

Monitoring Study Group

California Water Quality Monitoring Collaboration Network



September 19, 2013

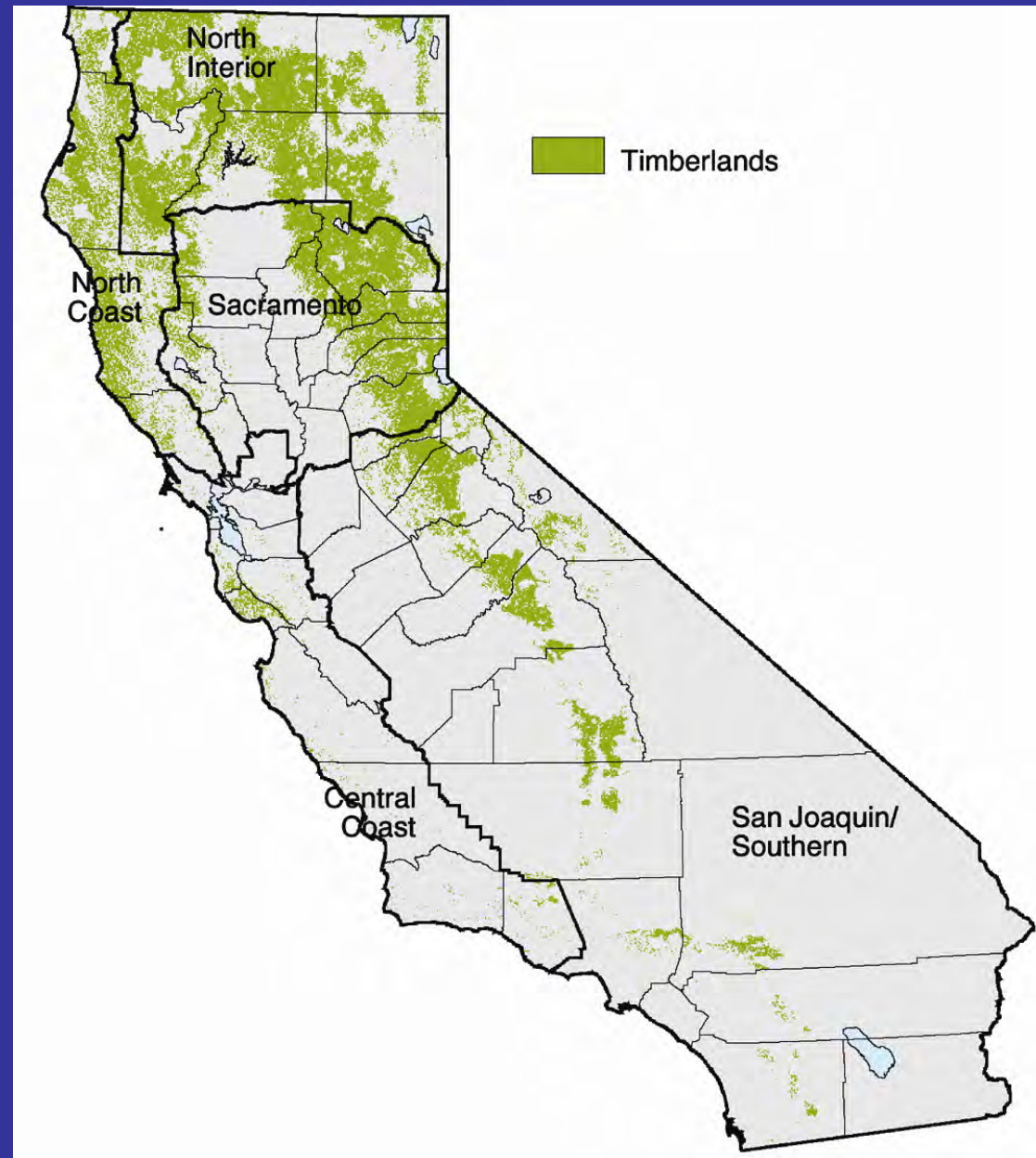
Pete Cafferata

California Department of Forestry and
Fire Protection



Outline

1. Introduction to forest practice regulation and monitoring approaches.
2. Monitoring Study Group overview.
3. Brief description of Water Quality Monitoring Programs used by the BOF and CAL FIRE from 1993 to the present.
4. Availability of MSG monitoring reports and information sharing approaches.
5. Planned activities in 2013.
6. Summary points.



