**
2064-2068	13	25	1,033	0	0	0	0	0	0	**1,070**
2069-2073	30	135	1,014	0	0	0	0	0	0	**1,178**
2074-2078	13	25	524	0	0	0	0	0	0	**562**
2079-2083	37	134	426	0	0	0	0	0	0	**597**
2084-2088	13	26	891	0	0	0	0	0	0	**929**
2089-2093	37	134	757	0	0	0	0	0	0	**928**
2094-2098	13	25	853	0	0	0	0	0	0	**891**
2099-2103	40	135	821	0	0	0	0	0	0	**996**
2104-2108	13	25	612	0	0	0	0	0	0	**650**

8.2 Big River Forest

The Big River Forest (11,707 acres) is primarily within the Big River watershed adjacent to and south of Jackson State Forest and Hwy 20. The calculated LTSY over the 100 year planning horizon is 7,840 MBF/ Year.

Table 11: LTSY Acres

Forest	Total Acres	Class I WLPZ No Harvest	Class I WLPZ Restricted Harvest (including flood plain)	Class II WLPZ No Harvest	Class II WLPZ Restricted Harvest	NSO	CE No Harvest	LTSY Acres
Big River	11,707	295	420	141	487	870	113	9,381

Table 12: Growth and Yield Over 100 Year Planning Horizon.

	Big River All Acres MBF Totals						Big River Unconstrained MBF Totals					
Period	**Pre-Harvest Standing**	**Harvested**	**Post-Harvest Standing**	**Growth**	**Growth / Year**	**Harvest as a % of Growth**	**Pre-Harvest Standing**	**Harvest**	**Post-Harvest Standing**	**Growth**	**Growth / Year**	**Harvest as a % of Growth**
2014-2018	268,328	18,288	306,060	56,020	11,204	**33%**	201,068	18,008	227,958	44,898	8,980	**40%**
2019-2023	306,060	17,929	344,644	56,513	11,303	**32%**	227,958	17,362	255,647	45,051	9,010	**39%**
2024-2028	344,644	21,724	379,489	56,569	11,314	**38%**	255,647	20,860	279,794	45,007	9,001	**46%**
2029-2033	379,489	22,616	414,506	57,632	11,526	**39%**	279,794	22,488	302,962	45,656	9,131	**49%**
2034-2038	414,506	34,534	437,134	57,162	11,432	**60%**	302,962	34,277	313,520	44,835	8,967	**76%**
2039-2043	437,134	20,967	474,383	58,217	11,643	**36%**	313,520	20,759	338,356	45,595	9,119	**46%**
2044-2048	474,383	26,955	505,959	58,531	11,706	**46%**	338,356	26,831	357,176	45,652	9,130	**59%**
2049-2053	505,959	43,046	519,983	57,070	11,414	**75%**	357,176	42,834	358,342	44,000	8,800	**97%**
2054-2058	519,983	23,613	553,654	57,284	11,457	**41%**	358,342	23,544	378,849	44,050	8,810	**53%**
2059-2063	553,654	41,867	568,086	56,299	11,260	**74%**	378,849	41,820	379,968	42,939	8,588	**97%**
2064-2068	568,086	28,698	595,653	56,266	11,253	**51%**	379,968	28,643	394,157	42,832	8,566	**67%**
2069-2073	595,653	41,020	609,791	55,157	11,031	**74%**	394,157	40,937	394,895	41,675	8,335	**98%**
2074-2078	609,791	29,068	635,742	55,019	11,004	**53%**	394,895	28,857	407,579	41,541	8,308	**69%**
2079-2083	635,742	25,514	665,434	55,206	11,041	**46%**	407,579	25,478	423,841	41,739	8,348	**61%**
2084-2088	665,434	25,680	695,076	55,321	11,064	**46%**	423,841	25,633	440,102	41,894	8,379	**61%**
2089-2093	695,076	40,929	708,691	54,545	10,909	**75%**	440,102	40,900	440,373	41,171	8,234	**99%**

Period	Big River All Acres MBF Totals						Big River Unconstrained MBF Totals					
	Pre-Harvest Standing	Harvested	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth	Pre-Harvest Standing	Harvest	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth
2094-2098	708,691	39,023	723,283	53,614	10,723	**73%**	440,373	38,987	441,700	40,314	8,063	**97%**
2099-2103	723,283	35,066	741,195	52,978	10,596	**66%**	441,700	34,965	446,498	39,763	7,953	**88%**
2104-2108	741,195	23,856	770,409	53,070	10,614	**45%**	446,498	23,829	462,622	39,953	7,991	**60%**
2109-2113	770,409	38,796	783,834	52,221	10,444	**74%**	462,622	38,737	463,086	39,201	7,840	**99%**

Table 13: Growth and yield/acre over 100 year planning horizon

Period	Big River MBF/acre Results					
	Pre-Harvest Standing (All Acres)	Pre-Harvest Standing (Unconstrained Acres)	Harvest (All Harvested Acres)	Harvest (Unconstrained Acres)	Post-Harvest Standing (All Acres)	Post-Harvest Standing (Unconstrained Acres
2011-2013	21.2	19.2	NA	NA	NA	NA
2014-2018	24.5	22.8	7.2	7.3	28.0	25.8
2019-2023	28.0	25.8	9.4	9.7	31.5	28.9
2024-2028	31.5	28.9	10.9	11.5	34.7	31.7
2029-2033	34.7	31.7	8.9	9.3	37.9	34.3
2034-2038	37.9	34.3	9.8	10.1	40.0	35.5
2039-2043	40.0	35.5	10.1	10.4	43.4	38.3
2044-2048	43.4	38.3	9.8	10.5	46.3	40.4
2049-2053	46.3	40.4	10.7	11.1	47.5	40.6
2054-2058	47.5	40.6	9.9	10.8	50.6	42.9
2059-2063	50.6	42.9	12.8	13.4	51.9	43.0
2064-2068	51.9	43.0	11.7	12.8	54.5	44.6
2069-2073	54.5	44.6	11.9	12.5	55.8	44.7
2074-2078	55.8	44.7	11.3	12.6	58.1	46.1
2079-2083	58.1	46.1	12.4	13.6	60.9	48.0
2084-2088	60.9	48.0	12.1	13.7	63.6	49.8
2089-2093	63.6	49.8	14.5	15.7	64.8	49.8
2094-2098	64.8	49.8	13.0	14.2	66.1	50.0
2099-2103	66.1	50.0	13.6	14.6	67.8	50.5
2104-2108	67.8	50.5	12.0	14.0	70.4	52.4

	Big River MBF/acre Results					
Period	**Pre-Harvest Standing (All Acres)**	**Pre-Harvest Standing (Unconstrained Acres)**	**Harvest (All Harvested Acres)**	**Harvest (Unconstrained Acres)**	**Post-Harvest Standing (All Acres)**	**Post-Harvest Standing (Unconstrained Acres**
2109-2113	70.4	52.4	15.1	16.3	71.7	52.4

Table 14: Acres Harvested By Silviculture.

	Big River Silvicultural Acres by Period								
Year	**WLPZ1**	**WLPZ2**	**Standard Selection**	**transition**	**VR40**	**VR60**	**Commercial Thin**	**Conifer Release**	**Rehab**	**Sum**
2014-2018	8	65	2,371	109	0	0	0	0	0	**2,553**
2019-2023	20	90	1,736	55	0	0	0	0	0	**1,901**
2024-2028	26	150	1,781	40	0	0	0	0	0	**1,997**
2029-2033	41	61	2,427	0	0	0	0	0	0	**2,529**
2034-2038	38	122	3,379	0	0	0	0	0	0	**3,538**
2039-2043	8	77	1,988	0	0	0	0	0	0	**2,073**
2044-2048	63	138	2,544	17	0	0	0	0	0	**2,762**
2049-2053	21	122	3,853	15	0	0	0	0	0	**4,010**
2054-2058	46	159	2,183	0	0	0	0	0	0	**2,388**
2059-2063	39	105	3,132	0	0	0	0	0	0	**3,276**
2064-2068	68	159	2,234	0	0	0	0	0	0	**2,461**
2069-2073	45	116	3,287	0	0	0	0	0	0	**3,447**
2074-2078	119	156	2,290	0	0	0	0	0	0	**2,564**
2079-2083	59	124	1,874	0	0	0	0	0	0	**2,058**
2084-2088	80	160	1,876	0	0	0	0	0	0	**2,116**
2089-2093	107	121	2,600	0	0	0	0	0	0	**2,829**
2094-2098	91	159	2,750	0	0	0	0	0	0	**2,999**
2099-2103	56	126	2,400	0	0	0	0	0	0	**2,582**
2104-2108	136	156	1,703	0	0	0	0	0	0	**1,995**
2109-2113	65	124	2,382	0	0	0	0	0	0	**2,571**

8.3 Garcia River Forest

The Garcia River Forest (23,769 acres) is primarily within the Garcia River Watershed, bordered by Mountain View Road on the north and Fish Rock Road on the south. The calculated LTSY for Garcia is 7,175 MBF/year.

Table 15: LTSY Acres

Forest	Total Acres	Class I WLPZ No Harvest	Class I WLPZ Restricted Harvest	Class II WLPZ No Harvest	Class II WLPZ Restricted Harvest	NSO	Oak Woodlands	Grasslands	Ecological Reserve	LTSY Acres
Garcia River	23,769	260	636	303	1,132	1,034	613	369	6,257	13,165

Table 16: Growth and Yield Over 100 Year Planning Horizon.

	Garcia River All Acres MBF Totals						Garcia River Unconstrained MBF Totals					
Period	**Pre-Harvest Standing**	**Harvested**	**Post-Harvest Standing**	**Growth**	**Growth / Year**	**Harvest as a % of Growth**	**Pre-Harvest Standing**	**Harvest**	**Post-Harvest Standing**	**Growth**	**Growth / Year**	**Harvest as a % of Growth**
2014-2018	252,291	11,304	289,682	48,695	9,739	**23%**	147,904	7,964	168,495	28,555	5,711	**28%**
2019-2023	289,682	13,209	335,546	59,073	11,815	**22%**	168,495	9,232	193,862	34,598	6,920	**27%**
2024-2028	335,546	15,225	389,964	69,643	13,929	**22%**	193,862	10,702	224,045	40,886	8,177	**26%**
2029-2033	389,964	19,140	447,556	76,733	15,347	**25%**	224,045	12,407	257,201	45,563	9,113	**27%**
2034-2038	447,556	19,628	497,450	69,522	13,904	**28%**	257,201	14,382	283,845	41,026	8,205	**35%**
2039-2043	497,450	22,991	543,659	69,199	13,840	**33%**	283,845	16,674	307,886	40,716	8,143	**41%**
2044-2048	543,659	26,512	586,710	69,562	13,912	**38%**	307,886	19,329	329,423	40,865	8,173	**47%**
2049-2053	586,710	28,790	627,447	69,528	13,906	**41%**	329,423	22,408	347,499	40,485	8,097	**55%**
2054-2058	627,447	32,587	664,118	69,258	13,852	**47%**	347,499	25,977	361,483	39,961	7,992	**65%**
2059-2063	664,118	34,227	698,730	68,840	13,768	**50%**	361,483	30,114	370,509	39,140	7,828	**77%**
2064-2068	698,730	36,794	730,068	68,132	13,626	**54%**	370,509	34,911	373,489	37,892	7,578	**92%**
2069-2073	730,068	30,508	767,511	67,950	13,590	**45%**	373,489	29,504	381,093	37,108	7,422	**80%**
2074-2078	767,511	36,988	797,732	67,209	13,442	**55%**	381,093	35,282	381,744	35,934	7,187	**98%**
2079-2083	797,732	35,394	828,864	66,526	13,305	**53%**	381,744	34,481	382,063	34,800	6,960	**99%**
2084-2088	828,864	31,843	863,121	66,099	13,220	**48%**	382,063	31,627	384,349	33,913	6,783	**93%**

Period	Garcia River All Acres MBF Totals						Garcia River Unconstrained MBF Totals					
	Pre-Harvest Standing	Harvested	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth	Pre-Harvest Standing	Harvest	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth
2089-2093	863,121	26,051	902,967	65,897	13,179	**40%**	384,349	25,600	392,136	33,387	6,677	**77%**
2094-2098	902,967	10,910	958,866	66,809	13,362	**16%**	392,136	10,653	415,477	33,994	6,799	**31%**
2099-2103	958,866	7,981	1,018,770	67,885	13,577	**12%**	415,477	7,407	442,918	34,848	6,970	**21%**
2104-2108	1,018,770	11,933	1,075,452	68,615	13,723	**17%**	442,918	11,236	467,088	35,406	7,081	**32%**
2109-2113	1,075,452	11,810	1,132,902	69,260	13,852	**17%**	467,088	11,695	491,269	35,876	7,175	**33%**

Table 17: Growth and yield/acre over 100 year planning horizon

Period	Garcia River MBF/acre Results						Harvest/Year (All Acres)	Harvest/Year (Unconstrained Acres)
	Pre-Harvest Standing (All Acres)	Pre-Harvest Standing (Unconstrained Acres)	Harvest (All Harvested Acres)	Harvest (Unconstrained Acres)	Post-Harvest Standing (All Acres)	Post-Harvest Standing (Unconstrained Acres		
2014-2018	11.5	11.4	5.1	6.8	13.2	13.0	2,261	1,593
2019-2023	13.2	13.0	5.8	6.9	15.3	15.0	2,642	1,846
2024-2028	15.3	15.0	6.2	7.7	17.8	17.3	3,045	2,140
2029-2033	17.8	17.3	4.9	8.4	20.4	19.9	3,828	2,481
2034-2038	20.4	19.9	7.0	9.5	22.7	21.9	3,926	2,876
2039-2043	22.7	21.9	7.4	9.2	24.8	23.8	4,598	3,335
2044-2048	24.8	23.8	6.5	9.5	26.7	25.4	5,302	3,866
2049-2053	26.7	25.4	8.6	10.3	28.6	26.8	5,758	4,482
2054-2058	28.6	26.8	9.9	11.8	30.3	27.9	6,517	5,195
2059-2063	30.3	27.9	9.1	13.7	31.8	28.6	6,845	6,023
2064-2068	31.8	28.6	12.0	13.6	33.3	28.8	7,359	6,982
2069-2073	33.3	28.8	11.1	12.7	35.0	29.4	6,102	5,901
2074-2078	35.0	29.4	9.4	12.4	36.4	29.5	7,398	7,056
2079-2083	36.4	29.5	10.9	12.6	37.8	29.5	7,079	6,896

Period	Garcia River MBF/acre Results							
	Pre-Harvest Standing (All Acres)	Pre-Harvest Standing (Unconstrained Acres)	Harvest (All Harvested Acres)	Harvest (Unconstrained Acres)	Post-Harvest Standing (All Acres)	Post-Harvest Standing (Unconstrained Acres	Harvest/Year (All Acres)	Harvest/Year (Unconstrained Acres)
2084-2088	37.8	29.5	12.0	13.1	39.3	29.7	6,369	6,325
2089-2093	39.3	29.7	8.9	13.5	41.2	30.3	5,210	5,120
2094-2098	41.2	30.3	10.0	13.8	43.7	32.1	2,182	2,131
2099-2103	43.7	32.1	9.1	15.0	46.4	34.2	1,596	1,481
2104-2108	46.4	34.2	7.0	14.6	49.0	36.1	2,387	2,247
2109-2113	49.0	36.1	5.1	6.3	51.6	37.9	2,362	2,339

Table 18: Acres harvested by silviculture

Year	Garcia River Silvicultural Acres by Period										
	WLPZ1	WLPZ2	Conservation Easement Selection	Standard Selection	transition	VR40	VR60	Commercial Thin	Conifer Release	Rehab	Sum
2014-2018	0	534	516	1,152	22	0	0	0	0	0	**2,224**
2019-2023	0	0	934	1,345	2	0	0	0	0	0	**2,281**
2024-2028	2	73	1,000	1,393	0	0	0	0	0	0	**2,468**
2029-2033	800	604	999	1,483	1	0	0	0	0	0	**3,887**
2034-2038	248	46	1,000	1,508	0	0	0	0	0	0	**2,801**
2039-2043	297	0	1,000	1,817	0	0	0	0	0	0	**3,114**
2044-2048	625	440	1,000	2,041	0	0	0	0	0	0	**4,106**
2049-2053	90	69	1,000	2,172	1	0	0	0	0	0	**3,331**
2054-2058	42	50	1,000	2,196	0	0	0	0	0	0	**3,287**
2059-2063	578	359	622	2,198	0	0	0	0	0	0	**3,757**
2064-2068	127	87	302	2,560	0	0	0	0	0	0	**3,076**
2069-2073	280	9	149	2,293	25	0	0	0	0	0	**2,756**
2074-2078	464	395	243	2,850	0	0	0	0	0	0	**3,952**
2079-2083	340	54	138	2,729	0	0	0	0	0	0	**3,262**

	Garcia River Silvicultural Acres by Period										
Year	**WLPZ1**	**WLPZ2**	**Conservation Easement Selection**	**Standard Selection**	**transition**	**VR40**	**VR60**	**Commercial Thin**	**Conifer Release**	**Rehab**	**Sum**
2084-2088	150	46	36	2,417	0	0	0	0	0	0	**2,650**
2089-2093	622	359	43	1,894	0	0	0	0	0	0	**2,918**
2094-2098	196	88	29	773	0	0	0	0	0	0	**1,086**
2099-2103	306	9	65	493	0	0	0	0	0	0	**873**
2104-2108	473	395	60	768	0	0	0	0	0	0	**1,697**
2109-2113	371	52	7	1,869	0	0	0	0	0	0	**2,298**

8.4 Gualala River Forest

The Gualala River Forest (13,537 acres) is primarily within the Gualala River Watershed, bordered by Fish Rock Road on the north and extending to the Sonoma County line on the south. The calculated LTSY for Gualala is 7,984 MBF/year.

Table 19: LTSY Acres

Forest	Total Acres	Class I WLPZ No Harvest	Class I WLPZ Restricted Harvest	Class II WLPZ No Harvest	Class II WLPZ Restricted Harvest	NSO	Oak Woodlands	Grasslands	LTSY Acres
Gualala River	13,537	119	277	151	779	102	91	115	11,903

Table 20: Growth and Yield Over 100 Year Planning Horizon

	Gualala River All Acres MBF Totals						Gualala River Unconstrained MBF Totals					
Period	**Pre-Harvest Standing**	**Harvested**	**Post-Harvest Standing**	**Growth**	**Growth / Year**	**Harvest as a % of Growth**	**Pre-Harvest Standing**	**Harvest**	**Post-Harvest Standing**	**Growth**	**Growth / Year**	**Harvest as a % of Growth**
2014-2018	120,074	8,748	147,849	36,523	7,305	**24%**	109,034	7,998	134,372	33,336	6,667	**24%**
2019-2023	147,849	10,000	180,172	42,324	8,465	**24%**	134,372	10,000	162,861	38,489	7,698	**26%**
2024-2028	180,172	13,387	207,530	40,745	8,149	**33%**	162,861	11,999	188,235	37,373	7,475	**32%**
2029-2033	207,530	14,021	243,658	50,148	10,030	**28%**	188,235	13,999	220,217	45,982	9,196	**30%**
2034-2038	243,658	15,718	279,409	51,470	10,294	**31%**	220,217	14,999	252,377	47,158	9,432	**32%**
2039-2043	279,409	16,241	310,912	47,743	9,549	**34%**	252,377	15,990	280,052	43,665	8,733	**37%**
2044-2048	310,912	17,510	341,326	47,925	9,585	**37%**	280,052	16,995	306,987	43,930	8,786	**39%**
2049-2053	341,326	17,983	371,419	48,076	9,615	**37%**	306,987	17,966	333,000	43,979	8,796	**41%**
2054-2058	371,419	19,098	400,372	48,050	9,610	**40%**	333,000	18,989	357,907	43,896	8,779	**43%**

Period	Gualala River All Acres MBF Totals						Gualala River Unconstrained MBF Totals					
	Pre-Harvest Standing	Harvested	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth	Pre-Harvest Standing	Harvest	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth
2059-2063	400,372	19,977	428,415	48,019	9,604	**42%**	357,907	19,963	381,720	43,775	8,755	**46%**
2064-2068	428,415	22,100	454,467	48,152	9,630	**46%**	381,720	21,989	403,602	43,871	8,774	**50%**
2069-2073	454,467	22,971	479,383	47,888	9,578	**48%**	403,602	22,946	424,203	43,548	8,710	**53%**
2074-2078	479,383	24,115	502,621	47,352	9,470	**51%**	424,203	23,984	443,224	43,005	8,601	**56%**
2079-2083	502,621	26,004	523,263	46,646	9,329	**56%**	443,224	25,975	459,510	42,260	8,452	**61%**
2084-2088	523,263	28,097	541,155	45,989	9,198	**61%**	459,510	27,975	473,145	41,611	8,322	**67%**
2089-2093	541,155	30,009	556,379	45,234	9,047	**66%**	473,145	29,982	483,989	40,826	8,165	**73%**
2094-2098	556,379	32,106	568,689	44,416	8,883	**72%**	483,989	31,992	492,021	40,023	8,005	**80%**
2099-2103	568,689	29,405	583,695	44,411	8,882	**66%**	492,021	29,378	502,642	39,999	8,000	**73%**
2104-2108	583,695	18,482	609,783	44,570	8,914	**41%**	502,642	18,376	524,444	40,178	8,036	**46%**
2109-2113	609,783	24,865	629,241	44,323	8,865	**56%**	524,444	24,837	539,526	39,919	7,984	**62%**

Table 21: Growth and yield/acre over 100 year planning horizon

Period	Gualala River MBF/acre Results							
	Pre-Harvest Standing (All Acres)	Pre-Harvest Standing (Unconstrained Acres)	Harvest (All Harvested Acres)	Harvest (Unconstrained Acres)	Post-Harvest Standing (All Acres)	Post-Harvest Standing (Unconstrained Acres	Harvest/Year (All Acres)	Harvest/Year (Unconstrained Acres)
2013	8.6	8.6	NA	NA	NA	NA	0	0
2014-2018	9.4	9.4	4.5	4.9	11.6	11.6	1,750	1,600
2019-2023	11.6	11.6	5.4	5.4	14.2	14.1	2,000	2,000
2024-2028	14.2	14.1	5.3	6.3	16.3	16.2	2,677	2,400
2029-2033	16.3	16.2	6.4	6.6	19.1	19.0	2,804	2,800
2034-2038	19.1	19.0	6.5	8.3	21.9	21.8	3,144	3,000
2039-2043	21.9	21.8	7.9	8.4	24.4	24.2	3,248	3,198
2044-2048	24.4	24.2	6.9	8.9	26.8	26.5	3,502	3,399
2049-2053	26.8	26.5	8.8	9.6	29.2	28.7	3,597	3,593
2054-2058	29.2	28.7	8.2	11.0	31.4	30.9	3,820	3,798