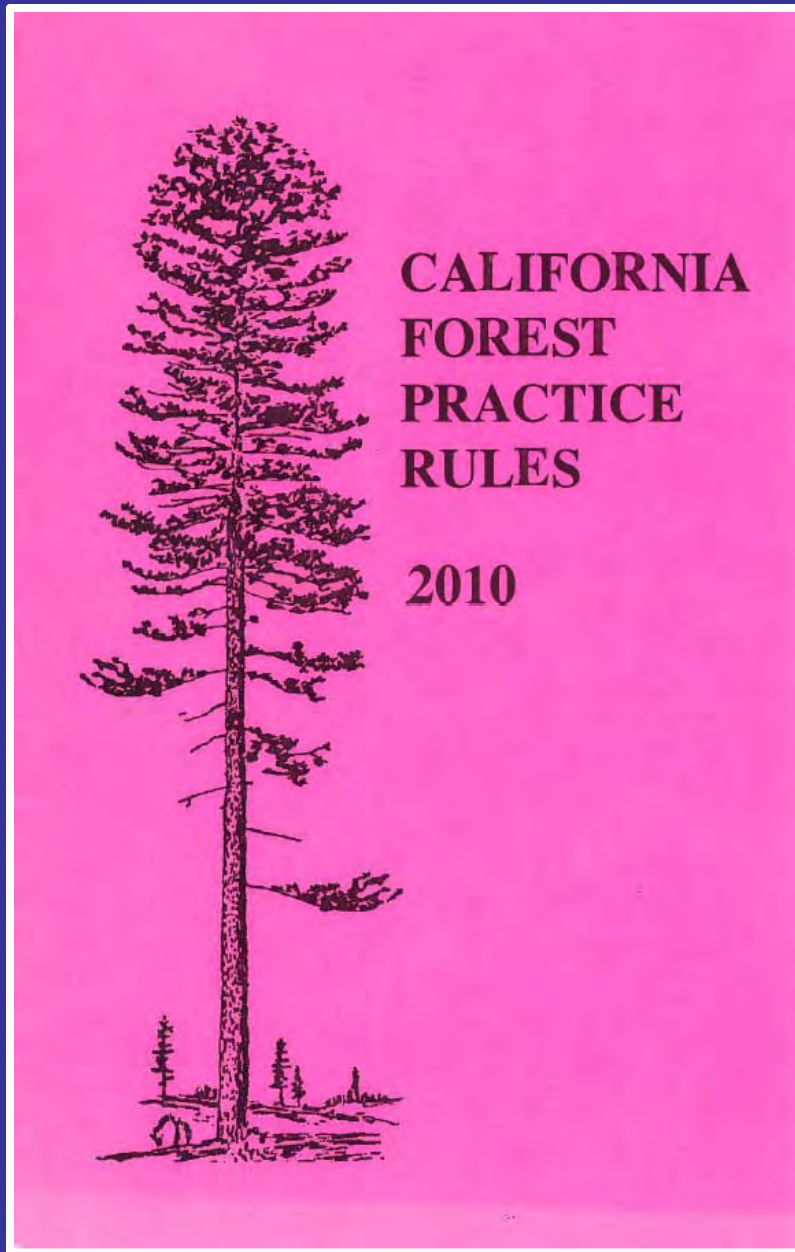
I. Introduction

CALIFORNIA

- ~101 M acres.
- 16.6 M ac of public and privately owned commercial timberland.
- 9.3 M ac in public ownerships.
- 7.3 M ac in privately-owned timberland.

CA FPRs apply to non-federal timberlands.

USFS BMPs apply to National Forest lands.



Board of Forestry and Fire Protection (BOF) – adopts the CA Forest Practice Rules.



California Department of Forestry and Fire Protection (CAL FIRE) – enforces and monitors the rules.



Logging Plan Permits in California

- Forest Practice Rules and needed additional mitigation measures are enforced as part of approved plans in California (not voluntary BMPs).
- Timber Harvesting Plans (THPs) and other types of plans must be approved by CAL FIRE prior to harvesting (i.e., receive an approved permit).
- Plans are evaluated for compliance with FPRs, CEQA, other state regulations by four state agencies (CAL FIRE, DFW, RWQCBs, and CGS).

CAL FIRE has a substantial program of inspection and enforcement of both the FPRs and Timber Harvesting Plan mitigations and provisions, in addition to water quality related monitoring and data collection



~50 Forest Practice Inspectors

Fiscal Year 2011-12:

~4400 inspections and ~360 rule violations

Examples of Forest Practice Rule Violations Related to Water Quality



Examples of inadequate road drainage structure installation and resulting erosion features

Monitoring Approaches Used in California on Non-Federal Timberlands

- **CAL FIRE/BOF/Monitoring Study Group (MSG)** projects
 - ★ Evaluating Forest Practice Rule (FPR) implementation and effectiveness.
 - Cooperative instream monitoring projects to evaluate FPR effectiveness at the project scale and/or trend monitoring.
- **Forest industry** instream monitoring for sediment, turbidity, water temperature, aquatic habitat parameters, fish, etc.
- **Regional Water Quality Control Board (RWQCB)** mandated monitoring associated with General Waste Discharge Requirements (GWDRs), Conditional Waivers, and TMDLs.
- **Watershed group/NGO** water quality monitoring.
- **University and consultant monitoring.**

2. Monitoring Study Group Overview

- In existence since 1989; formed in response to US EPA's request for an ongoing assessment of the effectiveness of CA's FPRs (for certification of FPRs as BMPs).
- 1989-July 1999: **“Ad hoc” committee**; meetings closed to public.
- July 1999-present: **BOF Advisory Committee**; meetings open to the public.
- Representatives from 9 agencies, timber industry, and the public.
- Meets approximately every 3-4 months, usually in Willits, Redding, or Willows.

Monitoring Study Group Purpose

- Provide abundant data and information on the implementation and effectiveness of the California Forest Practice Rules (FPRs) specifically designed to protect water quality and beneficial uses, such as riparian/aquatic habitat.
- Provide timely information to be used by forest managers, agencies, and the public in California to improve water quality protection.

Monitoring Study Group Overview

- Provides guidance and oversight to CAL FIRE in implementing a long-term water quality monitoring program.
- Serves as an open public forum for sharing monitoring-related information.
- Chaired by a BOF member or the Board's Executive Officer and staffed by CAL FIRE.

Monitoring Study Group



Willits—September 2004
MSG Meeting

- No BOF-appointed members.
- 25 relevant organizations invited to attend.
- Email list of 225 people, meetings average ~20 attendees and on-line participants.
- Widely ranging attendance.
- Subcommittees established when needed.
- 72 meetings since 1994; minutes since 2002 available online.
- Meetings mostly indoors...



Western Mendocino Co. 2004



Swanton Pacific Ranch, Santa Cruz Co. 2006



Angora Fire Monitoring, Lake Tahoe, 2008



Kings River Exp. Watershed Study, Fresno Co. 2007

Revised 2007 MSG Strategic Plan Key Goals

- Providing guidance on developing programs testing FPR implementation and effectiveness related to water quality.
- Providing sound advise to the BOF and the BOF-appointed Research and Science Committee.
- Disseminating monitoring information in timely manner.
- Ensuring that the monitoring results are used in training programs to help improve water quality protection.

January 2007
California State Board of Forestry and Fire Protection

Monitoring Study Group **STRATEGIC PLAN**



Stan Dixon
Chair
Board of Forestry and Fire Protection

Ruben Grijalva
Director
Department of Forestry and Fire Protection

Mike Chrisman
Secretary for Resources
The Resources Agency

Arnold Schwarzenegger
Governor
State of California



Audience for MSG Information

- State Board of Forestry and Fire Protection (BOF).
- California Department of Forestry and Fire Protection (CAL FIRE).
- State Water Resources Control Board (SWRCB).
- Regional Water Quality Control Boards (RWQCBs) with timberland within their jurisdictions (4).
- California Department of Fish and Game (DFG).
- California Geological Survey (CGS).
- NOAA Fisheries (NMFS).
- Other state and federal agencies.
- Universities (e.g., UCB, HSU, Cal Poly, OSU, CSU, etc.).
- Environmental groups.
- Timber companies.
- Interested general public.

**3. Brief Descriptions of Water
Quality Monitoring
Programs used by the BOF
and CAL FIRE**

Two Types of Water Quality-Related Monitoring Conducted

- **Hillslope Monitoring** (qualitative estimates of rule implementation and quantitative measurements of rills, gullies, landslides, riparian canopy cover, etc.).
- **Instream Monitoring** (water column measurements, including suspended sediment concentration, turbidity, water temperature).

Hillslope and Instream Monitoring
Complement Each Other

Hillslope Monitoring

- **Close linkage to impacts from recent timber operations.**
- **Can test implementation and effectiveness of actual logging practices.**
- **Provides feedback loop to improve practices quickly.**



Instream Monitoring

- Can look at current conditions and long-term trends over time, but...
- Not specific to impacts from timber operations.
- Often cannot tie instream measurements to a given current logging practice.



MSG Upslope (Out of Channel) Monitoring Projects: 1993-Present

- 1. Pilot Monitoring Program (1993-1995).**
 - Develop and test monitoring protocols**
- 2. Hillslope Monitoring Program (1996-2002).**
- 3. Modified Completion Report Monitoring Program (2001-2004).**
- 4. Interagency Mitigation Monitoring Program (2005-2007).**
- 5. FORPRIEM (2008-present).**

2. Hillslope Monitoring Program

- Program ran from 1996 through 2002 (data analyzed and reported for 1996 to 2001).
- Data collected on 345 randomly selected Timber Harvesting Plans and 5 NTMP-NTOs.
- Evaluated the implementation and effectiveness of 191 Forest Practice Rule requirements related to water quality.