Period	Gualala River MBF/acre Results: Pre-Harvest Standing (All Acres)	Pre-Harvest Standing (Unconstrained Acres)	Harvest (All Harvested Acres)	Harvest (Unconstrained Acres)	Post-Harvest Standing (All Acres)	Post-Harvest Standing (Unconstrained Acres	Harvest/Year (All Acres)	Harvest/Year (Unconstrained Acres)
2059-2063	31.4	30.9	11.3	12.3	33.6	33.0	3,995	3,993
2064-2068	33.6	33.0	11.1	16.0	35.7	34.8	4,420	4,398
2069-2073	35.7	34.8	13.2	14.5	37.6	36.6	4,594	4,589
2074-2078	37.6	36.6	10.0	13.5	39.5	38.3	4,823	4,797
2079-2083	39.5	38.3	13.1	14.2	41.1	39.7	5,201	5,195
2084-2088	41.1	39.7	11.9	16.1	42.5	40.8	5,619	5,595
2089-2093	42.5	40.8	15.4	16.7	43.7	41.8	6,002	5,996
2094-2098	43.7	41.8	13.4	18.1	44.7	42.5	6,421	6,398
2099-2103	44.7	42.5	21.9	24.8	45.8	43.4	5,881	5,876
2104-2108	45.8	43.4	10.9	17.4	47.9	45.3	3,696	3,675
2109-2113	47.9	45.3	16.2	18.0	49.4	46.6	4,973	4,967

Table 22: Acres harvested by silviculture

Year	Gualala River Silvicultural Acres by Period: WLPZ1	WLPZ2	Standard selection	transition	VR40	VR60	Commercial Thinning	Conifer Release	Rehab	Sum
2014-2018	15	290	892	743	0	0	0	0	0	**1,940**
2019-2023	0	0	1,834	1	0	0	0	0	0	**1,835**
2024-2028	142	470	1,913	0	0	0	0	0	0	**2,525**
2029-2033	78	4	2,107	3	0	0	0	0	0	**2,192**
2034-2038	204	421	1,808	2	0	0	0	0	0	**2,435**
2039-2043	90	52	1,910	0	0	0	0	0	0	**2,052**
2044-2048	218	400	1,904	0	0	0	0	0	0	**2,522**
2049-2053	95	61	1,881	0	0	0	0	0	0	**2,037**
2054-2058	189	412	1,729	0	0	0	0	0	0	**2,330**
2059-2063	86	62	1,617	0	0	0	0	0	0	**1,764**
2064-2068	204	412	1,374	0	0	0	0	0	0	**1,990**
2069-2073	95	62	1,582	0	0	0	0	0	0	**1,738**

	Gualala River Silvicultural Acres by Period									
Year	**WLPZ1**	**WLPZ2**	**Standard selection**	**transition**	**VR40**	**VR60**	**Commercial Thinning**	**Conifer Release**	**Rehab**	**Sum**
2074-2078	218	412	1,771	0	0	0	0	0	0	**2,401**
2079-2083	97	62	1,828	0	0	0	0	0	0	**1,986**
2084-2088	219	412	1,734	0	0	0	0	0	0	**2,366**
2089-2093	97	62	1,794	0	0	0	0	0	0	**1,953**
2094-2098	221	412	1,769	0	0	0	0	0	0	**2,402**
2099-2103	97	62	1,184	0	0	0	0	0	0	**1,342**
2104-2108	221	412	1,056	0	0	0	0	0	0	**1,689**
2109-2113	97	62	1,377	0	0	0	0	0	0	**1,535**

8.5 Cumulative LTSY

The Calculated LTSY for The Conservation Fund Mendocino County Ownership is 25,766 MBF/year

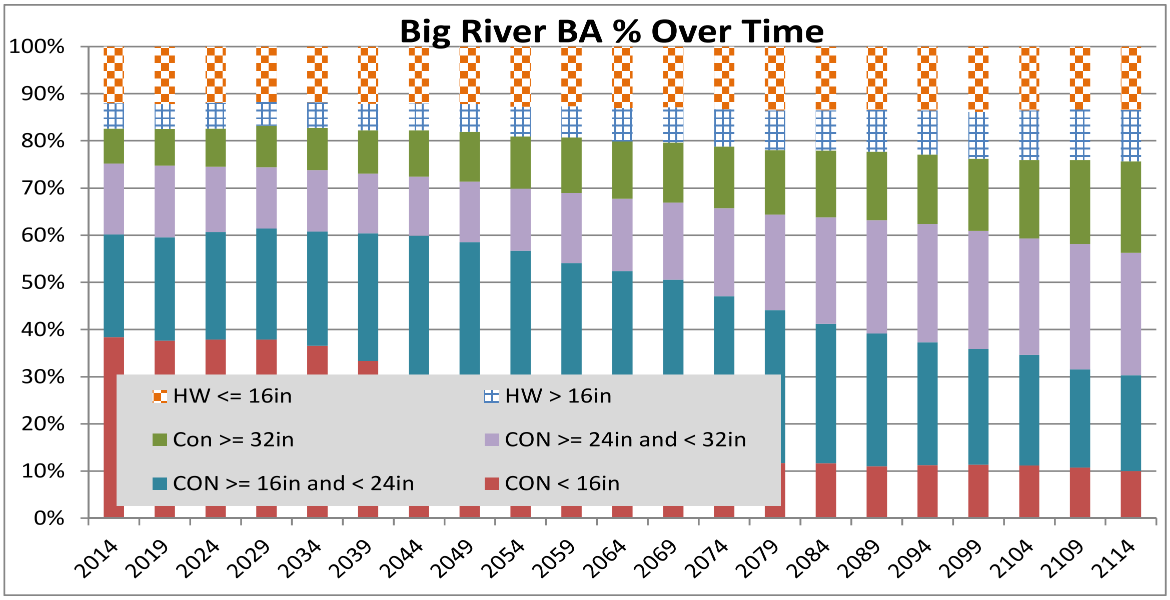
Table 23: Cumulative LTSY for all tracts combined.

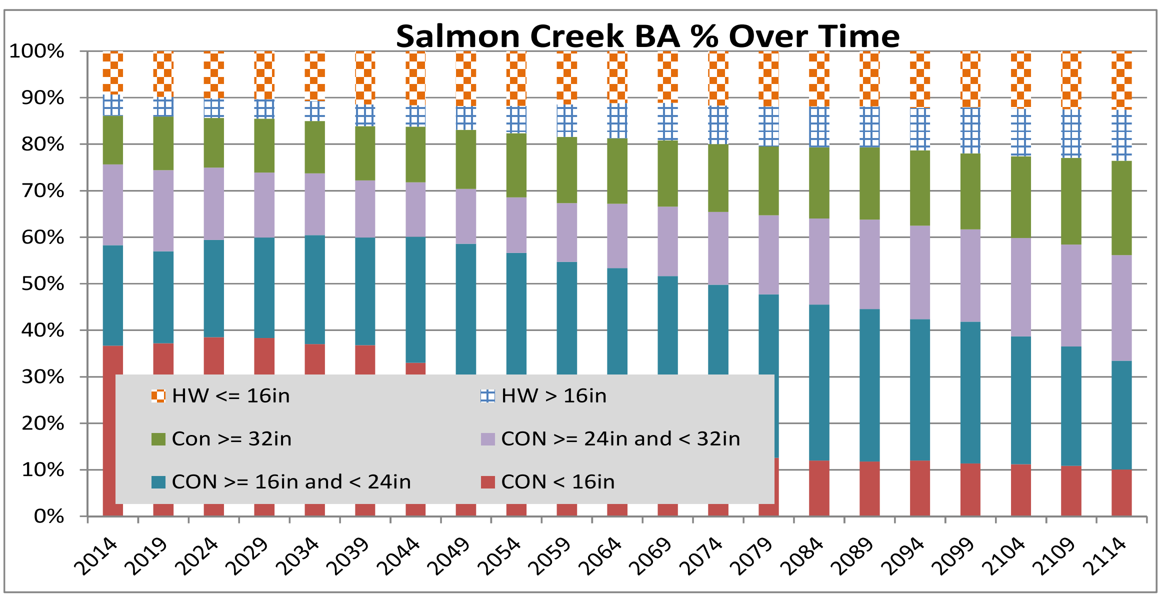
All Tracts All Acres MBF Totals							All Tracts Unconstrained MBF Totals					
Period	Pre-Harvest Standing	Harvested	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth	Pre-Harvest Standing	Harvest	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth
2014-2018	774,183	46,610	891,611	164,038	32,808	28	539,924	41,695	621,018	122,789	24,558	34
2019-2023	891,611	49,690	1,022,655	180,734	36,147	27	621,018	44,916	710,280	134,178	26,836	33
2024-2028	1,022,655	59,793	1,152,076	189,214	37,843	32	710,280	52,506	796,534	138,759	27,752	38
2029-2033	1,152,076	65,430	1,293,630	206,984	41,397	32	796,534	58,530	890,686	152,682	30,536	38
2034-2038	1,293,630	83,898	1,410,179	200,447	40,089	42	890,686	77,633	961,193	148,141	29,628	52
2039-2043	1,410,179	66,496	1,541,677	197,994	39,599	34	961,193	59,710	1,046,978	145,495	29,099	41
2044-2048	1,541,677	82,132	1,658,217	198,672	39,734	41	1,046,978	74,223	1,118,431	145,676	29,135	51
2049-2053	1,658,217	103,759	1,751,442	196,984	39,397	53	1,118,431	97,147	1,164,538	143,254	28,651	68
2054-2058	1,751,442	85,898	1,862,400	196,855	39,371	44	1,164,538	79,061	1,228,070	142,593	28,519	55
2059-2063	1,862,400	104,754	1,953,260	195,615	39,123	54	1,228,070	100,506	1,268,249	140,685	28,137	71
2064-2068	1,953,260	96,704	2,051,592	195,036	39,007	50	1,268,249	94,608	1,313,090	139,449	27,890	68
2069-2073	2,051,592	108,487	2,136,251	193,145	38,629	56	1,313,090	107,372	1,342,565	136,847	27,369	78
2074-2078	2,136,251	103,211	2,224,486	191,447	38,289	54	1,342,565	101,137	1,376,163	134,736	26,947	75
2079-2083	2,224,486	93,726	2,321,193	190,434	38,087	49	1,376,163	92,745	1,416,695	133,276	26,655	70

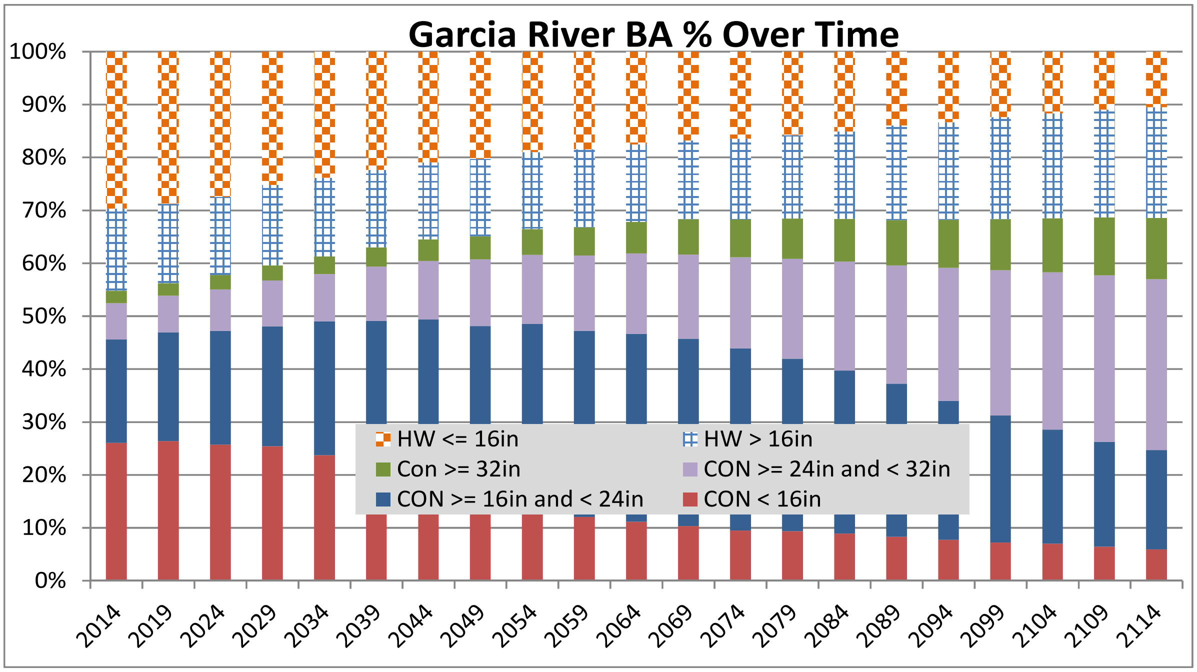
All Tracts All Acres MBF Totals							All Tracts Unconstrained MBF Totals					
Period	Pre-Harvest Standing	Harvested	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth	Pre-Harvest Standing	Harvest	Post-Harvest Standing	Growth	Growth / Year	Harvest as a % of Growth
2084-2088	2,321,193	90,702	2,420,232	189,741	37,948	48	1,416,695	90,219	1,458,702	132,227	26,445	68
2089-2093	2,420,232	110,974	2,496,923	187,666	37,533	59	1,458,702	110,457	1,478,150	129,905	25,981	85
2094-2098	2,496,923	96,112	2,587,451	186,639	37,328	51	1,478,150	95,620	1,511,263	128,732	25,746	74
2099-2103	2,587,451	86,148	2,688,036	186,733	37,347	46	1,511,263	85,442	1,554,549	128,728	25,746	66
2104-2108	2,688,036	66,226	2,809,236	187,426	37,485	35	1,554,549	65,370	1,618,619	129,440	25,888	51
2109-2113	2,809,236	85,951	2,910,119	186,834	37,367	46	1,618,619	85,748	1,661,700	128,829	25,766	67

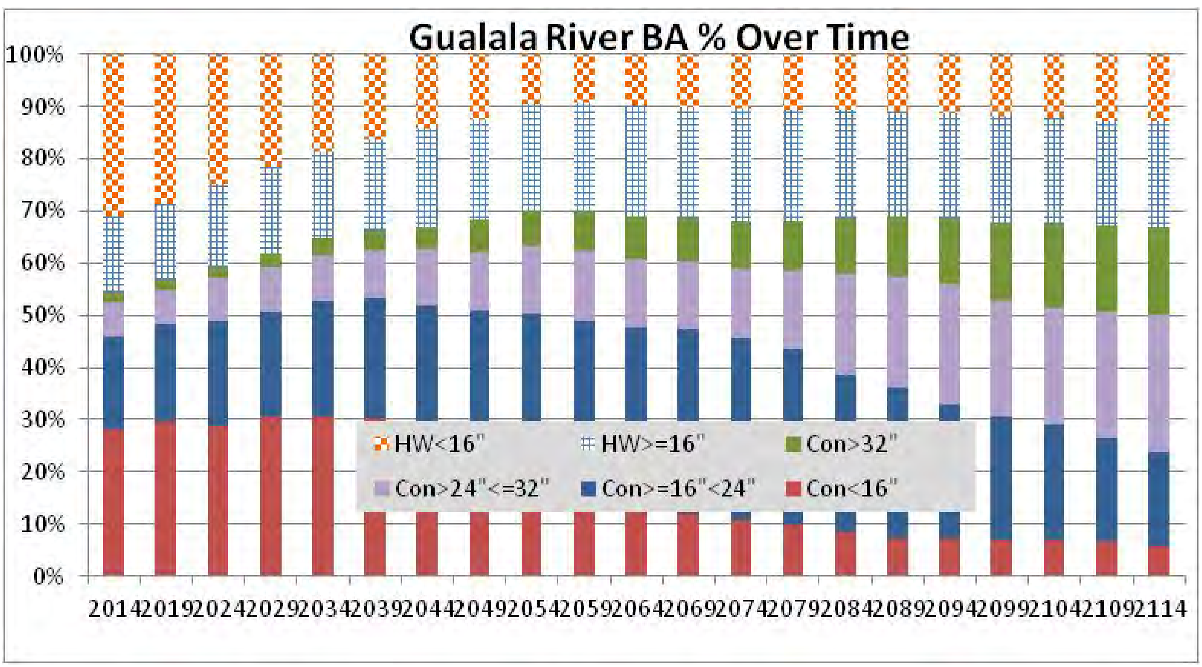
The following tables show the change in diameter class distribution over time for the unconstrained acres on Big River and Salmon Creek, in particular the increase in large conifers.

Table 23: Change in BA distribution over time






Garcia River BA % Over Time
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
HW <= 16in
HW > 16in
Con >= 32in
CON >= 24in and < 32in
CON >= 16in and < 24in
CON < 16in
2014
2019
2024
2029
2034
2039
2044
2049
2054
2059
2064
2069
2074
2079
2084
2089
2094
2099
2104
2109
2114


Gualala River BA % Over Time
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
HW<16"
HW>=16"
Con>32"
Con>24"<=32"
Con>=16"<24"
Con<16"
2014
2019
2024
2029
2034
2039
2044
2049
2054
2059
2064
2069
2074
2079
2084
2089
2094
2099
2104
2109
2114

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9 Appendices

- **Appendix A:** BRSC Forest Stratification
- **Appendix B:** Garcia River and Gualala River Forest Stratification
- **Appendix C:** Modeling Plan
- **Appendix D:** Inventory Collection Summary
- **Appendix E:** Property Maps

Appendix A: Big River and Salmon Creek Forest Stratification

1. 2011 Remote Sensing Data

In August 2011, GeoDigital flew the Big River and Salmon Creek Forests to acquire high-resolution color-infrared (CIR) imagery as well as LiDAR (Light Detection and Ranging) data. The CIR data was acquired at .5m^2 resolution. The LiDAR data was collected with at least 5 points per square meter. The LiDAR data was used to generate a 1 m^2 resolution Digital Elevation Map (DEM) and Canopy Height Model (CHM).

2. 2012 Stand Delineation and Stratification Method

A new stand layer was created for the Big River and Salmon Creek Forests using the LiDAR and CIR remote sensing data. The stand delineations are based on the CHM but several processing steps are required before stands of the appropriate size are made. The basic outline of the steps required to create the new stand layer is:

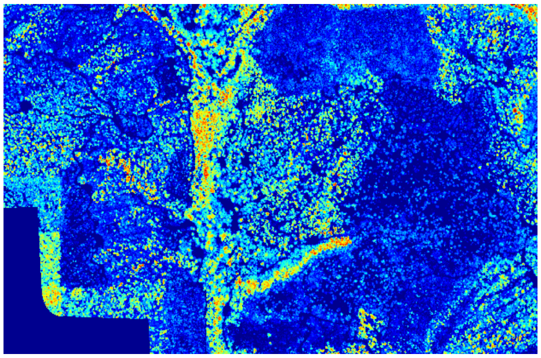
Create micro stands less than 1 acre by identifying timber with similar height and density attributes. (Figure a)

Merge micro stands by combining micro stands with similar attributes that are adjacent to one another. There is some tolerance built into the merging routine which allows dissimilar stands to be merged together to form stands which meet the minimum acreage criteria desired. (Figure b)

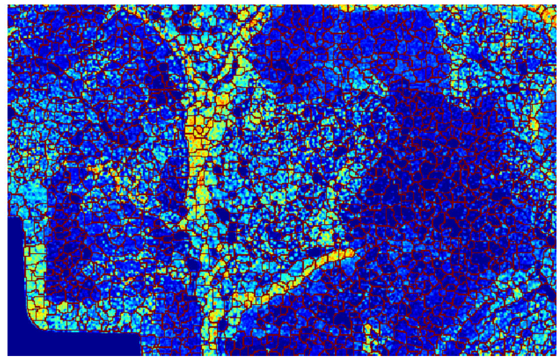
Once the microstand polygons were created, each polygon was placed into a strata based on 3 criteria. Polygons were classified based on the percent crown cover of canopy over 25 feet tall, the mean of the maximum heights found within tree crowns (i.e. – mean tree height), and the variability of the height of the trees within the stand polygon. The table below details the stratification system. All metrics are calculated on trees greater than or equal to 25 feet tall. A summary of the stratification can be seen below in table 4.[2]

[2] See Golinkoff, J. S. 2013. Area Dependent Region Merging: A Novel, User-Customizable Method to Create Forest Stands and Strata. European Journal of Remote Sensing 46:511–533.

a) **Original CHM (1m^2 resolution)**



b) **Final Watershed Microstand over CHM**



c) **Final Stand Delineation over CHM**

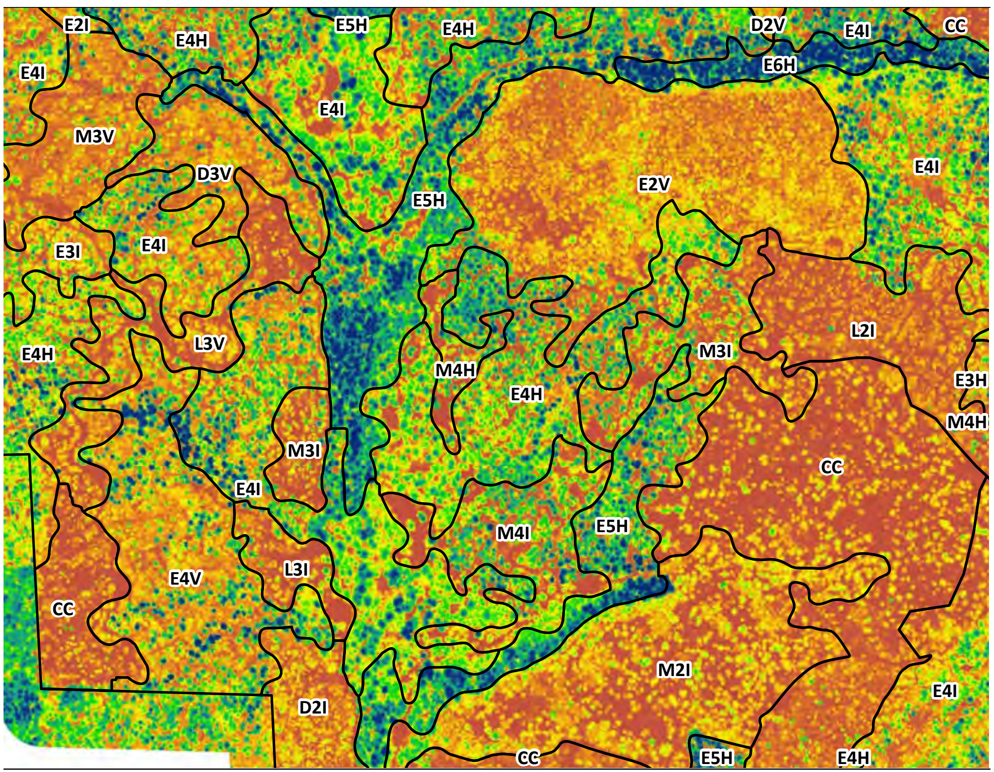


Table 1: Big River / Salmon Creek Statification Categories

Category	Class Names	Class Breaks
Percent Canopy Cover over 25ft	O (Open) L (Low) M (Medium) D (Dense) E (Extremely Dense)	20% canopy cover bins where % cover is defined as crown elements above 25ft
Mean Tree Height	1, 2, 3, 4, 5, 6, 7	25 foot height bins of mean tree heights

Tree Height Variability (Coefficient of Variation of Tree Height)	H (Homogeneous) I (Intermediate) V (Variable)	Homogeneous stands are any stand with CV < .23 Intermediate: .24< CV < .33 Variable: CV > .34

Table 2: Big River / Salmon Creek Stratification Results.