MONITORING STUDY GROUP
CALIFORNIA STATE BOARD OF FORESTRY AND FIRE PROTECTION

HILLSLOPE MONITORING PROGRAM

MONITORING RESULTS FROM
1996 THROUGH 2001

Andrea E. Tuttle
Director
Department of Forestry and Fire Protection

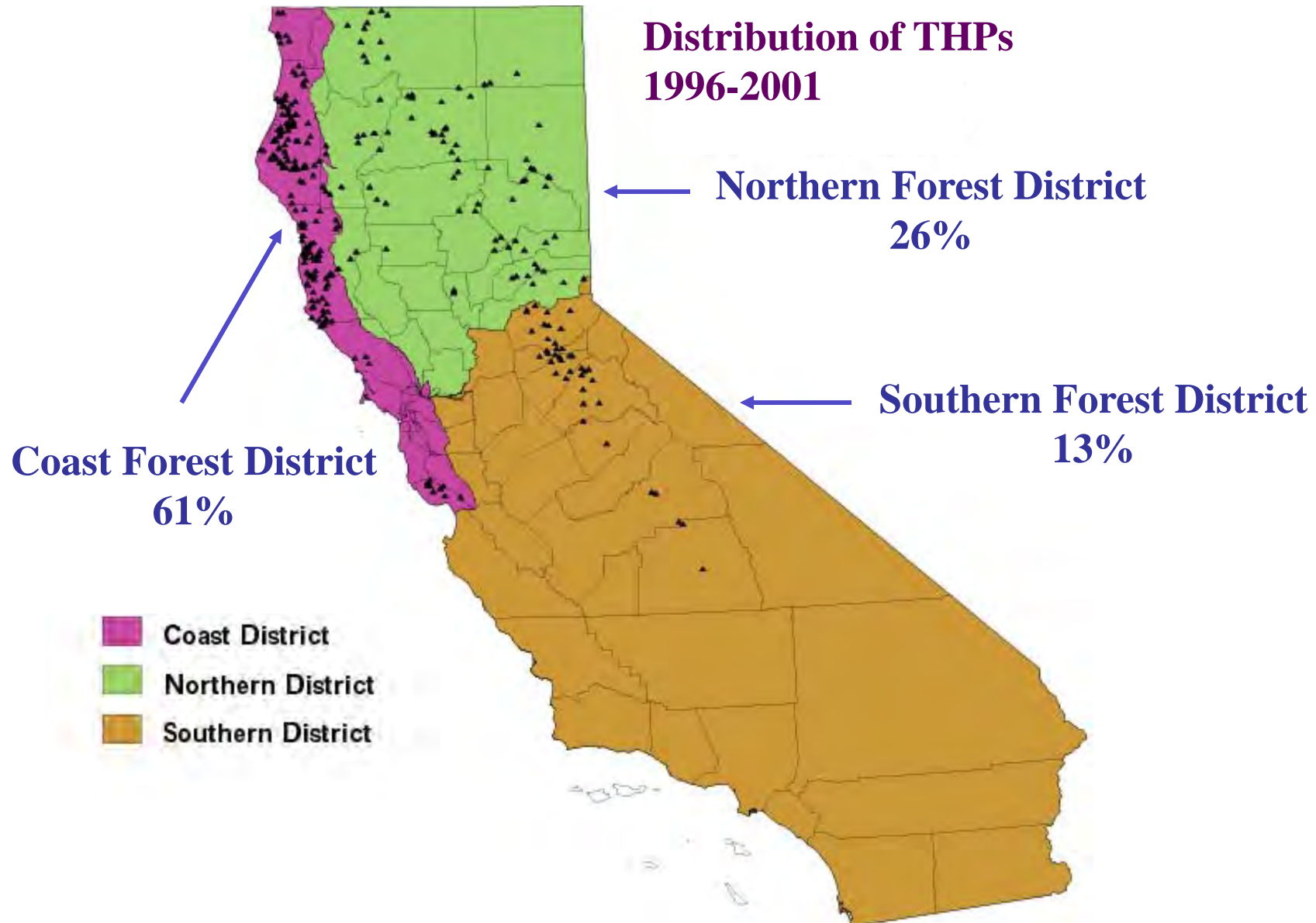
Mary D. Nichols
Secretary for Resources
The Resources Agency

Gray Davis
Governor
State of California

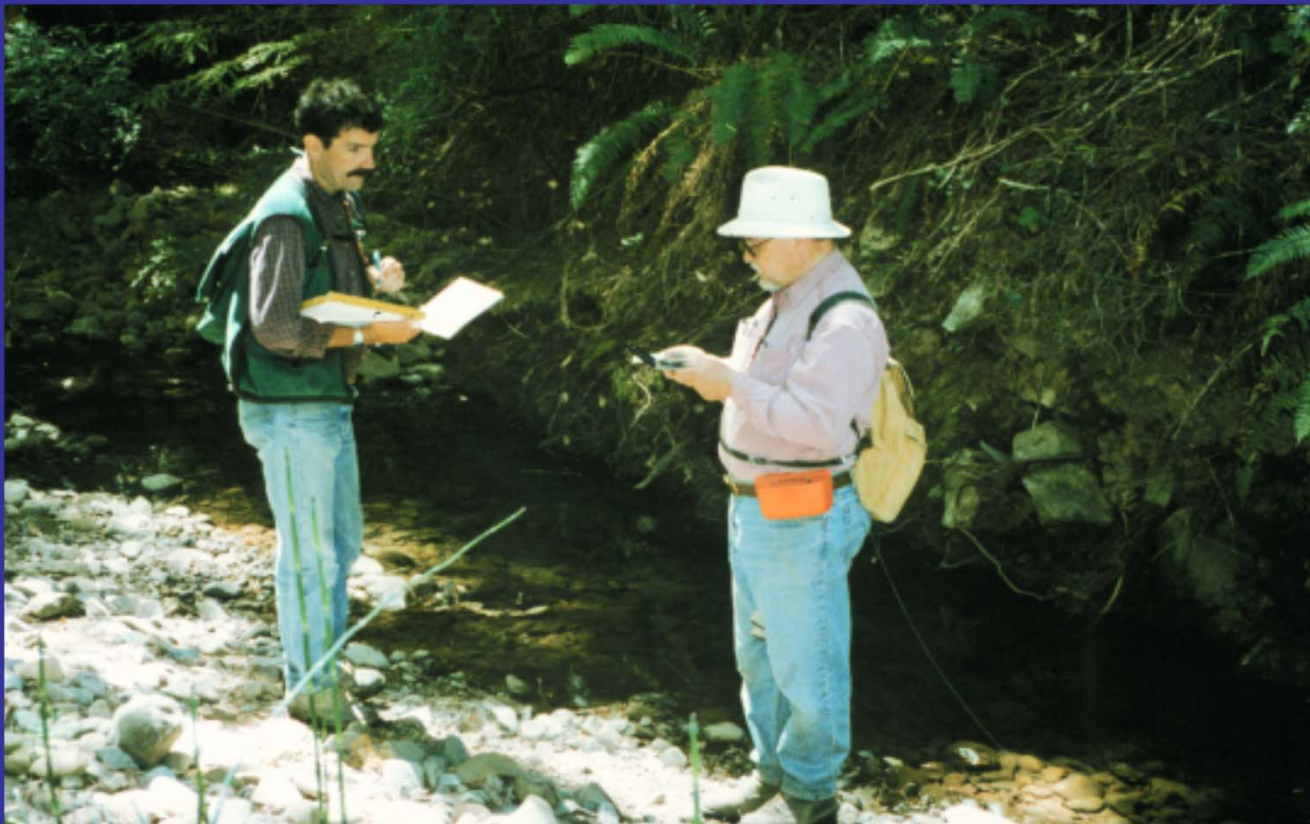


DECEMBER 2002
SACRAMENTO, CALIFORNIA
BOARD OF FORESTRY AND FIRE PROTECTION

Hillslope Monitoring Program



Data Collected by Highly Qualified Independent Contractors— *Third Party Audit*



HMP 1996 to 2001 Totals

(randomly located features in THPs)

- **568 Road Segments (104.2 mi)**
- **480 Skid Trail Segments (66.7 mi)**
- **569 Landings**
- **491 Watercourse Crossings**
- **683 Watercourse Buffer Strips (WLPZs)
(96.8 mi)**

Hillslope Monitoring Program

- Interim report prepared for the State Board of Forestry and Fire Protection in June 1999.
- Final report written in 2002.