Strata	Sampled Area	Total Acres	Sampled Stands	Total Stands	Plots	Area Weight
CC	210	1,301	9	59	36	0.0876
D2H	68	93	2	5	8	0.0063
D2I	626	803	4	12	44	0.0541
D2V	65	148	2	5	9	0.0100
D3H	78	239	2	9	8	0.0161
D3I	316	476	5	14	35	0.0321
D3V	35	142	2	10	8	0.0096
D4H	82	209	1	8	9	0.0141
D4I	17	45	1	2	4	0.0031
D4V	13	13	1	1	4	0.0009
D5H	3	30	1	3	4	0.0021
E2H	83	192	3	9	15	0.0129
E2I	297	880	4	19	36	0.0592
E2V	62	120	2	5	9	0.0081
E3H	864	1,381	6	30	44	0.0930
E3I	883	2,303	8	45	75	0.1551
E3V	177	365	4	12	20	0.0246
E4H	446	1,186	6	43	51	0.0799
E4I	307	1,355	5	55	32	0.0912
E4V	20	86	2	5	8	0.0058
E5H	135	504	4	34	26	0.0339
E5I	115	182	3	9	15	0.0123
E5V	4	16	1	2	4	0.0011
E6H	85	197	3	12	16	0.0133
E6I	17	17	1	1	4	0.0012
E7H	5	16	1	2	4	0.0011
ES12	189	189	1	1	22	0.0127
L2H	54	111	2	9	8	0.0075
L2I	145	378	4	17	18	0.0255
L2V	71	143	1	3	8	0.0096
L3H	8	47	1	6	4	0.0032
L3I	28	162	2	13	8	0.0109
L3V	55	89	2	5	9	0.0060
L4H	9	21	1	2	4	0.0014
L4I	47	50	2	3	8	0.0033
LP12	121	121	1	1	10	0.0081
M2H	49	76	1	3	5	0.0051
M2I	55	97	2	3	8	0.0065

M2V	116	217	2	6	15	0.0146
M3H	12	42	1	3	4	0.0028
M3I	121	249	3	12	18	0.0168
M3V	38	49	2	3	12	0.0033
M4H	21	74	1	7	4	0.0050
M4I	19	63	1	4	8	0.0043
M4V	2	2	1	1	4	0.0001
PC12	372	372	1	1	41	0.0250

3. Inventory Design and Methodology Details

The 2012 Big River and Salmon Creek (BRSC) inventory used a multi-stage probability proportional to size sample.[3] The cruise was completed in the June, 2012. There were 43 forested strata sampled using a total of 677 plots. The sampled stands were randomly selected with replacement with probability proportional to their area. All plots were installed on a 5 by 5 chain grid. Stands that were selected more than once had plots installed on grids that were offset by 2.5 chains. Sampled stands received 1 plot per 10 acres with all stands getting at least 4 and at most 8 plots per random selection. If a sampled stand was selected more than once, this same sampling intensity was used.

The 2012 inventory plots used exactly the same design as in past cruises. A basal area factor (BAF) prism was established in each stand to select 5 to 10 trees per plot greater than 5.5 inches DBH. Trees less than 5.5in DBH were measured in a 1/100 acre regeneration plot. Standing dead trees and snags were measured if they were counted in the variable radius prism plot. Old growth stumps were measured in 1/10th acre fixed area plots. Down dead material was measured using two 50ft long transects.

The 2012 BRSC inventory proceeded in 2 stages. In the first stage, the first randomly selected stand within each stratum was sampled. Based on this first stage, the coefficient of variation of all strata was used to estimate the number of plots needed in the second stage. There were 231 plots sampled in the first stage and 446 plots sampled in the second stage.

4. Post-Harvest Cruising

Areas subject to timber harvest or other disturbance such as fire or insect attack are inventoried each year utilizing the cruise specifications and design mentioned here. THP areas are delineated as new stands with new, unique strata calls. Each new stratum was then cruised using a systematic 10 by 10 chain grid with a random start. In this way, the inventory is updated with new strata and plot data information and the inventory recalculated to reflect yearly harvests.

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[3] See Borders, B. E., B. D. Shiver, and M. L. Clutter. 2005. Tmber Inventory of Large Acreages Using Stratified Two-Stage List Sampling. Southern Journal of Applied Forestry 29:152–157.
Shiver, B. D., and B. E. Borders. 1996. Sampling techniques for forest resource inventory. John Wiley & Sons, Inc., New York, NY.

Appendix B: Garcia and Gualala Forest Stratification

The following sections describe the stand delineation process and sampling design for the Garcia River and Gualala River Forests. The sampling design used LiDAR and high-resolution color infrared imagery to create a cell based stratified inventory. These initial cells were then combined to create forest management units. This is similar in concept to the mirostand combination process described for Big River and Salmon Creek (BR/SC) except that cells size was predefined. The process described below is the precursor to the BR/SC stratification process.

1. 2010 Garcia River Forest Stratification and Sampling Design

A full-property wide inventory of the GRF was completed in 2010 using a pixel-based (cell) stratification. This inventory broke the GRF into 1 square chain (1/10 acre) grid cells and used high-resolution color-infrared and LIDAR data collected in 2009 to characterize each cell. The 2009 remote sensing data, correlated with 199 new inventory plots, was used to create a set of strata across the property that optimally partition the variability of conditions found in the forest. The 199 plots were then supplemented with 611 plots and all of these 810 plots were used to describe the forest conditions across the GRF.

The 2010 inventory classified each cell into a forest stratum. There were 43 different strata identified as a result of this methodology and each stratum had about 20 plots measured in it. Plots were randomly placed within strata with the number of plots allocated in each strata based on the variability of the strata. The plot data collected across the property was compiled and expanded into cells that had not been inventoried (similar to how a traditional stand-based stratified forest inventory works). Using the plot data paired with the remote sensing data, forest attributes for any individual cell or any region within the ownership can be estimated and used for management purposes. [4]

The 2010 inventory used a simple stratified random sample. Plots were randomly located within each strata and were not located on a grid. All plots were cruised using a 20 Basal Area Factor (BAF) prism for trees larger than 5.5 inches DBH. Regeneration was measured in 1/100th acre plots.

2. 2014 Gualala River Forest Stratification and Sampling Design

A full-property wide inventory of the Gualala River Forest was completed in 2014 using a pixel-based (cell) stratification. This inventory broke the Gualala Forest into 1/2 acre grid cells and used the high-resolution color-infrared and LIDAR data to characterize/stratify each cell. A total of 339 plots were installed on the property.

3. 2013 Stand Delineation

Using the remote sensing data, the individual cells were combined into forest management units using the same approach as was described in Appendix A for the Big River and Salmon Creek forests. Forest inventory data was assigned to the stands by using the tree lists from the cell based inventory data. In this way, each stand received a unique tree list based on recent inventory data. These stands

[4] See Golinkoff, J., M. Hanus, and J. Carah. 2011. The use of airborne laser scanning to develop a pixel-based stratification for a verified carbon offset project. Carbon Balance and Management 6:9.

were all classified based on the remote sensing data and assigned strata calls using the same method as was used on the BRSC property. The same strata categories as were used on the Big River and Salmon Creek Forests were used for the Garcia and Gualala forest (see table above).

4. Results

The 2010 sample of the GRF used 43 strata (42 forested and 1 non-forest) across the property. Each strata is at least 10 acres in size composed of at least 100 cells of similar characteristics recognized in the remote sensing data. The final sample had better than 10% accuracy at the 90% confidence level. The 2013 stand delineation using this data resulted in 870 stands that averaged about 25 acres per stand.

5. Post-Harvest Cruising

Areas subject to timber harvest or other disturbance such as fire or insect attack are inventoried each year utilizing the cruise specifications mentioned above. THP areas are delineated as new stands with new, unique strata calls. Each new stratum is then cruised using a systematic 10 by 10 chain or 5 by 5 chain grid with a random start such that at least 4 plots per stand are installed and there are on average 1 plot per every 10 acres. In this way, the inventory is updated with new strata and plot data information and the inventory recalculated to reflect yearly disturbance.

Appendix C: Modeling Plan

The FORSEE (4C) growth and simulation model was used to project changes in forest conditions over time. 4C was developed by the California Growth and Yield Model Cooperative and runs the CRYPTOS model developed by the Cooperative Redwood Yield Project Timber Output Simulator. 4C grows each tree in a tree list based on the tree species, crown canopy and competition, as well as the site conditions in each stand. This model also accounts for tree mortality over time and forest regeneration after disturbance. Growth estimates of the forest include user provided assumptions on regeneration after harvest. Harvest is simulated in the model based upon user defined harvest routines. TCF has developed a set of stand level targets and constraints that guide the choice of silviculture and timing of harvests within each stand. As a result of this, 4C will only initiate harvest provided that the set of management constraints are met for each individual stand. All stands have minimum BA removal constraints to control entry and minimum residual stocking constraints to control final stand conditions. Subsequent entries into the same stand cannot occur until the stand has increased in BA sufficiently to allow for another harvest. This ensures long term site occupancy and a continual increase in standing inventory.

Before modeling the management activities on in a given area, an accurate representation of the size of buffers based on the laws governing forest management is needed. The California Forest Practice Rules define the buffer area (linear distance from objects) requirements in terms of silvicultural limitations, which may be based on retention standards defined by either basal area or canopy cover retention, or disallowing any harvest. The CA FPR mandates that streams, certain rare and endangered species, and areas that are highly sensitive to erosion be buffered so as to reduce the potential impact of forest management activities on riparian areas and sensitive species. These areas constrain harvest and are mapped in GIS to capture the stands constrained from harvest by other forest resources.

1. Management Buffers

The first calculation applied to the gross property acreage is to remove non-forest areas. This involves removing rock pits, bare ground, grassland, and shrub-land areas that do not support forest. The next step is to remove all road surfaces from the forest land area using an 18 foot linear buffer on each side of all mapped truck roads. The forest area is then the basis for all future modeling steps.

1.1. No Harvest Area

No harvest areas are defined in the California Forest Practice Rules (CA FPR) for certain sensitive species and to provide watershed protection for anadromous fisheries. The primary species of concern which have mandated protection zones in the coastal northern California region are Northern Spotted Owls (14 CCR 919.9) and Coho Salmon (14 CCR 916). The forest non-harvestable area is calculated next by removing non-harvestable Northern Spotted Owl (NSO) areas, non-harvestable stream areas.

1.2. Constrained Harvest Area

Some degree of harvesting is allowed outside of the inner stream zones according to the CA FPR. The CA FPR requires that class 1 watercourses have a 30 ft inner no harvest area but allowed limited harvest to occur in an outer 70 foot buffer area on class 1 and large class 2 streams. Similarly, no harvest is allowed within an inner 15 foot area on class 2 streams but limited harvest is allowed in an outer buffer area. For a standard class II an outer buffer of 60 feet on average was used to capture the variable width allowed by the FPR's. Class 1 and large class 2 streams (WLPZ1) require that harvest within the constrained area retain at least 80% canopy cover and the largest 13 trees per acre (TPA). Class 2 streams (WLPZ2) require that at least 50% canopy cover is retained at all times. These two separate classes of constrained acres (WLPZ1 and WLPZ2) were then modeled and tracked separately for the full 100 year assessment period.

The tables below summarize the acres of constrained areas for each forest.

Table 1: Watercourse Buffers

WLPZ Management Buffers				
Salmon Creek Forest		Acres		
Forest Management Consideration	**Description**	**No Harvest**	**High Retention Selection**	**Medium Retention Selection**
Class I stream Buffer	*Management buffers along fish-bearing watercourses and watercourses used for domestic water supply.* TCF 's management plan requires a 50 foot no harvest buffer and an additional 50 foot buffer in which 80% of the overstory canopy is retained. For Modeling; Stream Buffers are measured from the centerline of the mapped Cass I watercourse or from the watercourse or lake transition zone (WLTZ) if it is discernible on the map layer, per CCR 916.9.	124	123	NA
Large Class II Watercourse Buffers	*Watercourses that support non- fish aquatic life with a watershed area equal to 100 acres or mapped on a current USGS quad as a blue line stream.* The FPR require a 30 foot no harvest buffer and an additional 70 foot buffer in which 80% of the overstory is retained per 916.9. Stream buffers are measured from the centerline of the mapped Cass II watercourse	20	50	NA
Standard Class II stream buffer	*Small class II watercourses that support aquatic life that are non-fish-bearing and have watershed area less than 100 acres in size.* The FPR require a variable buffer width depending on side slope. TCF has determined that the average buffer width implemented on Salmon Creek is a 15 foot no harvest buffer and an additional 60 foot buffer in which 50% of the overstory canopy is retained. The actual buffer widths implemented in the field will vary based on stream side slopes.	46	NA	188

Big River Forest		Acres		
Forest Management Consideration	**Description**	**No Harvest**	**High Retention Selection**	**Medium Retention Selection**
Class I stream Buffer	*Management buffers along fish-bearing watercourses and watercourses used for domestic water supply.* TCF 's management plan requires a 50 foot no harvest buffer and an additional 50 foot buffer in which 80% of the overstory canopy is retained. For Modeling; Stream Buffers are measured from the centerline of the mapped Cass I watercourse or from the watercourse or lake transition zone (WLTZ) if it is discernible on the map layer, per CCR 916.9.	295	289	NA
Class I flood zone	*Management buffers along fish-bearing watercourses and watercourses used for domestic water supply in unconfined class I channels*. For Modeling the Option A TCF delineated the flood prone zone from a digital elevation model developed from LiDAR imagery.	NA	131	NA
Large Class II Watercourse Buffers	*Watercourses that support non- fish aquatic life with a watershed area equal to 100 acres or mapped on a current USGS quad as a blue line stream.* The FPR require a 30 foot no harvest buffer and an additional 70 foot buffer in which 80% of the overstory is retained per 916.9. Stream buffers are measured from the centerline of the mapped Cass II watercourse	60	151	NA
Standard Class II stream buffer	*Small class II watercourses that support aquatic life that are non-fish-bearing and have watershed area less than 100 acres in size.* The FPR require a variable buffer width depending on side slope. TCF has determined that the average buffer width implemented on Big River is a 15 foot no harvest buffer and an additional 60 foot buffer in which 50% of the overstory canopy is retained. The actual buffer widths implemented in the field will vary based on stream side slopes.	81	NA	336

Gualala River Forest		Acres		
Forest Management Consideration	**Description**	**No Harvest**	**High Retention Selection**	**Medium Retention Selection**
Class I stream Buffer - including main stem	*Management buffers along fish-bearing watercourses and watercourses used for domestic water supply*. The FPR require a 30 foot no harvest buffer and an additional 70 foot buffer in which 80% of the overstory canopy is retained. For Modeling; Stream Buffers are measured from the centerline of the mapped Cass I watercourse or from the watercourse or lake transition zone (WLTZ) if it is discernible on the map layer, per CCR 916.9.	119	277	NA
Large Class II Watercourse Buffers	*Watercourses that support non- fish aquatic life with a watershed area that is equal to 100 acres or more or is mapped on a current USGS quad as a blue line stream*. The FPR require a 30 foot no harvest buffer and an additional 70 foot buffer in which 80% of the overstory canopy is retained. Stream Buffers are measured from the centerline of the mapped Cass I watercourse or per CCR 916.9.	27	68	NA
Standard Class II stream buffer	*Small class II watercourses that support aquatic life that are non-fish-bearing and have watershed area less than 100 acres in size.* The FPR require a variable buffer width depending on side slope. TCF has determined that the average buffer width implemented on the Gualala River Forest is a 15 foot no harvest buffer and an additional 60 foot buffer in which 50% of the overstory canopy is retained. The actual buffer widths implemented in the field will vary based on stream side slopes.	124	NA	502

	Garcia River Forest			
Forest Management Consideration	**Description**	**No Harvest**	**High Retention Selection**	**Medium Retention Selection**
Class I stream	*Management buffers along fish-bearing watercourses and watercourses used for domestic water supply*. The FPR require a 30 foot no harvest buffer adjacent to Class I streams and an additional 70 foot buffer in which 80% of the overstory canopy is retained. The Garcia Forest Management requires an additional 100' RMZ adjacent to class I stream zones and an addition 200' RMZ adjacent to the mainstem Garcia River. For Modeling; Stream Buffers are measured from the centerline of the mapped Cass I watercourse or from the watercourse or lake transition zone (WLTZ) if it is discernible on the map layer, per CCR 916.9. The RMZ' are modeled with the ER Selection silviculture.	260	602	NA
Class I flood zone	*Management buffers along fish-bearing watercourses and watercourses used for domestic water supply in unconfined class I channels*. For Modeling the Option A TCF delineated the flood prone zone from a digital elevation model developed from LiDAR imagery	NA	35	NA
Large Class II Watercourse	*Watercourses that support non- fish aquatic life with a watershed area that is equal to 100 acres or more or is mapped on a current USGS quad as a blue line stream*. The FPR require a 30 foot no harvest buffer and an additional 70 foot buffer in which 80% of the overstory canopy is retained. Stream Buffers are measured from the centerline of the mapped Cass I watercourse or per CCR 916.9.	66	166	NA
Standard Class II stream	*Description: Small class II watercourses that support aquatic life that are non-fish-bearing and have watershed area less than 100 acres in size*. TCF's management plan requires a 25 foot no harvest buffer and an additional buffer of 50 feet in which 50% of the overstory canopy shall remain after harvest. The actual buffer widths implemented in the field will vary based on stream side slopes.	237	NA	966

Table 2 Non Timber Resources

Non Timber Resources		Acres			
Resource	**Description**	**Big River**	**Salmon Creek**	**Gualala River**	**Garcia River**
Northern Spotted Owl	Northern Spotted Owl habitat retention and maintenance is required wherever a valid NSO activity center is known to occur. Protection measures consist of maintaining a 100 acre core habitat area as well as 200 acres of nesting and roosting habitat within .7 miles of the activity center. This table shows core habitat acres only.	7 Territories 870 acres	7 Territories 731 acres	1 Territory 102 acres	9 Territories 1,034 acres
Pygmy Forest	Pygmy forests are rare and unique ecosystems that exist close to the Pacific Ocean shore. There are many rare plants which are found only in these vegetation communities, including dwarfed pines (bolander pine). No harvest will occur in the pygmy forest. The pygmy forest occurs only on TCF's Salmon Creek Forest.	0	7	0	0
Oak Woodlands	Description: Forested areas consisting largely of true oaks.	0	0	91	613
Grasslands	Description: Areas dominated by grass either native or converted	0	0	115	369

Table 3: Conservation Easements

Conservation Easement		Acres	
Forest	**Description**	**No Harvest**	**High or Moderate Retention Selection Harvest**
Big River	The Big River Conservation Easement extends from the northwest corner to the southwest corner for the property and extends from the western property line east for approximately 300 feet parallel to the property line and adjacent to The Mendocino Headlands State Park. No Harvest is allowed with the Easement area, the remainder of the property is restricted from development or conversion by a recorded Offer to Dedicate, allowed uses include wildlife management, sustainable timber harvesting, recreation and education.	113	NA
Salmon Creek	The property is restricted from development or conversion by a recorded Offer to Dedicate; allowed uses include wildlife management, sustainable timber harvesting, recreation and education.	NA	NA
Gualala River	The property is restricted from development or conversion by a recorded conservation easement; allowed uses include wildlife management, sustainable timber harvesting, recreation and education.	NA	NA
Garcia River	Approximately one third of the forest is within The Ecological Reserve which is dedicated to the development of late seral stage forest. The remainder of the property is restricted from development or conversion by a recorded conservation easement; allowed uses include wildlife management, sustainable timber harvesting, recreation and education.	NA	8,321

2. Tree List Inputs

A tree list for each cruised stand was generated by combining the plots measured in each cruised stand of similar strata and expanding the plot estimates to per acre values. Uncruised stands were given the tree list of the averaged cruised stands in the same strata. All stands' tree lists were the basis for all future growth and yield modeling.

3. Regeneration Assumptions

The FORESEE model only applies regeneration after harvest events. The regeneration tree counts are defined as the number of viable trees surviving to at least five years after the harvest event.

Table 4: Regeneration by harvest type.

Prescription	Description	Conifer Regen (TPA)	HW Regen (TPA)
Single Tree Selection	Natural regeneration only	25	10
Transition	Natural regeneration only	50	10
Variable retention 40	Natural regeneration and planted seedlings are used for this treatment.	270	10
Commercial Thin	Natural regeneration only.	30	10
Rehabilitation	Natural regeneration and planted seedlings are used for this treatment.	270	10

4. Management Description

The forest model considers four distinct management areas when modeling forest growth and yield. As described in the management buffer section above, the modeling separately projects no-harvest forest areas, class 1 and large class 2 (WLPZ1) forest areas, class 2 forest areas (WLPZ2), and unconstrained forest areas. The management of unconstrained areas uses primarily uneven-aged forest management approaches to harvest timber. The growth and yield modeling is done using 5 year planning periods and stand re-entry occurs no more frequently than once every 10 years for site class I and II and 15 years for site class III and IV.

The Garcia River Forest Reserve Area is designated for the development of a late seral stage forest. Therefore silviculture has been restricted to long rotation thin from below harvesting. The model uses as 20 year reentry period on all stands. TCF expects that harvesting will cease in the reserve after two or three entries, this Option A models 2 full entries into the reserve area.

4.1. No Harvest Acres

The non-harvestable acres were grown forward with no harvest for the full 100 year planning period.

4.2. WLPZ Constrained Harvestable Acres

The WLPZ acres were harvested according to the CA FPR which state that for class 1 and large class 2 streams at least 80% canopy cover and the largest 13 trees per acre (TPA) are retained. For class 2 streams at least 50% canopy cover is retained at all times. To model these constraints, a FORESEE batch script was developed to leave the 13 largest TPA for WLPZ1 areas and to calculate the canopy cover for all WLPZ areas so as to meet the canopy cover constraints. The canopy cover was calculated using a modified version Beer-Lambert law that scales the overlapping individual tree crown area to non-overlapping canopy cover. The individual tree crown area is calculated by

FORESEE based on equations from the literature. The non-overlapping canopy is then calculated using the following formula[5]:

Equation 1: Non-Overlapping Canopy Cover

$$CCnon = (1 - Exp(CCoverlapping))$$

In this formula, CCoverlapping is the overlapping canopy cover as a percentage of the ground area based on FORESEE's crown width models.

4.3. Unconstrained Harvestable Acres

After removing the non-forest acres, the non-harvestable acres, and the constrained harvested acres from the gross project acreage the remaining area is then available to be modeled without constraints.

The forest area unconstrained by streams or owls is managed using a tiered system of stand structure metrics. There were six different management approaches used when modeling. Single tree selection and transition silviculture are uneven-aged approaches. Variable Retention, commercial thinning, rehabilitation, are considered even-aged silvicultural approaches. Stands which contain more than 30% of the total basal area in tanoak pre harvest are also managed for tanoak reduction during the initial conifer harvest. Tanoak is removed to make growing space for conifer seedlings and saplings. Only tanoak is modeled for harvest all other true oaks and hardwood species are retained for wildlife habitat. Each harvesting approach is briefly described in the table below. The next table outlines the decision framework used to determine which silviculture to apply when entering a stand.

Table 5: Silvicultural systems descriptions.

Silviculture	Description
Single Tree Selection and Group selection	The goal of this prescription is to create and maintain multistoried, uneven-aged stands with varied ages classes, diameter distribution and tree heights. Trees are harvested individually, or in small groups up to 1 acre in size.
Ecological reserve Selection	The Garcia River Forest Reserve Area is designated for the development of a late seral stage forest. Silviculture has been restricted to longer rotations and thinning from below. The model uses as 20 year reentry period on all stands. TCF expects that harvesting will cease in the reserve after two or three entries, this Option A models 2 full entries into the reserve area.

[5] The Beer-Lambert law can be seen in Waring, R. H., and S. W. Running. 2007. Forest Ecosystems: Analysis at Multiple Scales. Elsevier Academic Press, San Francisco, CA. The conversion of this relationship to calculate non-overlapping canopy can be seen in Crookston, N. L., and A. R. Stage. 1999. Percent Canopy Cover and Stand Structure Statistics from the Forest Vegetation Simulator. Pages 16. General Technical Report, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Rocky Mountain Research Station.

Silviculture	Description
Transition	The goal of this prescription is to develop uneven-aged stands from stands that currently have an even-aged or irregular stand structure. Trees are harvested individually, or in small groups up to 1 acre in size.
Variable Retention	Variable retention is a harvesting approach based on the retention of structural elements or biological legacies (trees, snags, logs, etc.) from the pre-harvest stand for integration into the post-harvest stand to achieve various ecological, social and geomorphic objectives. Retained trees may be intended to become part of future stands managed by the Selection regeneration method. Retained trees are often designated as decadent tree or snag recruitment and therefore not ever intended for harvest.
Commercial Thinning	Commercial thinning is the removal of trees in a young-growth stands to maintain or increase average stand diameter and height of the residual crop trees, promote timber growth, and/or improve forest health. The residual stand shall consist primarily of healthy and vigorous dominant and co-dominant trees from the pre-harvest stand.[10]
Rehabilitation	The goal of this prescription is to regenerate stands that do not meet minimum stocking standards. Successive harvests will utilize uneven-aged silviculture.
Conifer Release	The goal of this prescription is to improve growth in stands that are primarily experiencing excessive hardwood competition, and that are also well stocked with conifer seedlings. Successive harvests will utilize uneven-aged silviculture.

The following table is the basic decision matrix table used in modeling the Option A

Table 6: Decision Matrix Table

			First Entry Triggers						General Targets	
Type	**Prescription**	**Miscellaneous**	**Con BA Lower Limit**	**Con BA Upper Limit**	**Con TPA (0 to 6in)**	**Minimum Con BA available for Harv (ft2/acre)**	**Min BA-Harv TO**	**Acreage Limit**	**Con BA Retention (ft2/acre)**	**TO BA Retention (ft2/acre)**
WLPZ Mngmt	**Class I and Large Class II**	From 30-100 feet from the WLTL retain 13 largest trees and 80% canopy	No triggers for WLPZ management as these stands are entered as neighboring non-WLPZ stands are entered. **No** HW harvest occurs in WLPZ areas.						75	NA
	Standard Class II	From 15-75 feet use Single tree selection silviculture only							75	NA
CE Mngmt	**GRF Ecological Reserve**	Each successive entry increases the Con BA target by 25ft2.	125	None	NA	25	NA	NA	3/4 starting ConBA	NA
Uneven Age Mngmt	**Single Tree Selection**	Final Target BA depends on the stands starting BA. Stands over 225 have a target of 250. Stands under 225 have a target of 200 ft2 BA. The min ConBA for entry increases by 25 ft2 BA until the target BA is reached.	125	None	NA	25	30% of Total BA	NA	2/3 of starting ConBA	30
	Transition	This only occurs once per stand.	75	125	NA	25	30% of Total BA	NA	50	30
Even Age Mngmt	**Variable retention 40**	Greater than 50% of conifer basal area in trees larger than 18" DBH (this is a surrogate for tree age >60 yrs)	30	125	< 125	25	30%	40	7.5	15
	Variable retention 60	same as VR40	30	125	< 125	25	30%	60	10	15
	Variable retention 80	same as VR40	30	125	< 125	25	30%	80	12.5	15
	Variable retention 120	same as VR40	30	125	< 125	25	30%	120	15	15
	Commercial Thin	50% of conBA < 14in DBH.	15	75	NA	25	30%	NA	8.72	15
	Conifer Release (HW treatment)	NA	0	50	>= 125	NA	30%	NA	No Con Harv	15
	Rehabilitation	NA	25	50	NA	25	NA	NA	8	15
	Just Grow	if none of the above, just grow.	NA	NA	NA	NA	NA	NA	NA	NA

		Conifer Tree Level Targets				Regeneration		Harvesting Approach				
Type	**Prescription**	**% Canopy Cover**	**TPA to Leave**	**BA to Leave (ft2/acre**	**BA or TPA constraints**	**Con (TPA)**	**TO (TPA)**	**Conifer Harvesting Approach**	**Conifer DBH range (in)**	**TO Harvesting Approach**	**TO DBH range (in)**	**Time to Next Treatment**
WLPZ Mngmt	**Class I and Large Class II**	80%	13	NA	largest	15	5	from below DBH	8 to 48	None	NA	At Least 10 Years
	Standard Class II	50%	NA	NA	NA	15	5	from below DBH	8 to 48	None	NA	At Least 10 Years
CE Mngmt	**GRF Ecological Reserve**	NA	NA	15	in trees >= 18in DBH	15	5	from below DBH	14 to 48	None	NA	At Least 20 Years
Uneven Age Mngmt	**Single Tree Selection**	NA	NA	15	in trees >= 18in DBH	25	10	Uniform across DBH	8 to 48	from above tallest	2 to 20	At Least 10 Years
	Transition	NA	NA	15	in trees >= 12in DBH	50	10	Uniform across DBH	8 to 48	from above tallest	2 to 20	Selection after at least 10 years
Even Age Mngmt	**Variable retention 40**	NA	NA	NA	NA	270	10	from above tallest	8 to 48	from above tallest	2 to 20	Selection after at least 30 years
	Variable retention 60	NA	NA	NA	NA	270	10	from above tallest	8 to 48	from above tallest	2 to 20	Selection after at least 30 years
	Variable retention 80	NA	NA	NA	NA	270	10	from above tallest	8 to 48	from above tallest	2 to 20	Selection after at least 30 years
	Variable retention 120	NA	NA	NA	NA	270	10	from above tallest	8 to 48	from above tallest	2 to 20	Selection after at least 30 years
	Commercial Thin	NA	100	NA	in trees >= 4in	30	10	from below DBH	8 to 14	from above tallest	2 to 20	Selection when BA >= 125
	Conifer Release (HW treatment)	NA	NA	NA	NA	20	5	from above tallest	NA	from above tallest	2 to 20	Commercial Thin after 30 years
	Rehabilitation	NA	300 POINT COUNT	NA	NA	270	10	from above tallest	8 to 48	from above tallest	2 to 20	Selection after at least 30 years

Appendix D: Timber Inventory procedures

1. Sampling Design

1.1. Plot Location

Stands to be sampled will be chosen with probability proportional to size within each stratum. Chosen stands will have a random set of plots chosen such that there is at least 1 plot per every 10 acres with a minimum of 4 plots per stand. Every 4th plot, starting with the first plot, will have heights measured on all trees.

Cruisers received a list of the randomly chosen plots within each stand in the order these plots should be cruised. This will aid in plot relocation for check-cruising and future audits.

1.2. Plot Design

The plot design consists of a variable radius plot for trees over 5.5 inches, a 1/100 acre regeneration plot for small trees. A 1/10 fixed radius plots for brush and old growth stumps, and a 100 ft transect for down dead material. On all properties, the basal area should be chosen such that most plots count 4 to 8 trees. Once a BAF is chosen for a stratum, all plots must have the same BAF within that stratum.

Variable Radius Plot Measurements (standing live and dead trees >=5.5 inches DBH):

species
diameter at breast height (DBH)
height to the nearest foot (on every 4th plot starting with the first plot)
and height to crown base (on every 4th plot starting with the first plot)
Crown Position (Dominant or Co-dominant, Intermediate, or Suppressed)

Fixed Radius Regeneration Plot Measurements (1/100th of an acre = 11.8 ft radius):

Species
Count of Trees < 5.5 inches DBH within 2 size classes by species (0 to 3 inches Diameter, and 3 to 5.4 inches diameter)

Fixed Radius Shrub and Old Growth Stump Plot Measurements (1/10th of an acre = 37.2 ft radius):

Dominant Shrub Type and Total Shrub % Cover
DBH and Height for Stumps between 6ft and 12ft tall, stump ht is calculated as the average of the uphill side and downhill side of the stump.

Down Dead Transect Measurements (Two 50ft Transects starting at Plot Center):

Length of Pieces (pieces must be greater than 6ft long)
Average Diameter of piece
Soundness of Piece (Hard or Soft)

1.3 Plots Falling on Roads:

Plots that fall on unmapped roads are sampled. Plots that fall on mapped truck roads shall be offset 1 chain to the west, and if still on truck road offset 1 chain north. The offset shall be in a cardinal direction moving clockwise on the compass until a bearing is found that will lead to a vegetated plot. Landings are included as part of the truck road and not sampled. New plot centers will be mapped and the GPS coordinates provided to TCF.

1.4 Site Class Sampling:

A minimum of **3 redwood or Douglas-fir** trees per strata should be selected and measured for species, DBH (to the nearest 10^{th} inch), height to nearest 1 foot, HTCB (height to crown base), and age. Each plot should be evaluated for the presence of potential site trees.

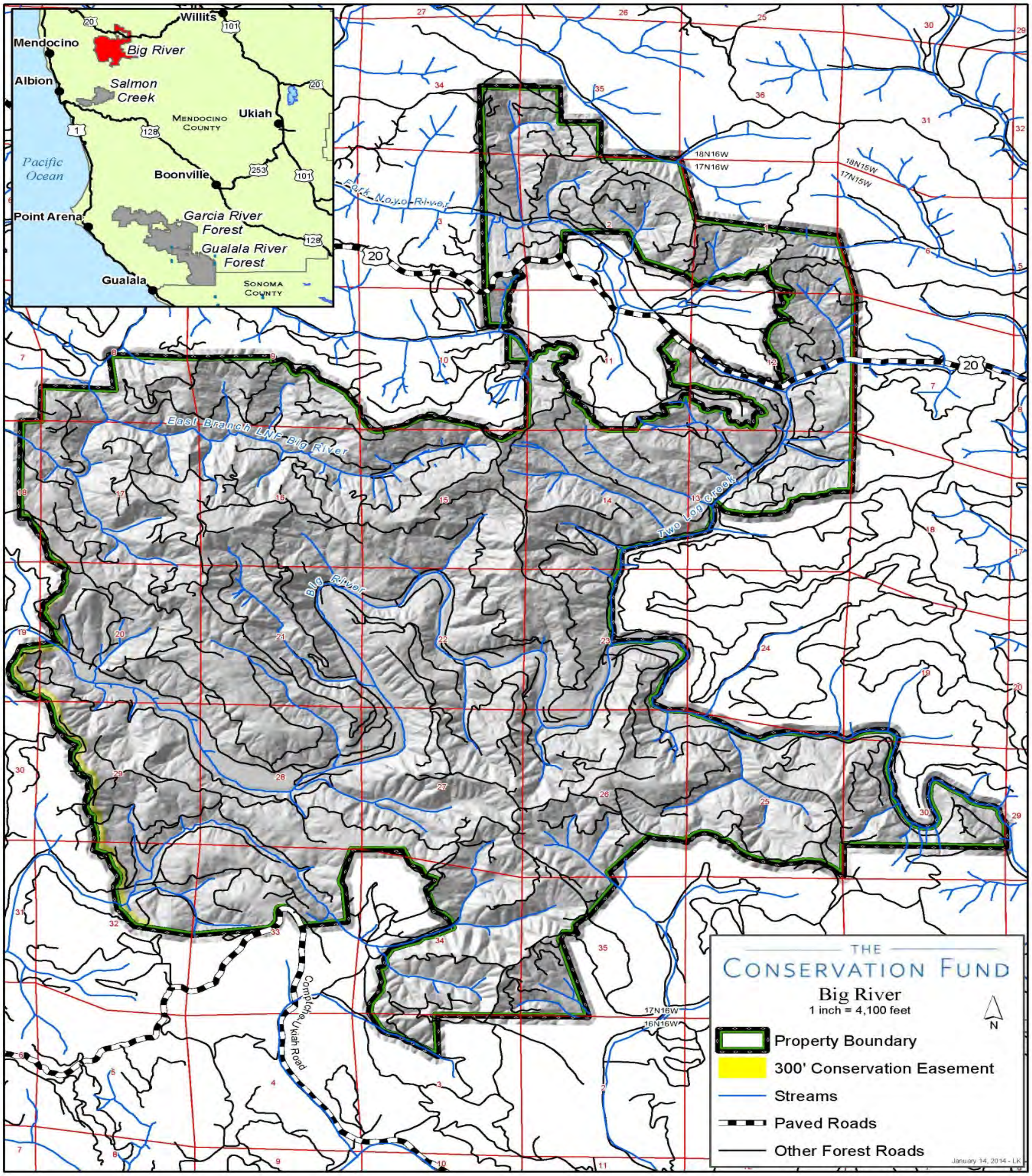
To be considered eligible for site tree measurement, a tree must have the following qualities:

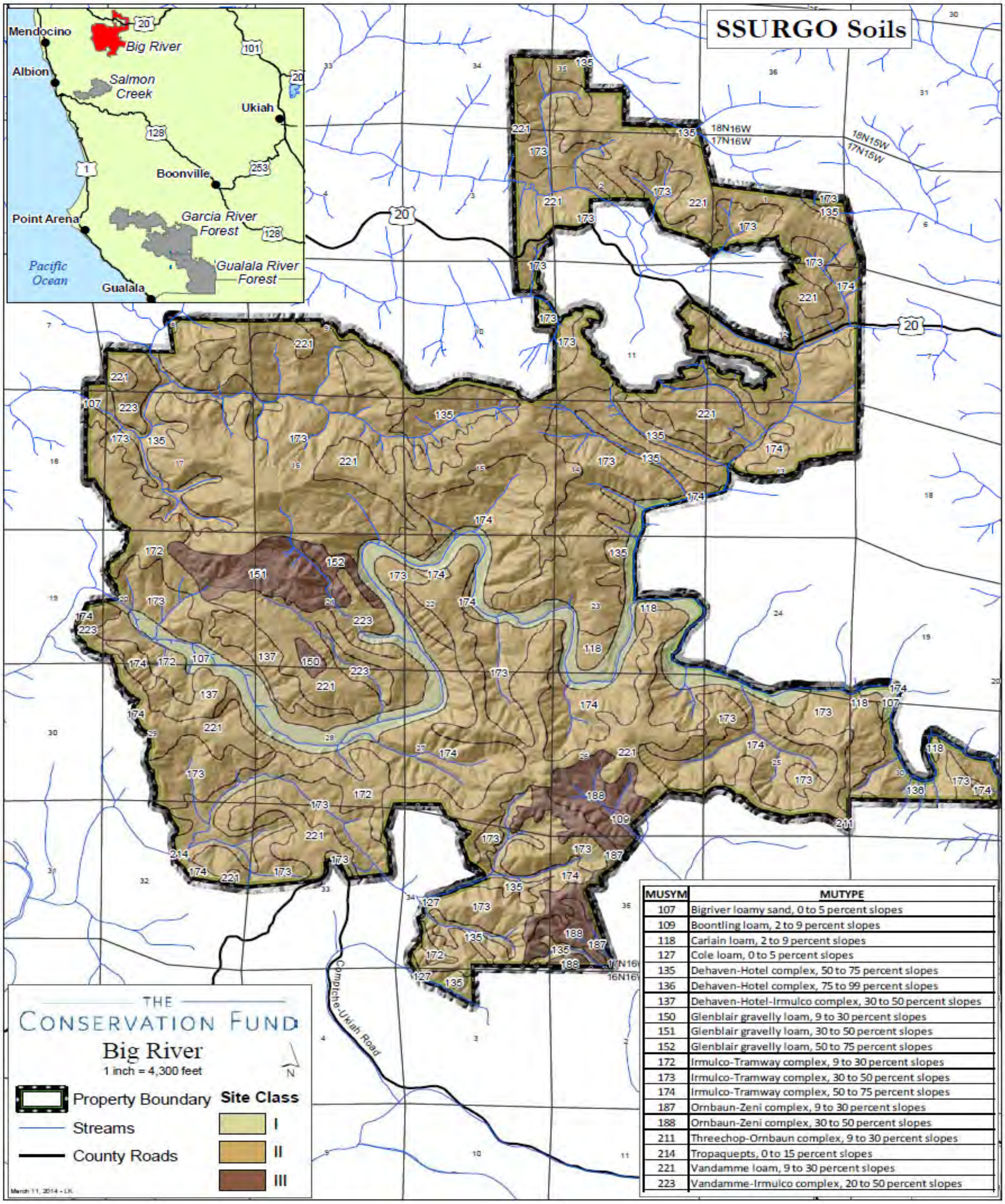
Be a conifer located within or near the plot (preferably within).
Have a dominant or co-dominant crown class.
Free of defect and disease and demonstrate good phenotype and vigor.

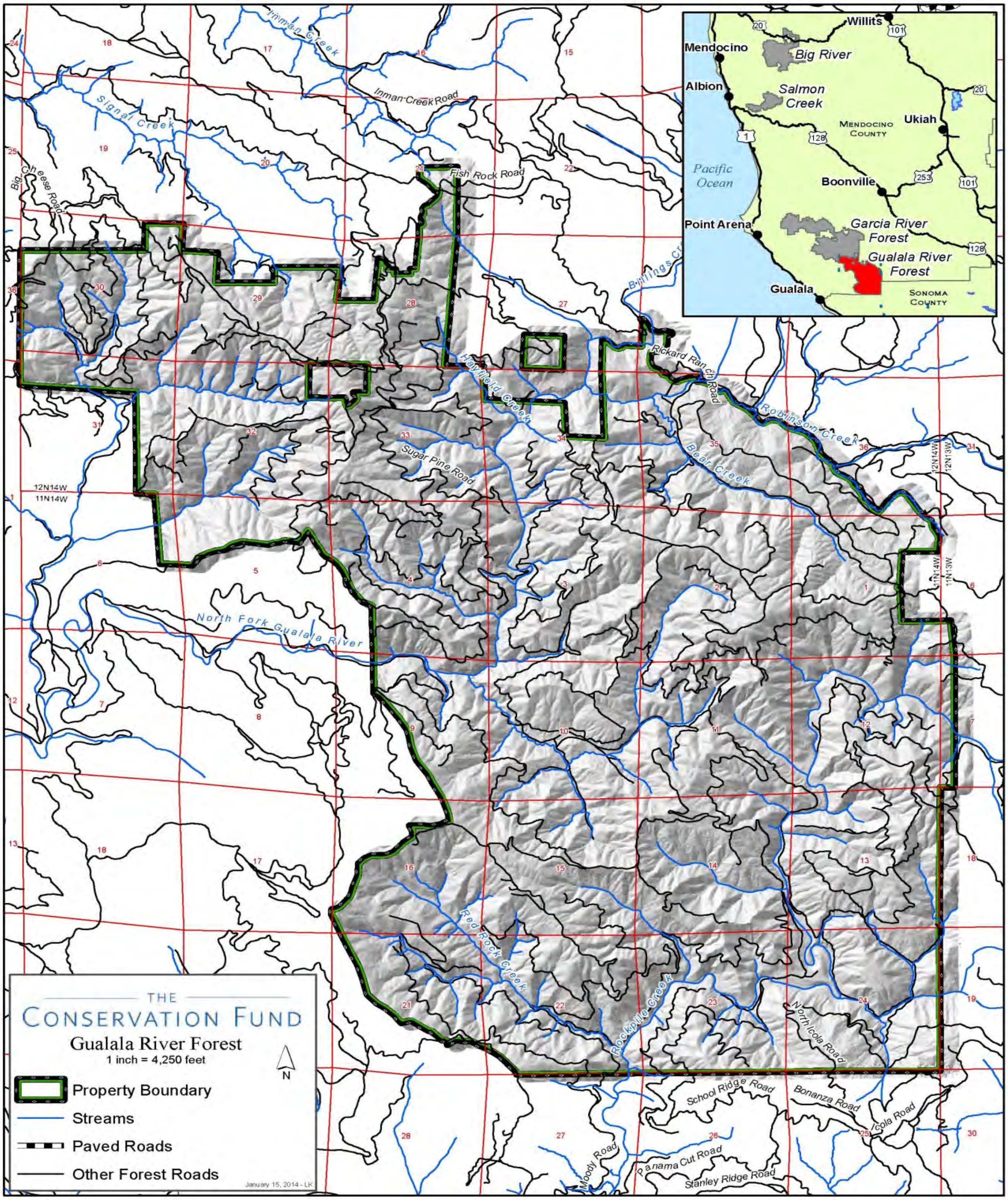
Final selection should be made on the basis of determining which of the eligible trees is the most vigorous. Relative vigor should be assessed by evaluating the crown condition, foliage complement, and bole condition of the trees present on the plot. Trees with full, healthy crowns, and no apparent disease or damage should be considered more vigorous than trees lacking these qualities. In many stands it may be difficult to find trees meeting these criteria; thus, it is important to look for such trees at each plot (until the minimum number have been identified and measured within a given stand). Tree selected for site tree measurement shall be marked with orange flagging with writing on the flag stating that it is selected as a site tree.

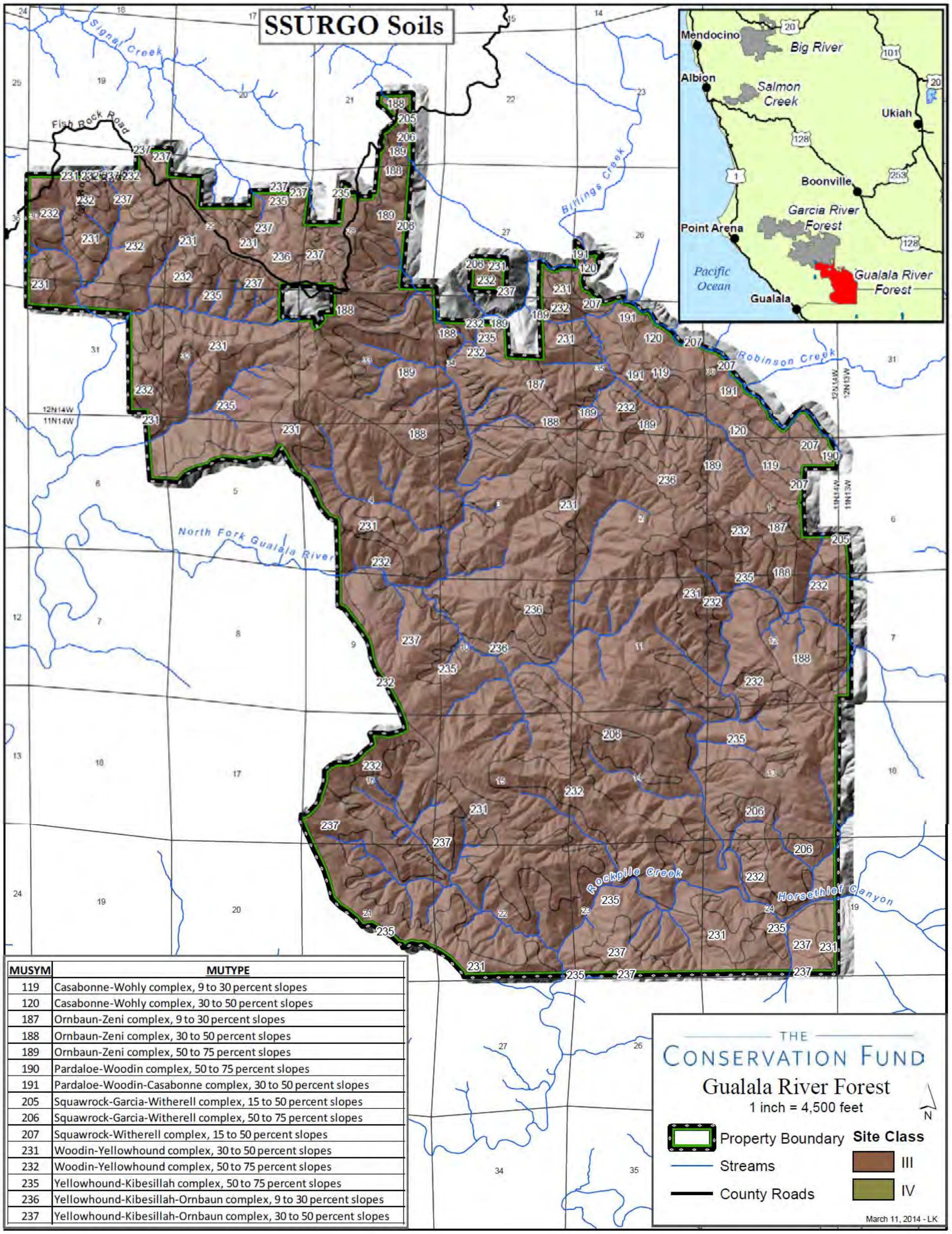
If no site trees are found meeting the criteria mentioned above, the cruiser shall find an appropriate site tree by seeking a tree off of the plot. In this case the cruise notes shall clearly indicate that the measurement occurred off plot.