INTERIM REPORT TO THE
CALIFORNIA STATE BOARD OF FORESTRY
AND FIRE PROTECTION

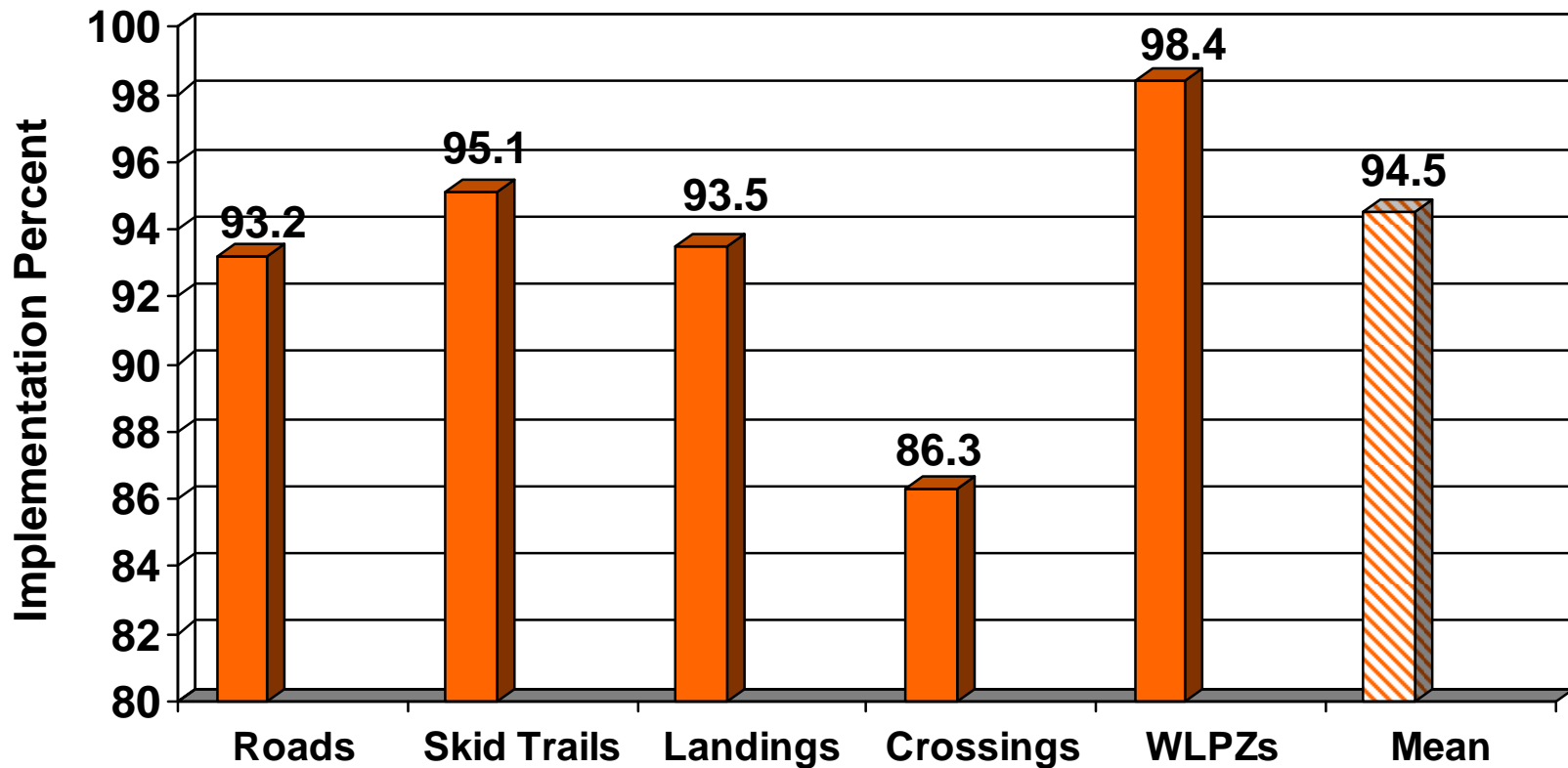
**HILLSLOPE MONITORING
PROGRAM:**

***MONITORING RESULTS
FROM
1996 THROUGH 1998***

PREPARED BY THE
MONITORING STUDY GROUP OF THE
CALIFORNIA STATE BOARD OF FORESTRY
AND FIRE PROTECTION

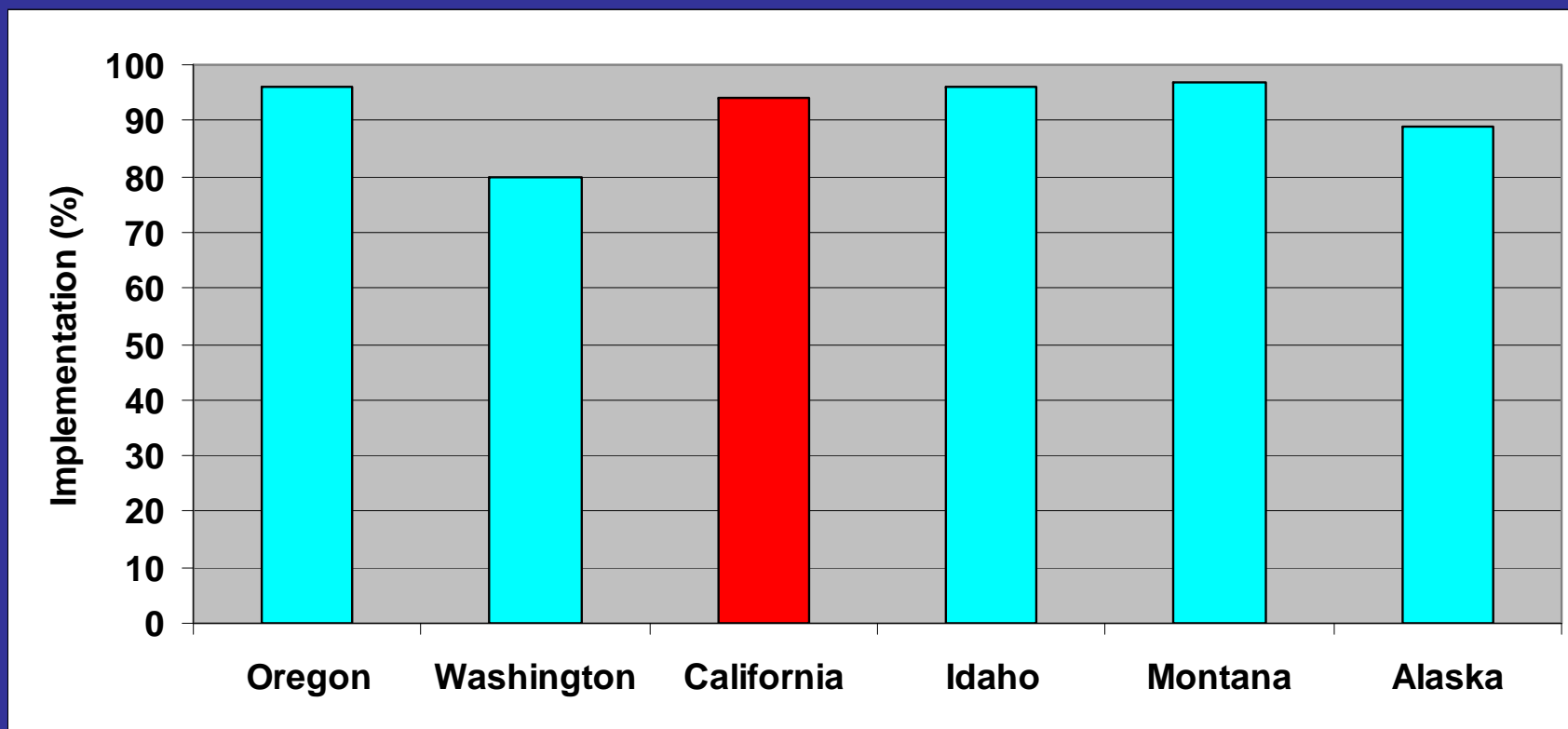
JUNE 1999
SACRAMENTO, CALIFORNIA