Appendix E: Maps

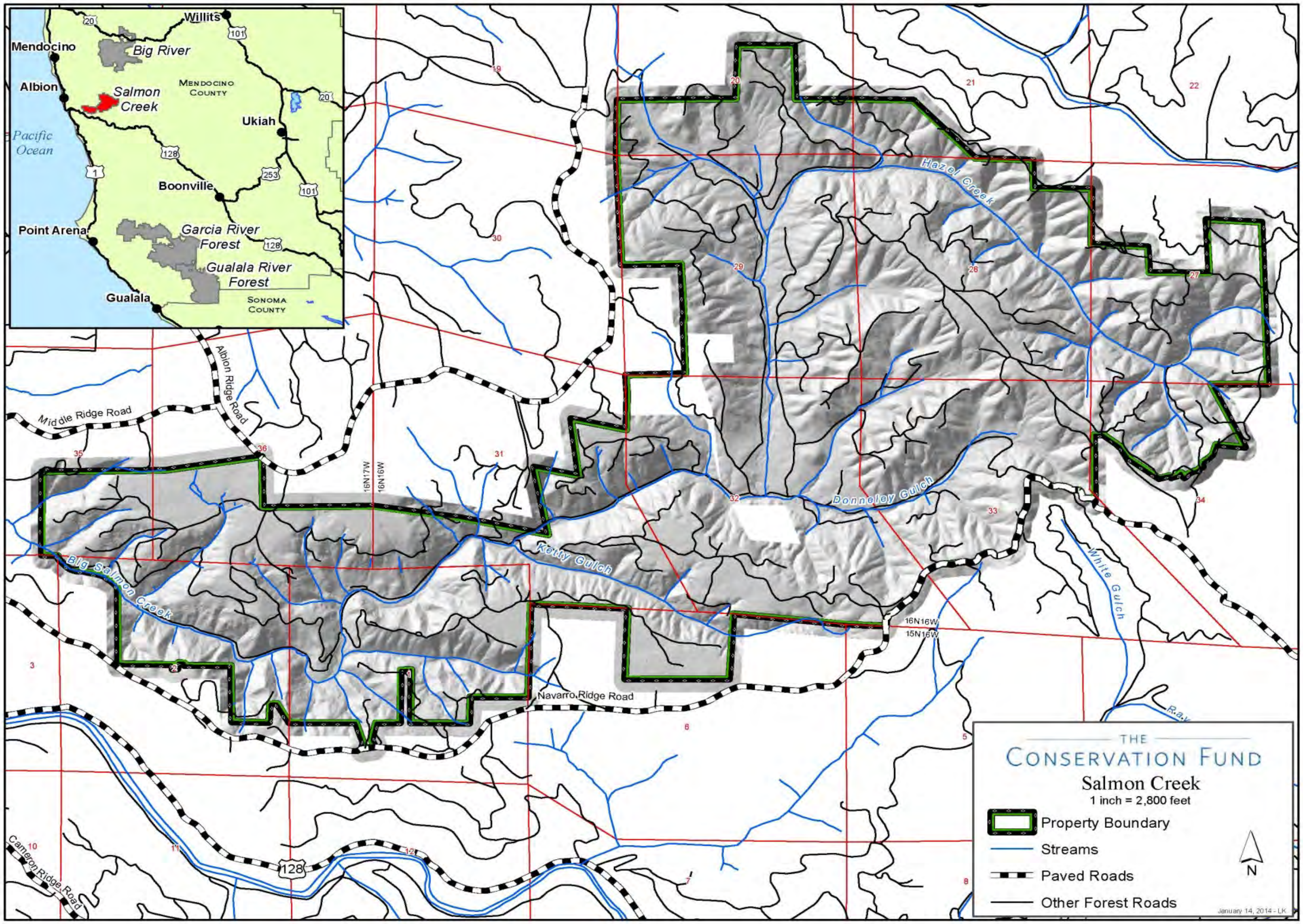



SSURGO Soils
Mendocino
Big River
Albion
Salmon Creek
Ukiah
Boonville
Point Arena
Garcia River Forest
Gualala River Forest
Pacific Ocean
Gualala
18N16W
17N16W
18N15W
17N15W
Comptche-Ukiah Road
THE CONSERVATION FUND
Big River
1 inch = 4,300 feet
Property Boundary
Streams
County Roads
Site Class
I
II
III
MUSYM | MUTYPE
107 | Bigriver loamy sand, 0 to 5 percent slopes
109 | Boontling loam, 2 to 9 percent slopes
118 | Carlain loam, 2 to 9 percent slopes
127 | Cole loam, 0 to 5 percent slopes
135 | Dehaven-Hotel complex, 50 to 75 percent slopes
136 | Dehaven-Hotel complex, 75 to 99 percent slopes
137 | Dehaven-Hotel-Irmulco complex, 30 to 50 percent slopes
150 | Glenblair gravelly loam, 9 to 30 percent slopes
151 | Glenblair gravelly loam, 30 to 50 percent slopes
152 | Glenblair gravelly loam, 50 to 75 percent slopes
172 | Irmulco-Tramway complex, 9 to 30 percent slopes
173 | Irmulco-Tramway complex, 30 to 50 percent slopes
174 | Irmulco-Tramway complex, 50 to 75 percent slopes
187 | Ornbaun-Zeni complex, 9 to 30 percent slopes
188 | Ornbaun-Zeni complex, 30 to 50 percent slopes
211 | Threechop-Ornbaun complex, 9 to 30 percent slopes
214 | Tropaquepts, 0 to 15 percent slopes
221 | Vandamme loam, 9 to 30 percent slopes
223 | Vandamme-Irmulco complex, 20 to 50 percent slopes

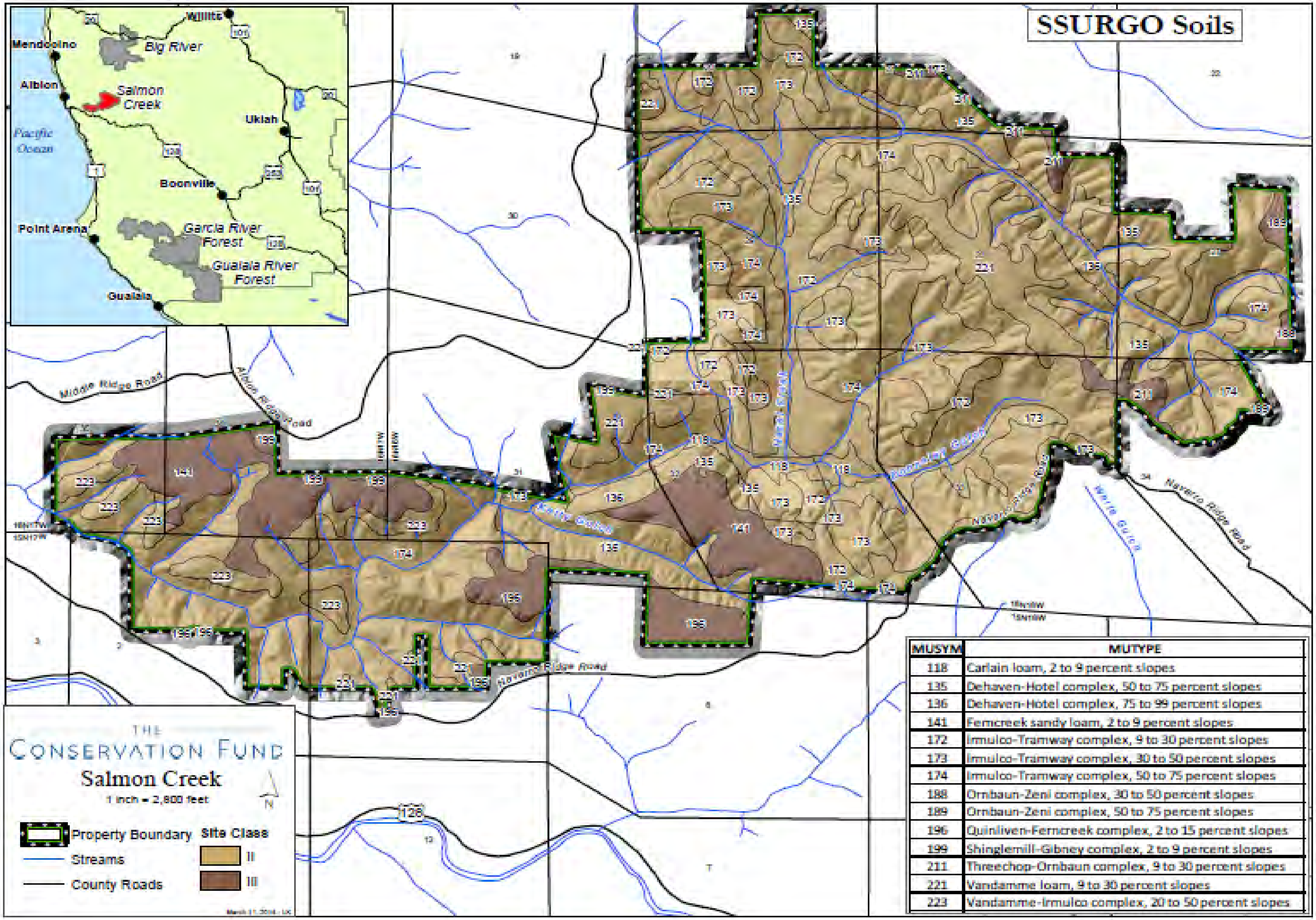

THE CONSERVATION FUND
Gualala River Forest
1 inch = 4,250 feet
N
Property Boundary
Streams
Paved Roads
Other Forest Roads
January 15, 2014 - LK
Willits
Mendocino
Big River
Albion
Salmon Creek
Mendocino County
Ukiah
Pacific Ocean
Boonville
Point Arena
Garcia River Forest
Gualala River Forest
Gualala
Sonoma County
Inman Creek
Inman Creek Road
Signal Creek
Big Cheese Road
Fish Rock Road
Billings Creek
Rickard Ranch Road
Hayfield Creek
Robinson Creek
Sugar Pine Road
Bear Creek
North Fork Gualala River
Red Rock Creek
Rockpile Creek
North Icola Road
School Ridge Road
Bonanza Road
Icola Road
Moody Road
Panama Cut Road
Stanley Ridge Road
12N14W
11N14W
12N13W
11N13W



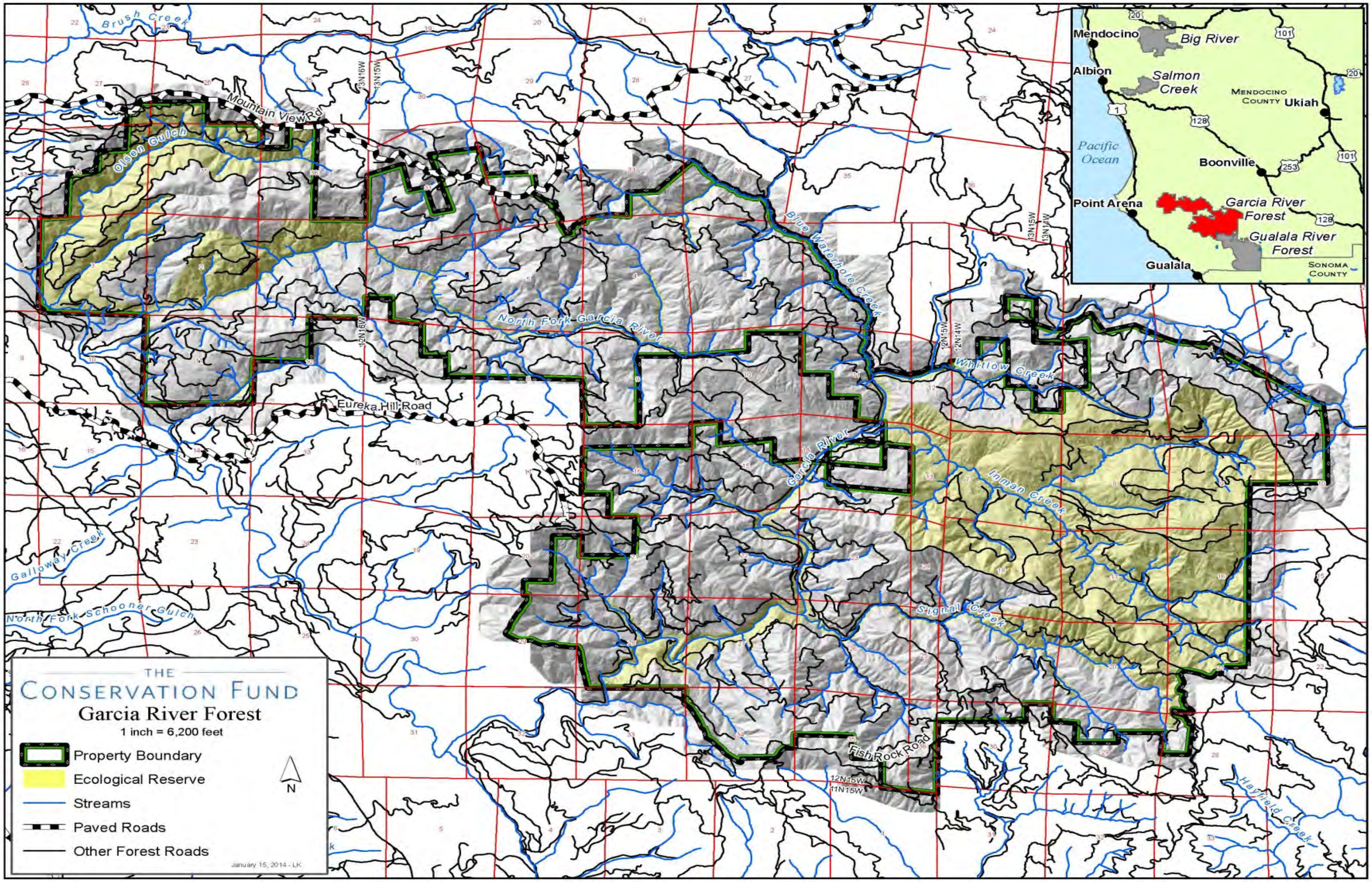
MUSYM	MUTYPE
119	Casabonne-Wohly complex, 9 to 30 percent slopes
120	Casabonne-Wohly complex, 30 to 50 percent slopes
187	Ornbaun-Zeni complex, 9 to 30 percent slopes
188	Ornbaun-Zeni complex, 30 to 50 percent slopes
189	Ornbaun-Zeni complex, 50 to 75 percent slopes
190	Pardaloe-Woodin complex, 50 to 75 percent slopes
191	Pardaloe-Woodin-Casabonne complex, 30 to 50 percent slopes
205	Squawrock-Garcia-Witherell complex, 15 to 50 percent slopes
206	Squawrock-Garcia-Witherell complex, 50 to 75 percent slopes
207	Squawrock-Witherell complex, 15 to 50 percent slopes
231	Woodin-Yellowhound complex, 30 to 50 percent slopes
232	Woodin-Yellowhound complex, 50 to 75 percent slopes
235	Yellowhound-Kibesillah complex, 50 to 75 percent slopes
236	Yellowhound-Kibesillah-Ornbaun complex, 9 to 30 percent slopes
237	Yellowhound-Kibesillah-Ornbaun complex, 30 to 50 percent slopes



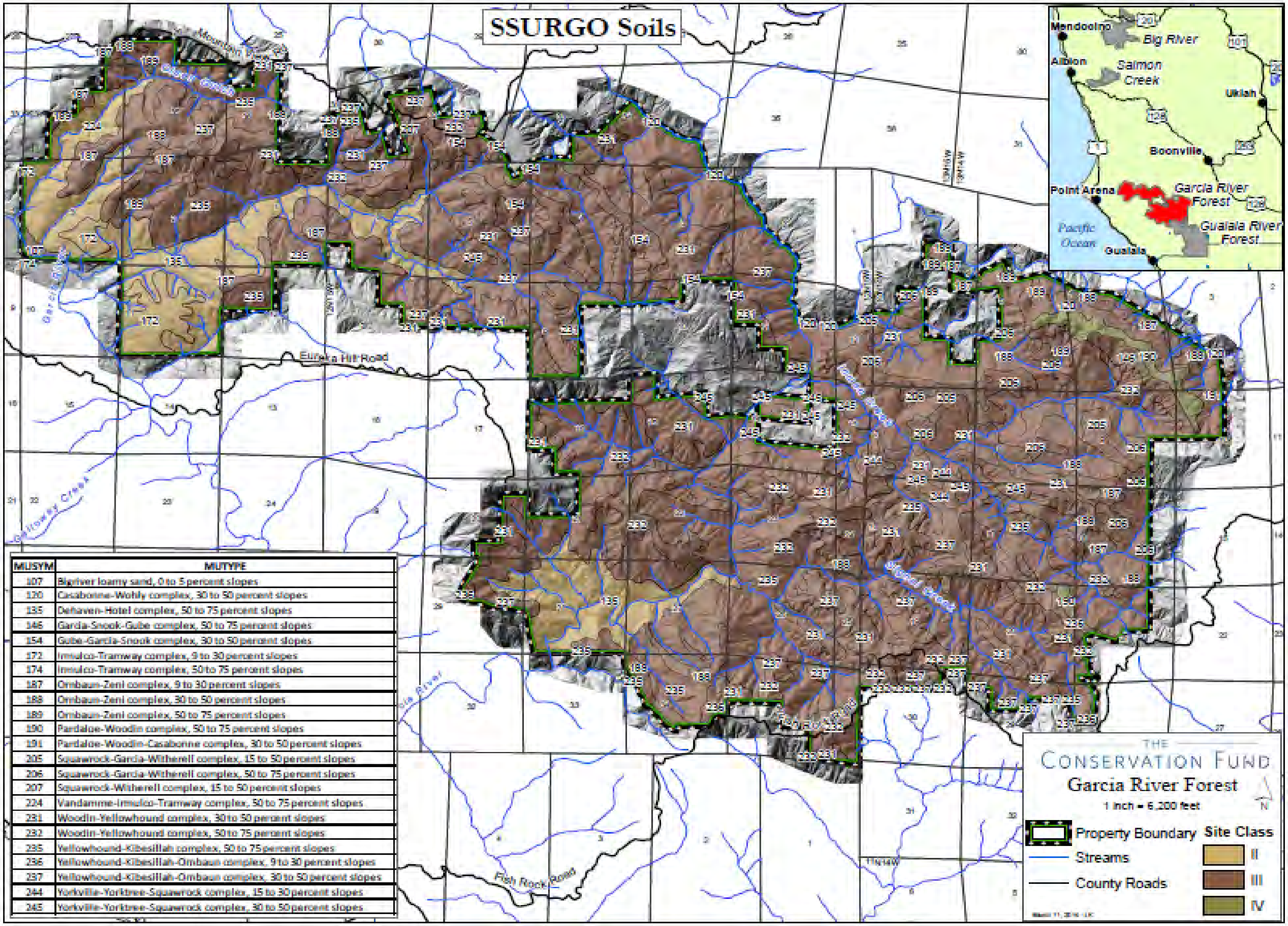
Willits
Mendocino
Big River
Albion
Salmon Creek
Mendocino County
Ukiah
Pacific Ocean
Boonville
Point Arena
Garcia River Forest
Gualala River Forest
Gualala
Sonoma County
Middle Ridge Road
Albion Ridge Road
Hazel Creek
Donnelly Gulch
Kitty Gulch
Big Salmon Creek
White Gulch
Navarro Ridge Road
Cameron Ridge Road
16N17W
16N16W
15N16W
THE CONSERVATION FUND
Salmon Creek
1 inch = 2,800 feet
Property Boundary
Streams
Paved Roads
Other Forest Roads
N
January 14, 2014 - LK



MUSYM	MUTYPE
118	Carlain loam, 2 to 9 percent slopes
135	Dehaven-Hotel complex, 50 to 75 percent slopes
136	Dehaven-Hotel complex, 75 to 99 percent slopes
141	Ferncreek sandy loam, 2 to 9 percent slopes
172	Irmulco-Tramway complex, 9 to 30 percent slopes
173	Irmulco-Tramway complex, 30 to 50 percent slopes
174	Irmulco-Tramway complex, 50 to 75 percent slopes
188	Ornbaun-Zeni complex, 30 to 50 percent slopes
189	Ornbaun-Zeni complex, 50 to 75 percent slopes
196	Quinliven-Ferncreek complex, 2 to 15 percent slopes
199	Shinglemill-Gibney complex, 2 to 9 percent slopes
211	Threechop-Ornbaun complex, 9 to 30 percent slopes
221	Vandamme loam, 9 to 30 percent slopes
223	Vandamme-Irmulco complex, 20 to 50 percent slopes


THE
CONSERVATION FUND
Garcia River Forest
1 inch = 6,200 feet
Property Boundary
Ecological Reserve
Streams
Paved Roads
Other Forest Roads
N
Mountain View Rd
Eureka Hill Road
Fish Rock Road
Olson Gulch
Brush Creek
North Fork Garcia River
Blue Waterhole Creek
Garcia River
Whitlow Creek
Inman Creek
Signal Creek
Galloway Creek
North Fork Schooner Gulch
Hayfield Creek
Mendocino
Big River
Albion
Salmon Creek
Mendocino County
Ukiah
Pacific Ocean
Boonville
Point Arena
Garcia River Forest
Gualala River Forest
Gualala
Sonoma County

79



MUSYM	MUTYPE
107	Bigriver loamy sand, 0 to 5 percent slopes
120	Casabonne-Wohly complex, 30 to 50 percent slopes
135	Dehaven-Hotel complex, 50 to 75 percent slopes
146	Garcia-Snook-Gube complex, 50 to 75 percent slopes
154	Gube-Garcia-Snook complex, 30 to 50 percent slopes
172	Irmulco-Tramway complex, 9 to 30 percent slopes
174	Irmulco-Tramway complex, 50 to 75 percent slopes
187	Ornbaun-Zeni complex, 9 to 30 percent slopes
188	Ornbaun-Zeni complex, 30 to 50 percent slopes
189	Ornbaun-Zeni complex, 50 to 75 percent slopes
190	Pardaloe-Woodin complex, 50 to 75 percent slopes
191	Pardaloe-Woodin-Casabonne complex, 30 to 50 percent slopes
205	Squawrock-Garcia-Witherell complex, 15 to 50 percent slopes
206	Squawrock-Garcia-Witherell complex, 50 to 75 percent slopes
207	Squawrock-Witherell complex, 15 to 50 percent slopes
224	Vandamme-Irmulco-Tramway complex, 50 to 75 percent slopes
231	Woodin-Yellowhound complex, 30 to 50 percent slopes
232	Woodin-Yellowhound complex, 50 to 75 percent slopes
235	Yellowhound-Kibesillah complex, 50 to 75 percent slopes
236	Yellowhound-Kibesillah-Ornbaun complex, 9 to 30 percent slopes
237	Yellowhound-Kibesillah-Ornbaun complex, 30 to 50 percent slopes
244	Yorkville-Yorktree-Squawrock complex, 15 to 30 percent slopes
245	Yorkville-Yorktree-Squawrock complex, 30 to 50 percent slopes

APPENDIX J

The Conservation Fund
North Coast Forest Conservation Program
2019 Fire Plan

This Fire Suppression Resource Inventory is being submitted to comply with 14CCR 918.1. Specific rule requirements cited in the plan are to be followed by contractors working in the woods at all times. This plan should not be construed to mean that untrained contractors or their personnel are required to actively fight wildland fires that occur on The Conservation Fund property.

The plan is to be kept with each employee or their assigned vehicle at all times. Copies to be provided to all Conservation Fund (TCF) employees and logging/road maintenance contractors operating on company managed lands. Copies provided to California Department of Forestry and Fire Protection (CAL FIRE) Northern region headquarters in Santa Rosa and on a CD to Mendocino ranger unit office in Willits (Howard Forest).

INTRODUCTION

The Conservation Fund owns and manages approximately 74,000 acres of timberland in five tracts on the Big River, Salmon Creek, Garcia River, Gualala River and Buckeye watersheds. Due to the risk that uncontrolled fire poses to its assets, The Conservation Fund manages its properties with careful and thorough consideration toward fire prevention, planning, and control. This Fire Plan is provided to acquaint all personnel with the policies and procedures for the current fire season. The policies and details listed in the following Plan apply across the entire TCF ownership and are not specific to any tract or area. Tract and area specific issues are conveyed through the maps attached at the end of the document. These maps display specific fire prevention and mitigation infrastructure, such as access points, roads, drafting sites, and helicopter landing sites.

POLICY STATEMENT

The Conservation Fund will respond within its capacity to all fires occurring within its ownership, as well as any uncontrolled fires which may threaten its ownership. TCF response will commence upon notification of a fire on or near TCF property, and with utmost concern for the safety of everyone involved.

TCF employees will take the immediate action necessary to contact appropriate fire control agencies once a fire is identified.

TCF employees will not place themselves or contractors at unreasonable risk during any response to a fire or during the course of fighting a fire. Safety is our first priority.

Appropriately-trained TCF employees and contractors may work at their discretion to contain and extinguish fires until the fire is taken over by the California Department of Forestry and Fire Protection (CAL FIRE) or some other responsible party.

TCF will cooperate with and follow the direction of CAL FIRE or local fire protection departments responsible for fire protection on private lands.

To the extent information is available; relative humidity, temperature, wind direction and speed, overall fire season trends, and availability of resources shall be considered when determining appropriate action should an ignition occur.

TCF shall strictly enforce all laws, rules and regulations governing logging operations during Fire Season.

TCF shall attend an Annual Fire Meeting at the beginning of the Fire Season, with representatives from CAL FIRE, logging contractors, and major adjacent forest landowners.

EMERGENCY TELEPHONE NUMBERS

TO REPORT A FIRE:

1. Call CAL FIRE Dispatch Howard Forest (707) 459-5336 or 459-7404 or Dial 911

   a) Give CAL FIRE the legal description (Township, Range & Section no. to the nearest ¼ section) and the approximate size of fire.

   b) Name of person reporting fire.

   c) Best access route(s) to the fire.

2. Call TCF emergency contact personnel in the order delineated below until a TCF representative is contacted in person:

   a) The TCF Office (707) 962-0712

   b) Scott Kelly, Timberland Manager (707) 272-4497

   c) Don Miller, Security Patrol (707) 489-0315

   d) Mark Taylor, Security Patrol (707) 367-8366

   e) Holly Newberger, Program Coordinator (707) 357-3391

FIRE PREVENTION PROCEDURES

General Responsibilities for Logging Contractors, Road Crews and Consultants, herein after referred to as “Contractor”.

All persons working on or traveling through TCF property must strictly adhere to the following Fire Prevention Procedures:

918.3 Roads to be Kept Passable.
Contractors shall always keep all logging truck roads in a passable condition or fire truck and emergency vehicle traffic. Felled timber shall be skidded daily or otherwise moved to maintain the road in a passable condition prior to the end of every work day. Road maintenance crew shall backfill all new culverts such that the road is open prior to the end of each work day.

918.4 Smoking and Matches
Subject to any law or ordinance prohibiting or otherwise regulating smoking, smoking by persons engaged in timber operations shall be limited to cleared log landing areas. Burning material shall be extinguished in such areas of bare soil before discarding. Contractors shall specify procedures to guide actions of his employees or other persons in his employment consistent with this subsection.

918.5 Lunch and Warming Fires
Under no conditions will warming fires be permitted on TCF property during the declared fire season. The Fire season is determined by CAL FIRE and it generally extends until sufficient rain has fallen to reduce the chance of accidental ignition.

918.6 Posting Procedures
Contractors shall post notices which set forth lists of procedures that they have established consistent with this Fire Plan. Such notices shall be posted in sufficient quantity and location throughout their logging areas so that all employees, or other persons employed by them to work, shall be informed of such procedures. Contractors shall provide for diligent supervision of such procedures throughout their operations.

918.7 Blasting and Welding
Contractors shall provide for a diligent fire watch service at the scene of any blasting or welding operations conducted on their logging areas to prevent and extinguish fires resulting from such operations. During fire season, blasting and welding on TCF property is prohibited. Please contact Scott Kelly if welding is required to maintain equipment.

918.8 Inspection for Fire
The Contractor or his/her agent shall conduct a diligent aerial or ground inspection within the first two hours after cessation of felling, yarding, or loading operations each day during the dry period when fire is likely to spread. The person conducting the inspection shall have adequate communication available for prompt reporting of any fire that may be detected.

918.10 Cable Blocks for Running Skylines
During fire season all tail and side blocks on a cable setting shall be located in the center of an area that is either cleared to mineral soil or covered with a fireproof blanket. The blanket or clearing must be at least 15 ft. in diameter. A shovel and an operational full five-gallon back pump or a fire extinguisher bearing a label showing at least a 4A rating must be located within 25 feet of each such block before yarding commences.

Fire Boxes
A sealed fire box shall be present on every active landing during the course of logging operations. Per Public Resources Code Division 4 Chapter 6 Section 4426: On any such operation a sealed box of tools shall be located, within the operating area, at a point accessible in the event of fire. This fire toolbox shall contain:

(a) one backpack pump-type fire extinguisher filled with water, two axes, two McLeod fire tools, and a sufficient number of shovels so that each employee at the operation can be equipped to fight fire. Fire equipment shall only be used in case of fire
(b) one or more serviceable chainsaws of three and one-half or more horsepower with a cutting bar 20 inches in length or longer shall be immediately available within the operating area, or, in the alternative, a full set of timber-felling tools shall be located in the fire toolbox, including one crosscut falling saw six feet in length, one double-bit ax with a 36-inch handle, one sledge hammer or maul with a head weight of six, or more, pounds and handle length of 32 inches, or more, and not less than two falling wedges

Heavy Equipment
All tracked or rubber-tired equipment over 5,000 lbs GVW shall be equipped with one serviceable shovel and one serviceable chemical fire extinguisher of at least a 2A:10B:C rating (5 lb. capacity) or water stored pressure fire extinguisher with at least a 2A rating (2½ lb. capacity). Equipment shall have and maintain the factory exhaust system or equivalent.

Vehicles
Shall keep a serviceable shovel at least 46 inch total length, an ax or Pulaski, and a fully charged fire extinguisher with at least a 1A:10B:C rating (2½ lb. capacity) in their vehicle and must be equipped with the factory exhaust system or equivalent.

Chainsaws
Chainsaws shall be equipped with the original factory exhaust system with spark arrestor or equivalent. A serviceable fire extinguisher must be located within 25 feet of the point of operation.

Firearms
The discharging of firearms is not permitted on TCF property.

TCF Responsibilities

a) Monitor fire weather daily during periods of extreme fire danger
b) All active operations may be required to be shut down when the relative humidity reaches 20% or lower, or when excessively high air temperatures are present.
c) All logging and road maintenance contractors shall be inspected for fire protection preparedness during the declared fire season. **Failure to comply will cause the job to be shut down until all fire protection measures are in place.**
d) Maintain and have ready fire equipment for immediate mobilization.
e) Use fire equipment only for fire related activities such as fire suppression and planned burning activities.
f) Each passenger vehicle shall be equipped with a fire extinguisher rated 1A:10B:C (2½ lb. capacity), shovel (46 inches in total length) and an ax.
g) TCF shall be a paid subscriber to the Mendocino County Cooperative Aerial Fire Patrol. Aerial flights are scheduled by CAL FIRE.
h) In the event that CAL FIRE announces "very high" fire danger or a "red flag warning" (extreme fire weather conditions), TCF shall determine whether any specific fire

prevention measures need to be implemented and if so, shall transmit such measures to contractors for implementation.

INITIAL ACTION INSTRUCTIONS

Any action taken will be done in the safest manner possible. Your personal safety and the safety of other individuals working in the area is the highest priority.

a) Contractor will report the fire to CAL FIRE and TCF personnel as described above.
b) Provide a precise location (general area, ¼ Section, Township and Range) and size of the fire if possible.
c) Describe best access route(s) to the fire. Where possible, open gate(s) or have a TCF employee wait for CAL FIRE/local volunteer fire department at the specified gate, to lead them to the fire.
d) Determine escape routes from the fire and be prepared to evacuate nearby personnel. If no escape route exists evacuate personnel from the area to a safe location, generally a large open area.
e) An appropriately-trained TCF employee responding to a fire on TCF lands, or a fire that is posing an immediate threat to TCF lands may at his or her own discretion assist in coordinating initial fire suppression actions. Take the lead to designate duties and remain in communication with all resources. As soon as CAL FIRE arrives, TCF personnel shall brief them and turn control of the fire over to CAL FIRE personnel.
f) Place available equipment on standby or route to the fire area.
g) Request additional appropriate equipment needs.
h) Direct all water tenders to fill up with water.
i) Place fire locator signs to mark route to the fire.
j) Leave gates on access roads to fire open until the fire is out.
k) Stop all operations that are on or will use the access road to the fire. In extreme fire weather all active logging on the property shall be shut down.

RECOGNIZING FIRE DANGER BUILD-UP

There are many environmental factors affecting the probability of fire ignition and the rate of fire spread, including low relative humidity, high wind speeds, high atmospheric instability, and others. The Burning Index, which indicates severe fuel and atmospheric conditions for logging operations, takes these different factors into account in order to assess the potential for hazardous fire behavior. It is derived from a calculation involving the drying rate of fuels, the humidity, temperature, wind, and the state of curing of the growing plants. It cannot pinpoint the exact conditions in any one particular place. This leaves the Contractor with the responsibility of policing his own area and using good judgment in operating procedures. The Burning Index for coastal Mendocino County is available each day during Fire Season at (707)-459-7404.

OPERATIONAL FIRE SUPPRESSION RULES

Any action taken will be done in the safest manner possible. Your personal safety and the safety of other individuals working in the area is the highest priority. There is no requirement for untrained or unwilling personnel to fight fire on TCF property. The following rules apply to persons who find themselves actively fighting fires.

FIRE SAFETY

a) Personal Safety: The safety of yourself and crew is your highest priority if you find yourself or your crew in an unsafe situation all persons should leave the scene immediately. If you or your crew are directed by anyone including CAL FIRE to do something which you feel is unsafe you may decline to do so. Report any such incidence to the CAL FIRE incident commander and TCF.
b) Working alone on a fire shall not be permitted.
c) Only experienced and capable operators shall be placed on or operate power equipment such as bulldozers, water trucks and chain saws.
d) Hand tools will be carried and used in a safe manner. Protect yourself and the person working next to you by maintaining safe working separation. Watch your footing at all times.
e) Be alert as to what is going on around you (e.g. burning snags, rolling rocks, and logs). Rolling debris comes from above, but don't forget, burning snags do sometimes fall up the hill.
f) Snag fallers must be exceptionally thorough and accurate in their "Timber" call and must allow ample time for an answer before starting their saw for the final cut. Close correlation between hand trail crews and snag fallers is most important.
g) The Fire Boss is responsible for his/her personnel. Missing personnel is cause for alarm and an immediate investigation.
h) Tractors must be provided with lights when working at night.

OPERATION OF TRACTORS

a) Avoid carrying fire outside the lines.
b) Push hot material away from the line and into the fire.
c) Don't bury fire. Buried fire may burn undetected for weeks and break out later when thought to be under control.
d) Work the tractors in pairs on steep terrain so that one can get the other out of "jackpots".

OPERATION OF WATER TRUCKS AND PORTABLE PUMPS

a) Operate pumps at the recommended speed. Exceed this only temporarily when the emergency justifies.
b) When pumping downhill, use only the pressure needed; often times gravity is enough. Excessive pressure will burst a hose and cause dangerous and costly delays.

c) When filling water trucks or pumping directly from streams, utilize a hose with a screened inlet. Keep the intake hose in clean water. Sand and gravel will easily go through the volume pump and will foul the pressure pump.
d) Always keep a grease gun, screwdriver, pliers, and a crescent wrench with the water truck or water pump to facilitate minor pump adjustments. Good service is important with the portable pumps, which in most cases, must be carried to their place of operation.

USE OF HAND TOOLS

a) Keep hand tools sharp and ready for use at all times.
b) All hand tools must be securely handled. Axes and Pulaskis tend to dry out during the summer months. They should be checked regularly and tightened with wedges if necessary.
c) Tools rendered ineffective due to damage or use shall be removed from active use and repaired or replaced as soon as possible.

ENVIRONMENTAL PROTECTION

a) When drafting water, screens will be used to prevent the entrapment of aquatic vertebrates. Drafting sites will be located to minimize damage to the watercourse.
b) When possible, firebreaks shall be placed outside of watercourse and lake protection zones (WLPZs) and other riparian areas.
c) When possible, firebreaks shall avoid unstable areas.
d) Water bars shall be installed on tractor constructed firebreaks as a part of the final "mop-up" operation. Mulching with slash or straw shall be conducted in WLPZ's where necessary to prevent erosion.

TCF CONTACTS

Contact Order	Name	Cell Phone #
1.	Scott Kelly	(707) 272-4497
2.	Don Miller	(707) 489-0315
3.	*Holly Newberger	(707) 357-3391

*Office and administrative support only/Fire dispatcher

TCF FIRE SUPPRESSION ORGANIZATION AND DUTIES

In the event that The Conservation Fund has to maintain fire suppression activities without the aid of CAL FIRE. The following is a list of individual fire suppression roles with their associated duties. In this hierarchical system, with fire fighter as the lowest rank and dispatcher as the highest, individuals report directly to the rank above them. Roles will be distributed between staff and contractors on the basis of experience and physical capacity.

Dispatcher/Fire Operations Manager (Holly Newberger)
Duties and Responsibilities: Maintains radio contact with TCF Fire Boss(es). Arranges for and dispatches equipment, personnel and supplies ordered by the Fire Boss. Maintains the following log/records:

• Daily log of contract equipment and personnel dispatched to each fire including numbers of personnel, supervisor, numbers and type of equipment, hours worked by shift.

• Daily log of all conversations, phone calls with CAL FIRE and others including the time, person talked to, fire command job title/function or other, and substance of the discussion. (Use the Incident Report Form).

Fire Boss (Scott Kelly or designee)
Duties and Responsibilities: Overall organization and supervision of suppression operations on each fire until relieved by CAL FIRE. Develops suppression strategy. Determines and manages manpower, equipment and supplies needs. Maintains personnel roster. Directly supervises crew bosses or fire fighters on small fires. Maintains radio/cellular contact with main office. Maintains contact with Crew Bosses as conditions dictate (intervals not to exceed two hours). Interacts with CAL FIRE hierarchy when present. Completes or directs other TCF personnel to complete the Wildfire Information Report Form. Ensures that the access route to the fire location is adequately signed.

Crew Boss (Scott Kelly or designee)
Duties and Responsibilities: Responsible for direct supervision of fire fighters engaged in suppression operations (e.g. tool complement, fire line location, width and construction; hose lays, mop-up operations). Follows directions and implements strategy developed by the Fire

Boss. Monitors fire suppression progress and fire behavior and reports said information to Fire Boss at intervals not to exceed two hours. Coordinates with water truck pump operators. Directs location and construction of tractor firelines. Ensures replacement of worn-out or unusable tools/equipment. Knows the location of and ensures the safety of each fire fighter on the crew at all times.

Fire Fighters
Duties and Responsibilities: Follows directions of Crew Boss and Fire Boss. Responsible for wearing protective clothing and gear (i.e. long-sleeve shirt, pants, boots, safety glasses, gloves, handkerchief, and hard hat). Wears ear protection and chaps when operating chainsaws; only operates power saws if trained and capable. Uses the proper tool for the specific task at hand. Reports unsafe conditions to Crew Boss. Reports broken or unusable tools to Crew Boss. Paces their work to forestall fatigue. Maintains a supply of personal drinking water. Keeps alert at all times and in contact with other crew members.

TCF EQUIPMENT RESOURCES

McClouds	3
Pulaskis	2
Shovels	4
Backpack pumps	2
Nomex shirts	2
BK radios	2
Fire shelters	2
Pick-ups	2

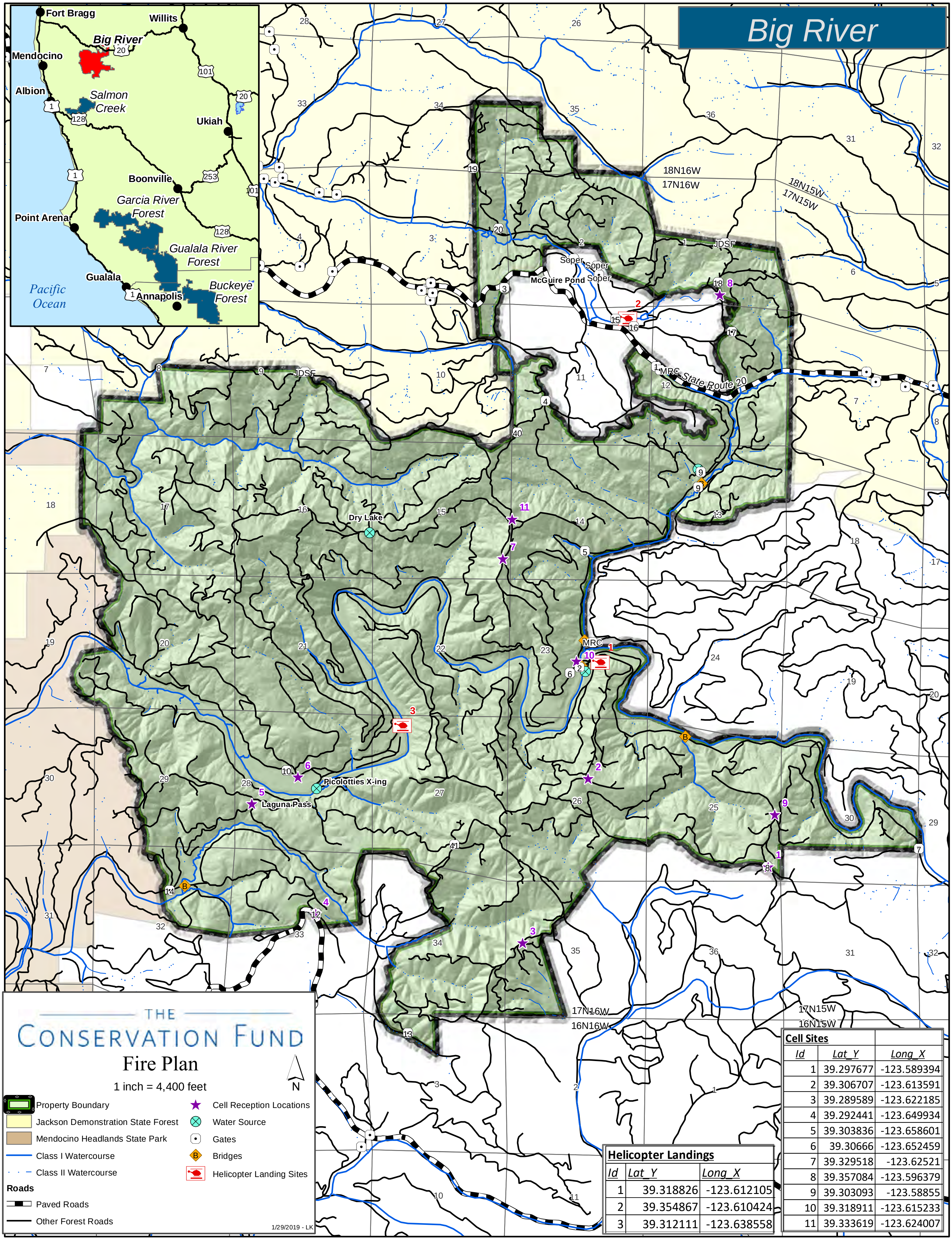
CONTRACTOR CONTACT LIST

This is a partial list of potential contractors. TCF office will know which contractors are on site and who to contact, additional manpower and equipment may be ordered by the TCF office as deemed necessary by the Fire Boss.