Hillslope Monitoring Program— Acceptable Overall Rule Implementation



Overall average acceptable implementation was ~94%

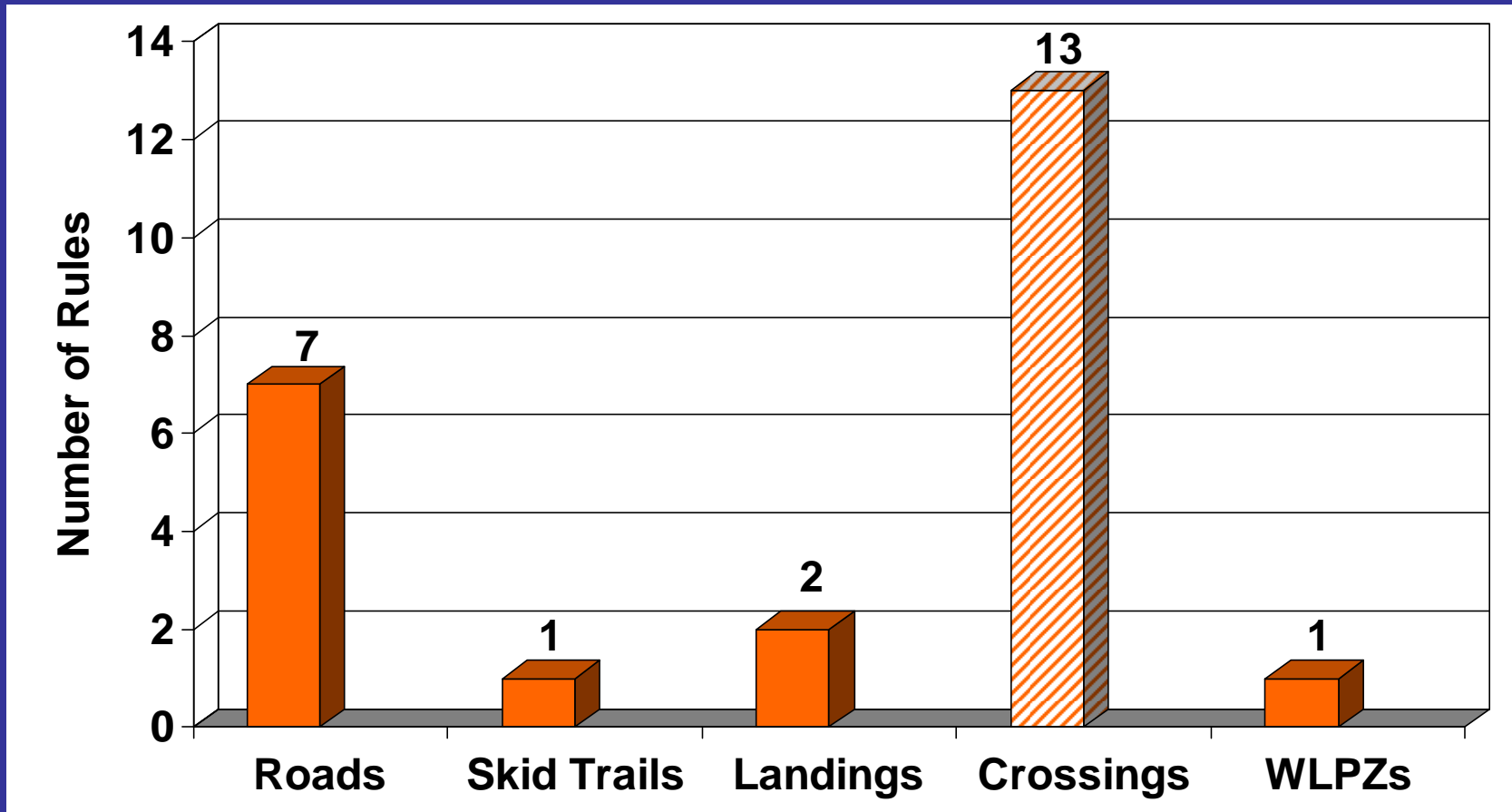
BMP/FPR Implementation Rates for Western U.S. States (Ice et al. 2010)



Mean for western US states = 92%

Mean for all US states = 89%

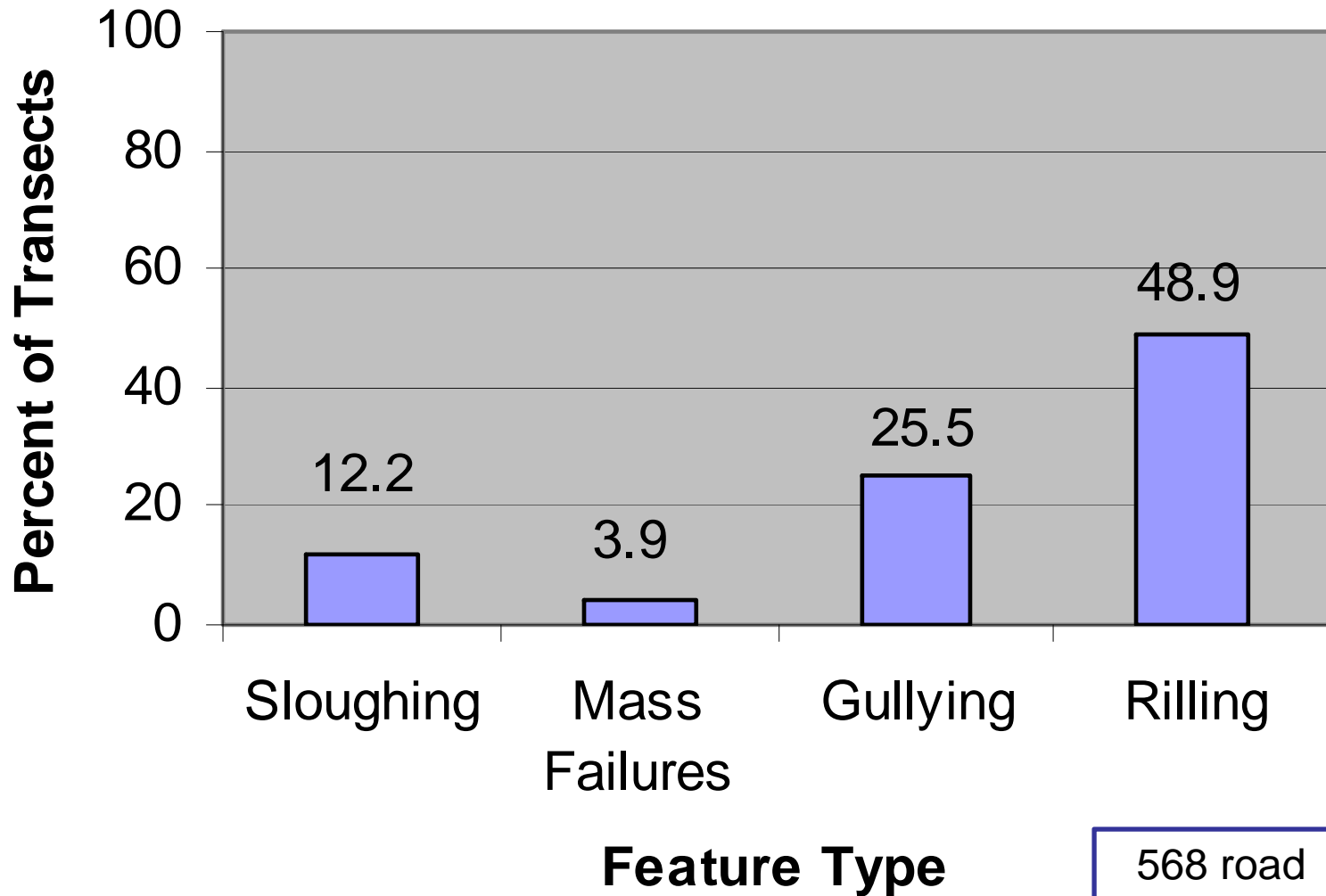
FPR Requirements with $\geq 4\%$ Significant Departures for Implementation