Contractor	LTO#	Contact Persons	Home/mobile (707)
Anderson Logging, Inc. P.O. Box 1266 Fort Bragg, CA 95437 (707)964-2770	A-7124	Mike Anderson Myles Anderson Don Sallinen Mark LeRoy Woods Office	964-0303/489-0837 964-2690/489-5805 961-0305/489-1625 964-0592/272-3706 964-4037
Barnett Logging 31651 Pudding Creek Road Fort Bragg, CA 95437	A-10343	Eddy Barnett	964-2542/357-1285
Bob Baker Trucking P.O. Box 655 Gualala, CA 95445		Bob Baker	884-3318
Christopher Blencowe 116 N Sanderson Way Fort Bragg, CA 95437		Chris Blencowe	964-1409/972-6768
Hautala & Mills Logging 27937 Highway #20 Fort Bragg, CA 95437	A-9276	Richard Hautala Parker Mills	964-2340/489-9556 877-3250/489-4587
Darcie Mahoney 30995 Greenwood Rd. Elk, CA 95432		Darcie Mahoney	877-3435/489-4865
Philbrick, Inc. P.O. Box 1288 Fort Bragg, CA 95437 (707) 964-2277	A-5697	Jerry Philbrick John Starkey	937-5919/489-0923 964-8809/489-2514
Robert Piper Logging P.O. Box 82 Manchester, CA 95459		Robert Piper	489-7923
William T. Piper Logging P.O. Box 295 Manchester, CA 95459 (707) 882-2561		Bill Piper	489-5150

Shuster's Logging Inc. 550 East Valley Street Willits, CA 95490 (707) 459-4131	A-8080	Steve Shuster Randy Yanez	456-9475/272-7120 964-7369/489-0237
Stornetta Excavating P.O. Box 225 Point Arena, CA 95468		Stan Stornetta	884-9628/357-1654
Summit Forestry 16575 Franklin Road Fort Bragg, CA 95437		Lee Susan	964-4566/357-0906
Gary Swanson 31651 Cedar Street (707) 964-3519	C-762	Gary Swanson	964-3519/489-0152
T&S Logging Inc. P.O. Box 31 Philo, CA 95466 (707) 895-3751		Ed Slotte	489-1948
Vasquez Reforestation PO Box 2407 Fort Bragg, CA 95437		Laura Schroeder Jesus Vasquez	357-8228 357-8388
Wylatti Resource Mngmnt. PO Box 575 Covelo, CA 95428	A-851	Brian Hurt	(707) 983-6633 (707) 983-8184 (707) 489-1463

MAPS OF TCF OWNERSHIPS
Helicopter suitable landings
Water drafting sites
Environmentally sensitive areas



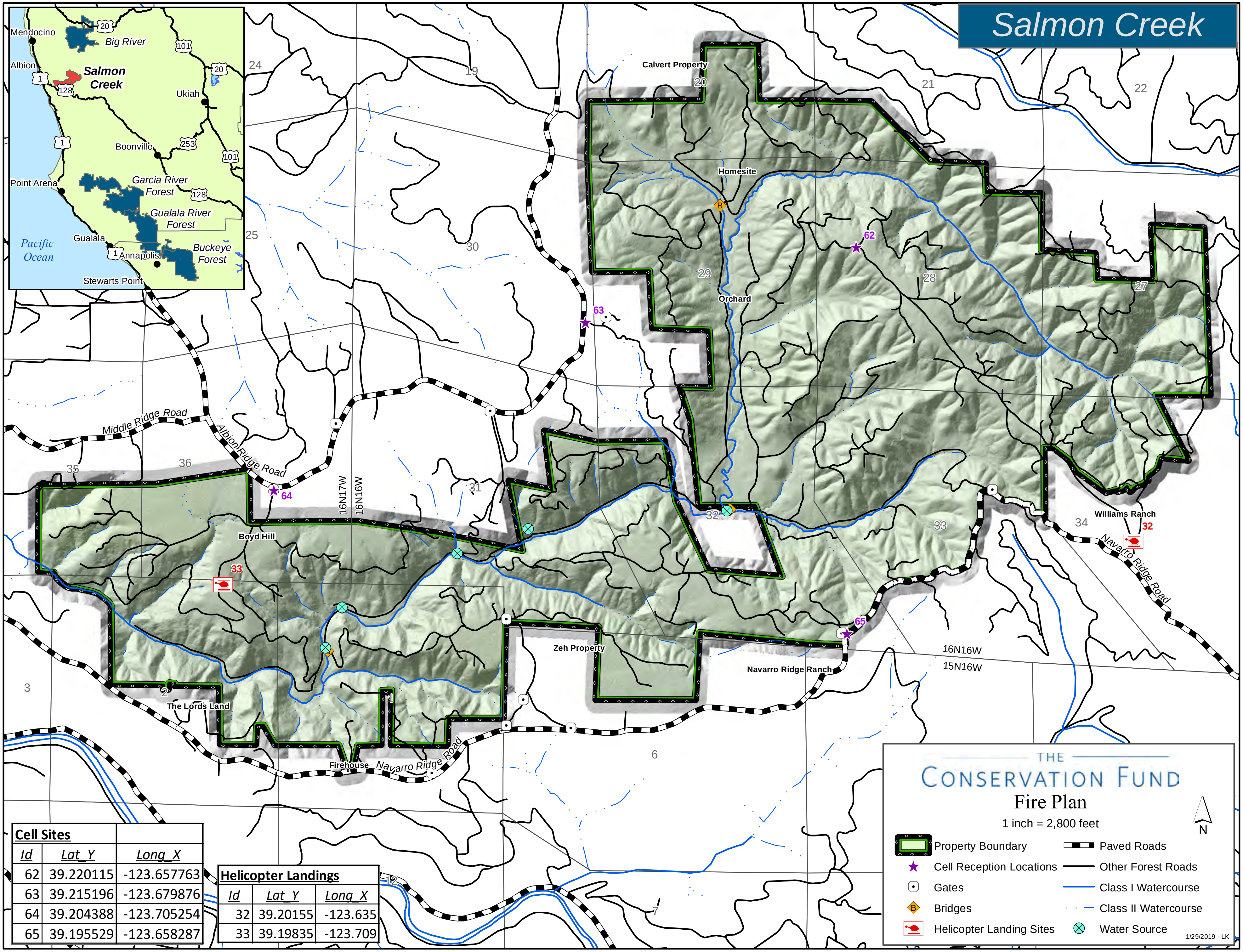
Cell Sites

Id	Lat_Y	Long_X
1	39.297677	-123.589394
2	39.306707	-123.613591
3	39.289589	-123.622185
4	39.292441	-123.649934
5	39.303836	-123.658601
6	39.30666	-123.652459
7	39.329518	-123.62521
8	39.357084	-123.596379
9	39.303093	-123.58855
10	39.318911	-123.615233
11	39.333619	-123.624007

Helicopter Landings

Id	Lat_Y	Long_X
1	39.318826	-123.612105
2	39.354867	-123.610424
3	39.312111	-123.638558

Salmon Creek



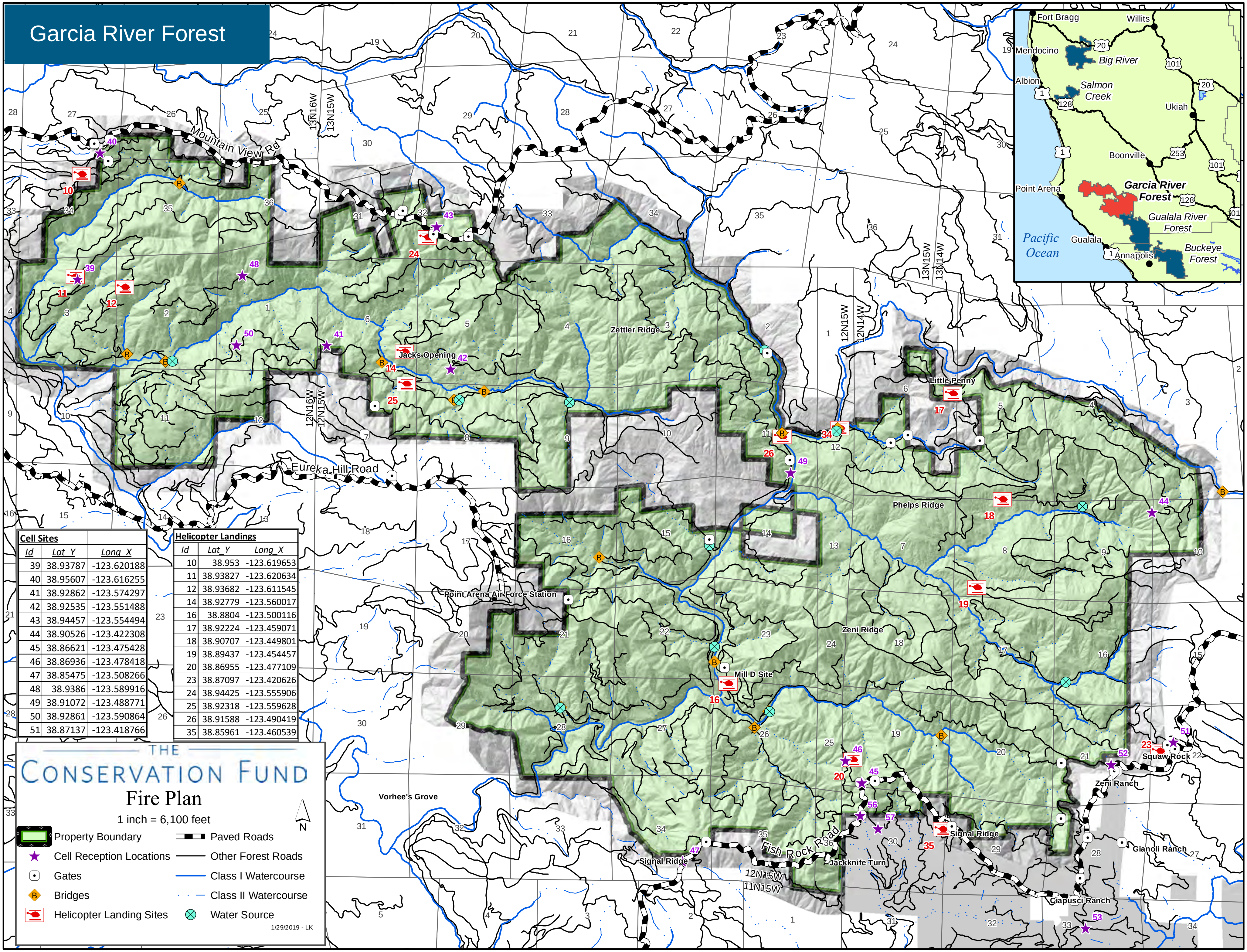
Cell Sites

Id	Lat_Y	Long_X
62	39.220115	-123.657763
63	39.215196	-123.679876
64	39.204388	-123.705254
65	39.195529	-123.658287

Helicopter Landings

Id	Lat_Y	Long_X
32	39.20155	-123.635
33	39.19835	-123.709

Garcia River Forest



Cell Sites		
Id	Lat_Y	Long_X
39	38.93787	-123.620188
40	38.95607	-123.616255
41	38.92862	-123.574297
42	38.92535	-123.551488
43	38.94457	-123.554494
44	38.90526	-123.422308
45	38.86621	-123.475428
46	38.86936	-123.478418
47	38.85475	-123.508266
48	38.9386	-123.589916
49	38.91072	-123.488771
50	38.92861	-123.590864
51	38.87137	-123.418766

Helicopter Landings		
Id	Lat_Y	Long_X
10	38.953	-123.619653
11	38.93827	-123.620634
12	38.93682	-123.611545
14	38.92779	-123.560017
16	38.8804	-123.500116
17	38.92224	-123.459071
18	38.90707	-123.449801
19	38.89437	-123.454457
20	38.86955	-123.477109
23	38.87097	-123.420626
24	38.94425	-123.555906
25	38.92318	-123.559628
26	38.91588	-123.490419
35	38.85961	-123.460539

THE CONSERVATION FUND

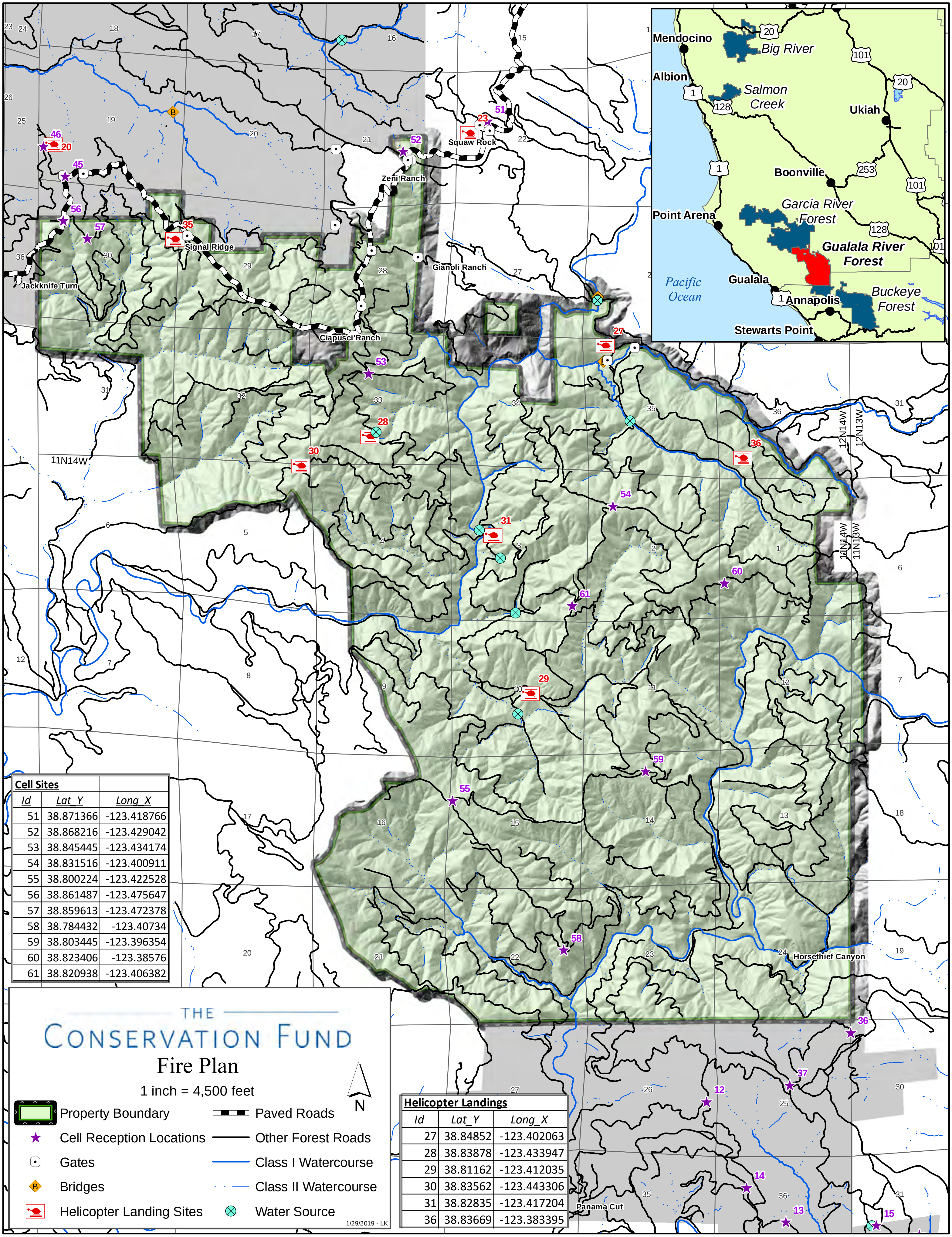
Fire Plan

1 inch = 6,100 feet

N

- Property Boundary
- Cell Reception Locations
- Gates
- Bridges
- Helicopter Landing Sites
- Paved Roads
- Other Forest Roads
- Class I Watercourse
- Class II Watercourse
- Water Source

1/29/2019 - LK



Cell Sites		
Id	Lat_Y	Long_X
51	38.871366	-123.418766
52	38.868216	-123.429042
53	38.845445	-123.434174
54	38.831516	-123.400911
55	38.800224	-123.422528
56	38.861487	-123.475647
57	38.859613	-123.472378
58	38.784432	-123.40734
59	38.803445	-123.396354
60	38.823406	-123.38576
61	38.820938	-123.406382

THE CONSERVATION FUND

Fire Plan

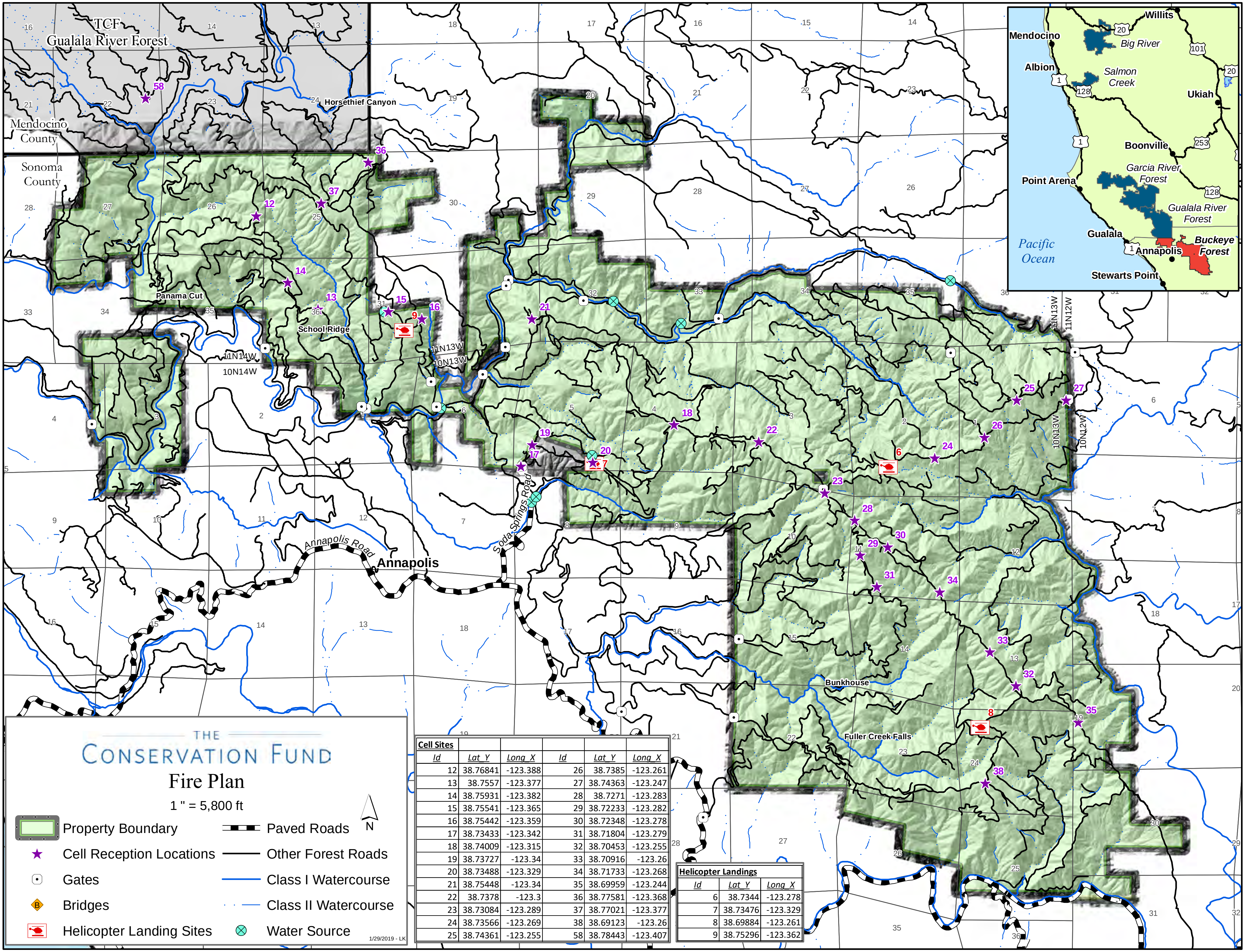
1 inch = 4,500 feet

N

- Property Boundary
- Cell Reception Locations
- Gates
- Bridges
- Helicopter Landing Sites
- Paved Roads
- Other Forest Roads
- Class I Watercourse
- Class II Watercourse
- Water Source

1/29/2019 - LK

Helicopter Landings		
Id	Lat_Y	Long_X
27	38.84852	-123.402063
28	38.83878	-123.433947
29	38.81162	-123.412035
30	38.83562	-123.443306
31	38.82835	-123.417204
36	38.83669	-123.383395



THE CONSERVATION FUND

Fire Plan

Cell Sites

Id	Lat_Y	Long_X	Id	Lat_Y	Long_X
12	38.76841	-123.388	26	38.7385	-123.261
13	38.7557	-123.377	27	38.74363	-123.247
14	38.75931	-123.382	28	38.7271	-123.283
15	38.75541	-123.365	29	38.72233	-123.282
16	38.75442	-123.359	30	38.72348	-123.278
17	38.73433	-123.342	31	38.71804	-123.279
18	38.74009	-123.315	32	38.70453	-123.255
19	38.73727	-123.34	33	38.70916	-123.26
20	38.73488	-123.329	34	38.71733	-123.268
21	38.75448	-123.34	35	38.69959	-123.244
22	38.7378	-123.3	36	38.77581	-123.368
23	38.73084	-123.289	37	38.77021	-123.377
24	38.73566	-123.269	38	38.69123	-123.26
25	38.74361	-123.255	58	38.78443	-123.407

Helicopter Landings

Id	Lat_Y	Long_X
6	38.7344	-123.278
7	38.73476	-123.329
8	38.69884	-123.261
9	38.75296	-123.362

APPENDIX K:

Garcia River Monitoring Program, Monitoring the Status and Trends of a Watershed Recovery Effort

To be added when compete.

Fixed Radius Plots Inventory Procedure
Buckeye, Garcia, and
Big River/Salmon Creek Forests

Revised November 29, 2016

Sampling Design and Overview

1.1. Plot Location – How are plots located across the property

Continuous Forest Inventory (CFI) is an inventory system in which a portion of a property is sampled annually. In a CFI, new plot data replaces old plot data continuously and the inventory is completely refreshed every 10 years or so. The advantage of this system is that cruising costs are averaged over a period of years. Additionally, disturbed or harvested plots are remeasured annually so the forest mensurationist does not have to estimate the effect of harvest on the forest inventory. The set of plots to sample in any given year is a combination of disturbed plots or old plots that should be retired from the population of sample plots in favor of more accurate data.

The original strata, plot centers and plot numbering system will be reused wherever possible, plot selection for the inventory update will be a systematic sample from the original population of plots until all of the plots have been re-measured. Plots that were not initially measured for height will be preferentially chosen until all plots have height measurement data and plots shall be measured in logical groups to facilitate cruiser production and reduce transportation time between plots.

1.2. Plot Design – Summary of Measurements

The plot design consists of a circular 1/10th acre plot (37.2 ft radius) for all conifer tree species, a circular 1/20th acre (26.3 ft radius) plot for all hardwood tree species, and a 1/100th acre circular fixed radius plot for regeneration (11.8 ft radius). All plots are concentric with the same plot center (PC).

1.2.1. Circular 1/10th Acre (37.2 ft radius) Fixed-Area Plot Measurements Standing live and dead *conifer* trees >=5.0 " DBH.

- species
- diameter at breast height (DBH) measured to the nearest 1/10 inch.
- height to the nearest foot
- height to crown base
- % defect, % missing height, and defect code where needed
- height and decay class for all conifer snags 10.5 inches DBH or greater and at least 15 feet tall

1.2.2. Circular 1/20th Acre (26.3 ft radius) Fixed-Area Plot Measurements Standing live and dead *hardwood* trees >=5.0 " DBH.

- species
- diameter at breast height (DBH) measured to the nearest 1/10 inch.
- height to nearest foot
- % defect, % missing height, and defect code where needed
  - the only defect that is recorded for hardwoods is missing volume, such as missing height and large cavities. Other defects often noted in timber cruises– such as a sweep in the bole – are not applicable to hardwoods

- height and decay class for all hardwood snags greater than 5.0” DBH and 15 feet tall.

1.2.3. Circular 1/100 acre Regeneration Plot Measurements (11.8 ft radius): Standing live conifer or hardwood trees between 2.5-5.0 “ DBH (BRSC & GRF) and 1.0-5.0”DBH (Buckeye) and greater than 7 feet tall.

- species
- diameter at breast height (DBH) measured to nearest 1/10”
- Trees *7 feet* tall and above
- height to crown base

1.3. Plot Access and Road Point Procedures

Each plot will be accessed from the nearest road entry point or the prior plot. The cruiser will navigate via GPS to the plot center. A map will be provided to cruisers which shows where plots have been placed and their corresponding GPS locations will be provided on a separate spreadsheet; shapefiles will also be provided to the cruisers as requested.

1.4 Plots on Truck Roads

Plots are located throughout the project area and may fall on a truck road or property edge. Plots that fall on unmapped truck roads are sampled. Plots that have *any portion* of the 37.2 ft radius land on mapped truck roads are offset 1 chain to the west, and if still on truck road the cruiser returns to the original point and offsets 1 chain north. The offset shall be in a cardinal direction moving 90 degrees clockwise on the compass until a bearing is found that will lead to a vegetated plot. Landings are treated as part of the truck road and not sampled. New plot centers will be mapped and the GPS coordinates will be provided to the data manager. If after offsetting the cruiser cannot get the plot off of the truck road the cruiser shall offset 2 chains from PC starting from the west and moving in a clockwise direction until the plot can be established with no interference from the roads.

1.5 Edge Plots

If a plot is near a property boundary according to GPS coordinates, but the cruiser cannot find a clear delineation of ownership change such as a boundary line or noticeable change in timber management then the plot is established and measured normally. However, if a portion of the plot, but not the plot center, is off property and the ownership boundary is very clear (e.g., fence, blaze line, obvious land management difference like a clearcut), the Walkthrough Method[1] is used. The Walkthrough Method

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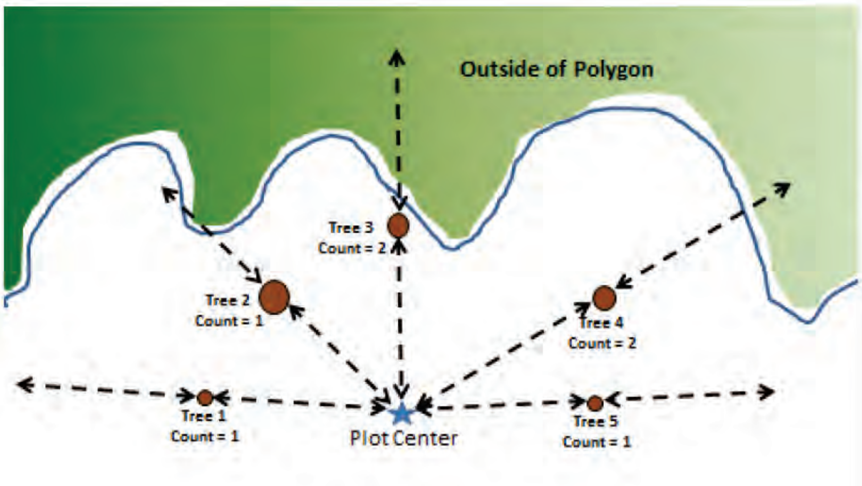
[1] Ducey, M.J,, J.H. Gove, and H.T. Valentine. 2004. A Walkthough Solution to the Boundary Overlap Problem. Forest Science 50: 427-435.

(Figure 1) is a proven method to eliminate bias in boundary overlap situations. If a plot center is clearly



1. Is the tallied tree closer to the boundary, than to the plot center point?
   NO – Tree count = 1
   YES – Proceed to 2
2. Move to the point that is the same distance from the plot center to the tallied tree on the same bearing on the other side of the tree. Is this point outside of the polygon?
   NO – Tree Count = 1
   YES – Tree Count = 2

beyond the property boundary, then the plot is thrown out and the cruiser navigates to the next plot.

Figure 1. Decision Key and Diagram for Walkthrough Method. If a portion of a plot is beyond a clear boundary, the Walkthrough Method is used to collected data in a boundary overlap situation. Further explanation is available in Ducey et al (2004).

1.6 Plot Monumenting and Plot Navigation Procedures

The following monumenting procedure should occur at all plots:

1. The plot center should be monumented with a plastic stake painted orange. The stake should extend at least 18 inches above the ground and be driven securely into the soil.
2. For CFI plots the cruiser shall ensure that the PC is secure in the ground and repaint the stake and all trees as necessary. The cruiser shall carry extra stakes and orange paint at all times. The plot number should be clearly written on an aluminum tag affixed to the plot center stake along with the date cruised and the cruiser's initials. Solid pink and solid white flagging is tied to the stake and also hung in the trees above the plot center.
3. GPS coordinates taken at plot centers and should be recorded on the plot sheet. **The GPS coordinates for plot center should be recorded 2 times for each plot:**
   a. When the plot center is established
   b. When the plot is completed
4. All trees measured on the plot should have a line spray painted **at the location they were measured for DBH** on the uphill side of the tree and facing plot center where possible. "Out Trees" – Trees whose center is just outside of the plot boundary should be spray painted with and "X" at DBH.
5. Trees in the 1/20th and 1/10th acre plots are numbered consecutively starting from the north and moving in a clockwise direction until the plots are completed.
6. Trees shall be numbered consecutively starting from '1' on each plot. As trees grow into the 1/10th and 1/20th acre plots new trees shall be numbered in sequence starting with the next number on the tree list for the plot.
7. Trees within the 1/100th acre regeneration plot are marked with a painted dot at DBH facing PC.

1.7 Bearing Trees

One to three bearing trees at least 6 inches DBH and in good health shall be established on each plot. The distance (in feet) and bearing (in degrees) from the face of each tree at ground level to the plot center at ground level shall be measured and recorded. The face of each tree shall be marked with a dot of orange paint denoting the location where the distance and bearing were taken. Reported distances shall be slope distance at ground level. Bearing trees will grow therefore it will be necessary to re-measure the bearing trees each time a plot is visited to ensure that the distance and bearing are accurate. If a bearing tree falls down or is harvested a new bearing tree shall be selected. Since the measurement has to be accurate, trees with an unobstructed path to the PC shall be chosen. There shall be a minimum of 1 and maximum of 3 bearing trees per plot. Bearing trees will be recorded in the data collection system on the iPad or datasheets. The distance and bearing for each bearing tree shall be verified each time the plot is measured.

2. Sampling Procedure and Data Collection at Plots

2.1. 1/10th Acre (37.2 ft Radius) Plot for conifer trees and 1/20th Acre (26.3 ft Radius) plot for hardwood trees

2.1.1. Borderline Trees

Any tree (live or dead) near the plot border shall be measured using a tape to check for in and out trees. A laser is not recommended to determine in and out trees. When checking borderline trees, the loggers tape shall be affixed to the face of the tree at DBH and then pulled to plot center. Once at plot center, the measured slope distance should be corrected to horizontal distance. The radius of the tree should be added to the horizontal distance to plot center when calculating whether or not the tree is located within the plot—the center of the tree needs to be within the plot radius to be considered "in". **When checking in and out trees be mindful of your units, plot radius is measured in feet and 1/10 of feet whereas DBH is measured and recorded in inches. To covert diameter in inches to the radius in 1/10 of feet divide the diameter by 24. For example, a 12 in DBH tree has a radius of .5 feet (12/24). In the field a 12" DBH tree which is 37 feet horizontal distance from plot center to the face would be measured as 37.5 feet to the center of the tree or "out".**

2.1.2. Live Trees

All live conifer trees greater than or equal to inches 5.0" DBH are measured if the **CENTER** (pith) of the stem at DBH is within 37.2 horizontal feet of plot center. All live hardwood trees greater than or equal to 5.0" DBH are measured if the **CENTER** of the stem at DBH is within 26.3 horizontal feet of plot center. Trees will be tallied and measured in a clockwise direction beginning in the north. **All trees should be marked and numbered with a line painted at DBH and the tree number shall be recorded by the cruiser.** The following data shall be collected for each tree measured:

- **Species** – The species and species codes of trees can be found in Table 1 below.
- **Group** – Each tree in the plot has a group assigned to it. Trees can be live (..) or snags (SN). See Table 2 below for a complete description of the group codes. **All snags (SN) must have a decay class from 1 to 5 assigned**. Decay class descriptions for snags are in table 3 below.
- **Diameter at Breast Height (DBH) see figure below** – Diameters are measured at a point 4.5 feet above the ground level or root collar on the uphill side of the tree.
  - **Measurement accuracy**: Diameter tapes should be read to the nearest 1/10 inch.
  - **Irregularities in DBH**: in case of swelling, bumps, depressions, branches or swollen knots that effect normal stem form, diameters are measured immediately ***above*** the irregularity at the place where it ceases to affect the normal stem form. For redwood stump sprouts the ground level should be considered to be the point where the tree no longer contacts the parent stump. Note the "ground level" and corresponding DBH could change so the original DBH line shall be used for all future measurements.
  - **Stem irregularities due to forked tress**: If a tree forks above DBH the tree is measured as one tree at a point 4.5 feet above the ground and no adjustment is made for swollen stems or bole irregularities.
  - **DBH for Forked trees** – Forked trees are measured as two separate trees if the fork originates below DBH. When the fork originates below DBH but has subsequently grown together the tree is cruised as two trees and the DBH for each is estimated by the cruiser. If the fork originates above DBH then the tree is measured and counted as a single tree. In either case. The "pith rule" shall be used in the case where the fork has grown together or when the cruiser is uncertain of the fork location. When using the pith rule the center of each fork, or pith, of the tree is projected downward to the point where they converge. If the convergence is above DBH then the tree is cruised as one tree if the projected pith is below DBH then the tree is cruised as two trees.
  - **DBH for Extreme Lean Trees** – Trees with lean in excess of 45 degrees should be measured 4.5 feet from the point where they leave the ground. When a portion or all of the stem is in contact with the ground DBH shall be measured 4.5 feet above the root collar on the underside of the tree. See the diagrams below for the methodology for measuring leaning trees.

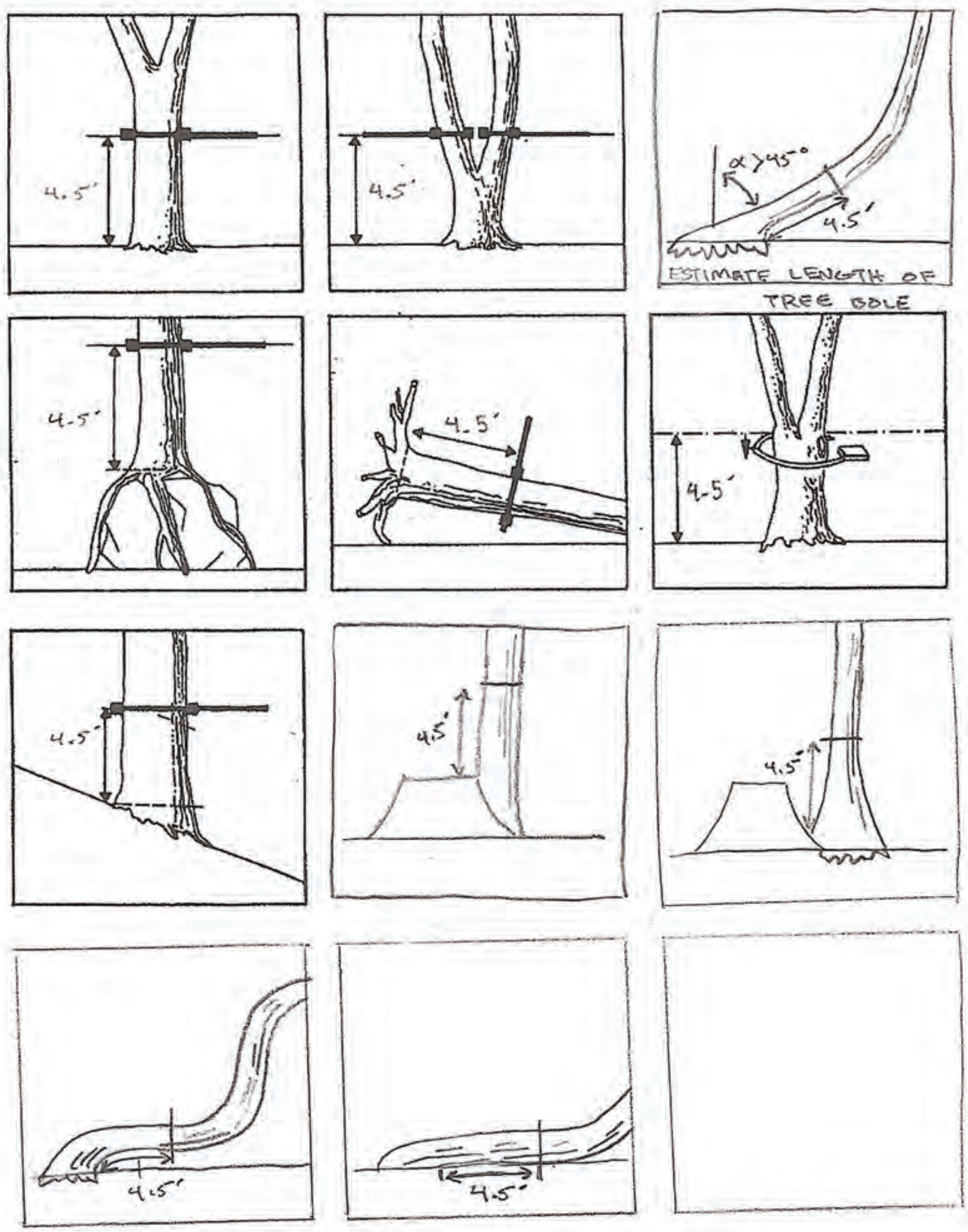


Figure 2. Point of measurement of diameter at breast height (from Pancel, 1993)[2]

[2] Pancel, L., ed. 1993. Tropical forestry handbook. Berlin, Germany, Springer-Verlag. Volume 1, 738 pp

- **Height** – Total height, measured to the nearest foot of the terminal leader on conifers and the highest point on hardwoods is recorded for all live tree trees >= 5 " DBH and for all **snags greater than 5.0"DBH and 15 feet tall**.[3] o
  - **Leaning Trees** – All conifers and tanoak with lean are measured for total vertical height from the ground at stump height to the tree top. If the lean is more than 45^{o} (100% slope), the total length of the primary bole is estimated and defect code 930 shall be recorded in the defect column of the IPAD or data sheet.
  - **Height to broken top**: Height to broken top is measured for trees that are broken at 4 inches in diameter or larger and defect code 91 is entered on the IPAD or data sheet.
  - **Reiterated top**: The height of trees with reiterated tops is recorded as the height to the break as described above or the height to the reiterated top using the following guidelines: If the reiterated top is at least 10% of the height of the tree as measured to the break then the reiterated top is considered the "top" and the tree is coded as "live". If the reiterated top is less than 10% of the height of the tree as measured to the break, then the height to the break is recorded and the tree coded as 91.
- **Height to Crown Base (HTCB)** – This measurement provides an estimate of the total vertical crown area. The measurement is taken on every height measure tree. The measurement is taken from the base of the tree on the uphill slope to the visually balanced base of the crown, since tree crowns are often irregular. Figure 2 below provides examples of how the height to crown base measurement is acquired.

[3] Every 3rd plot has height and height to crown based measured starting with the first plot measured in a stand.

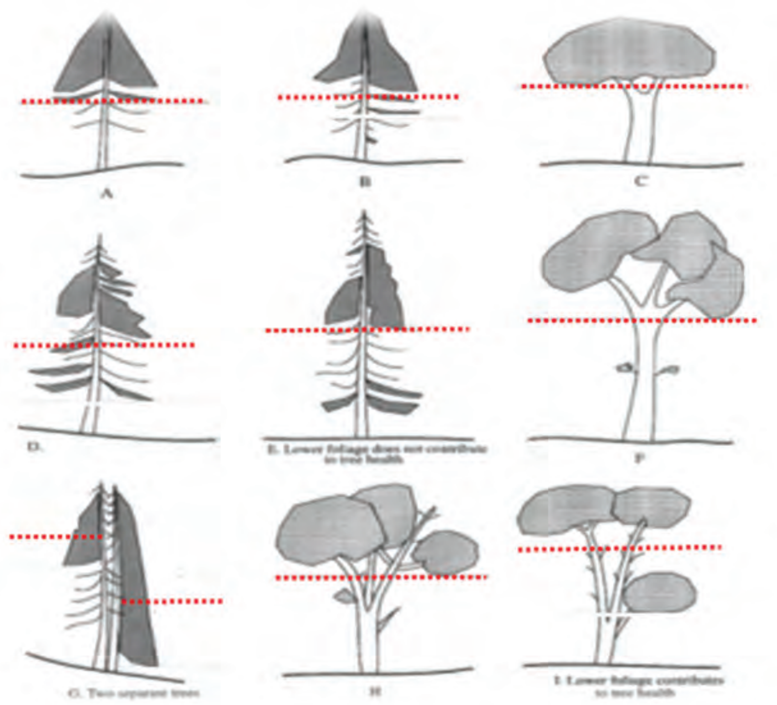


Figure 3. Height to Crown Base Measurement Examples (use the dotted line)

- **<u>Damage/Defect/Missing Volume</u> –** A damage code is assigned to damaged trees. See codes in Table 4 below for descriptions of these codes. Damaged trees should have a defect % recorded. Cruisers shall deduct for defect and missing volume as a percent of the total tree volume. The percent missing volume should be recorded on trees with large hollows that impact the gross volume of the tree the missing volume must be at least 10% to be recorded. Defect deductions and missing volume is only recorded for visible defect in trees ≥ 8 inches DBH. Missing volume due to broken tops is assumed to be captured in the section on measuring trees with broken tops.

2.1.3. Snags (Standing Dead Trees[4]) > 15ft Tall

All snags over 5.0" DBH and 15ft tall should be measured for **DBH** and **height** and should have their species noted. All conifer snags and Hardwood snags with the 1/10 and 1/20th acres plot respectively are recorded. All snags must have their **decay class** noted in the defect column (see Table 3 for Decay Classes). All snags should have a line painted where they were measured for DBH and their tree number painted above this line. They should be given a number in sequence with the live trees. Residual (old growth) stumps are not measured as snags unless they are at least 15' high as measured from the uphill side of the tree.

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[4] Standing dead trees and snags are synonyms, and are used interchangeably in this document.

Table 1: List of Tree Species and their Species Codes

Species Code	Scientific Name	Common Name
AS	*Fraxinus sp.*	Ash species
BM	*Acer macrophyllum*	Big Leaf Maple
BO	*Quercus kellogii*	Black Oak
BP	*Pinus muricata*	Bishop Pine
CB	*Umbellularia californica*	California Bay
CO	*Quercus chrysolepis*	Canyon Live Oak
CU	*Aesculus californica*	California Buckeye
DF	*Pseusostugsa mensziesii*	Douglas-fir
EF	*Ficus carica*	Edible Fig
GC	*Chrysolepis chrysophylla*	Giant Chinquapin
GF	*Abies grandis*	Grand Fir
LO	*Quercus wislizenii and Quercus Parvula var. shrevei*	Interior Live Oak & Shreve's Oak
MD	*Cornus nuttallii*	Mountain Dogwood
MP	*Pinus radiata*	Monterey Pine
NM	*Torreya californica*	California Nutmeg
OL	*Olea europa*	Olive
PM	*Arbutus mensziesii*	Madrone
PP	*Pinus ponderosa*	Ponderosa Pine
PY	*Taxus brevifolia*	Pacific Yew
RA	*Alnus rubra*	Red Alder
RW	*Sequoia sempervirens*	Redwood
SP	*Pinus lambatiana*	Sugar Pine
TO	*Lithocarpus densiflorus*	Tanoak
TY	*Heteromeles arbutifolia*	Toyon
UK	N/A	Unknown
WA	*Alnus rhombifolia*	White Alder
WH	*Tsuga heterophylla*	Western hemlock
WI	*Salix sp.*	Willow species
WM	*Myrica californica*	Wax Myrtle
WO	*Quercus garryana*	Oregon White Oak

Table 2: Group Code Descriptions

Status Code	Code Definition	Description
..	Live	Default code for all trees with normal form including regeneration.
SN	Snag	Standing trees that are dead. Snags have no branches or leaves and are greater than 15 ft tall.

Table 3: [5]. Snag Decay Class Descriptions

Decay class	Limbs and branches	Top	% Bark Remaining	Sapwood presence and condition *	Heartwood condition *
1	All present	Pointed	100	Intact; sound, incipient decay, hard, original color	Sound, hard, original color
2	Few limbs, no fine branches	May be broken	Variable	Sloughing; advanced decay, fibrous, firm to soft, light brown	Sound at base, incipient decay in outer edge of upper bole, hard, light to reddish brown
3	Limb stubs only	Broken	Variable	Sloughing; fibrous, soft, light to reddish brown	Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown
4	Few or no stubs	Broken	Variable	Sloughing; cubical, soft, reddish to dark brown	Advanced decay at base, sloughing from upper bole, fibrous to cubical, soft, dark reddish brown
5	None	Broken	Less than 20	Gone	Sloughing, cubical, soft, dark brown, OR fibrous, very soft, dark reddish brown, encased in hardened shell
***Characteristics are for Douglas-fir. Dead trees of other species may vary somewhat. Use this only as a guide.**					

[5] Forest Service. 2012. Forest Inventory and Analysis National Core Field Data Collection Procedures for Phase 2 Plots. Version 6.0. Page 427. National Core Field Guide, U.S. Department of Agriculture, Forest Service

Table 4: Damage Codes

3 - Chemical	1 - Foliar (broadcast)	0 - Unspecified		
	2 - Stem (spot	1 - Light Damage		
		2 - Moderate Damage		
		3 - Severe Damage		
		4 - Fatal Damage		
4 - Disease	1 - Mistletoe	1 - Light Damage		
	2 - Needle Rusts	2 - Moderate Damage		
	3 - Stem Decay	3 - Severe Damage		
	4 - Stem Rusts	4 - Fatal Damage		
	5 - Stem Cankers			
	6 - Root Disease			
5 - Insects	2 - Bark Beetles	1 - Light Damage		
		2 - Moderate Damage		
		3 - Severe Damage		
		4 - Fatal Damage		
6 - Animal	1 - Deer & Elk			
	2 - Bear	1 - Light Damage		
	3 - Livestock	2 - Moderate Damage		
	4 - Porcupine	3 - Severe Damage		
	6 - Small Mammals	4 - Fatal Damage		
9 – Physical and Mechanical	1 - Broken top	Fork codes	Lean Codes	Codes For
	2 - Dead Top	1 - Below	1 - <25	0 – height
	3 - Multiple Tops	2 - Above	2 - 26 to 45	1 - Light
	4 - Forked Tree	3 - Above	3 - >45	2 - Moderate
	5 - Leaning Tree			3 - Severe
	6 - Crook or Sweep			4 - Fatal
	7 - Bole Cracks			
	8 - Epicormic Branching			

2.2. 1/100 Acre (11.8 ft radius) Plot

2.2.1. Regeneration – Trees < 5.0” DBH

The sample area measured for regeneration is a fixed 1/100th acre plot (11.8 ft radius). All live trees between 2.5” and 5.0” DBH (BRSC & GRF) and 1.0” and 5.0” DBH (Buckeye) and at least 7’ tall are measured in the 1/100th nested plot. All species with a tree form are measured, (see table 1 for species that should be measured as trees), if the individual meet the minimum DBH and height requirements.

- **Species** – Record species for all trees
- **DBH** – All live trees greater than 2.5” (1.0” for Buckeye) and less than 5.0” at DBH if the pith of the tree is within the 1/100th acre plot where it comes out of the ground.
- **Height** – All live trees greater than or equal to 7 feet tall are measured to the nearest foot.

2.3. Additional Plot Information

Any further information concerning the stand being cruised can be extremely important.

- GPS coordinates should be recorded at each plot center when the plot is established, and again when the plot is completed.
- The cruiser should also record plot aspect, % slope, cruiser, and date
- Items that should be noted are the location of skid trails that occur within the plot, springs, watercourses and historical artifacts when they assist in relocating the plot.
- Wildlife species of concern observed should be noted including raptors and their nests pileated wood peckers, tree vole, red legged frog, mountain lions, bears, etc.
- If a plot has no trees, please make a note of the plot conditions and record one species with species code XX, DBH equal to 12, and tree count equal to 0.

2.4. Site Class Sampling

Site tree sampling was completed in 2013 (Buckeye) and 2015 (GRF & BRSC) and no additional site tree data is required. This section is to remain in the OPDR for reference.

3. Data Entry and Transfer

Data will be collected using iPad tablets or other data logger provided by the cruising contractor. Cruisers shall email completed data to TCF at the end of each work day or as agreed. Cruisers should carry paper data sheets in the field so that data can be collected in the event that an iPad stops functioning.

4. Check Cruise Specifications

Total plot carbon and gross board foot volume must be within 5% of the check cruise results. Any cruiser who has more than 25% of their plots outside of this 5% range must have all of their plots re-cruised at their expense.