HMP Road Results

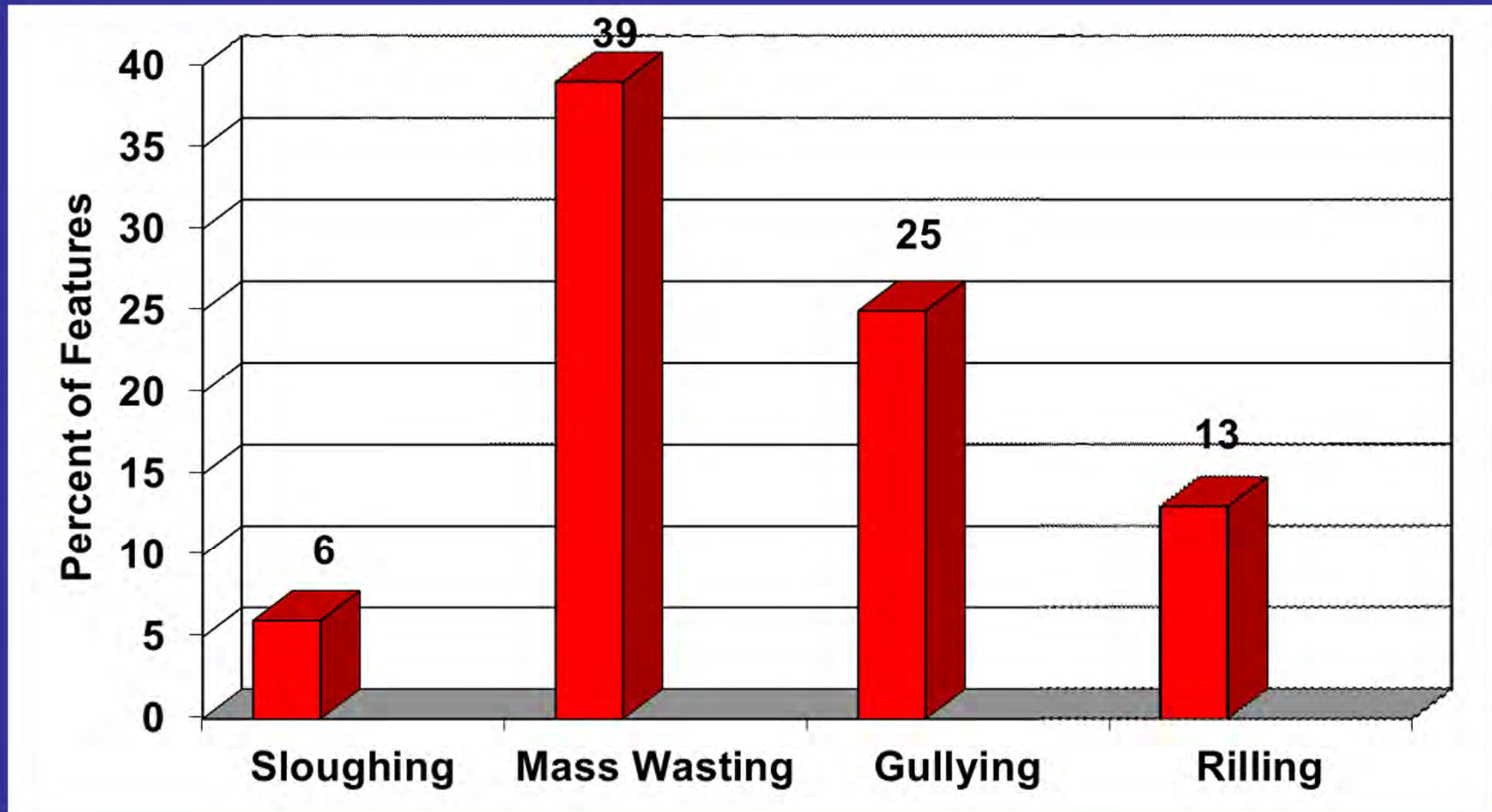


Percent of Road Transects with One or More Erosion Features Present



568 road segments

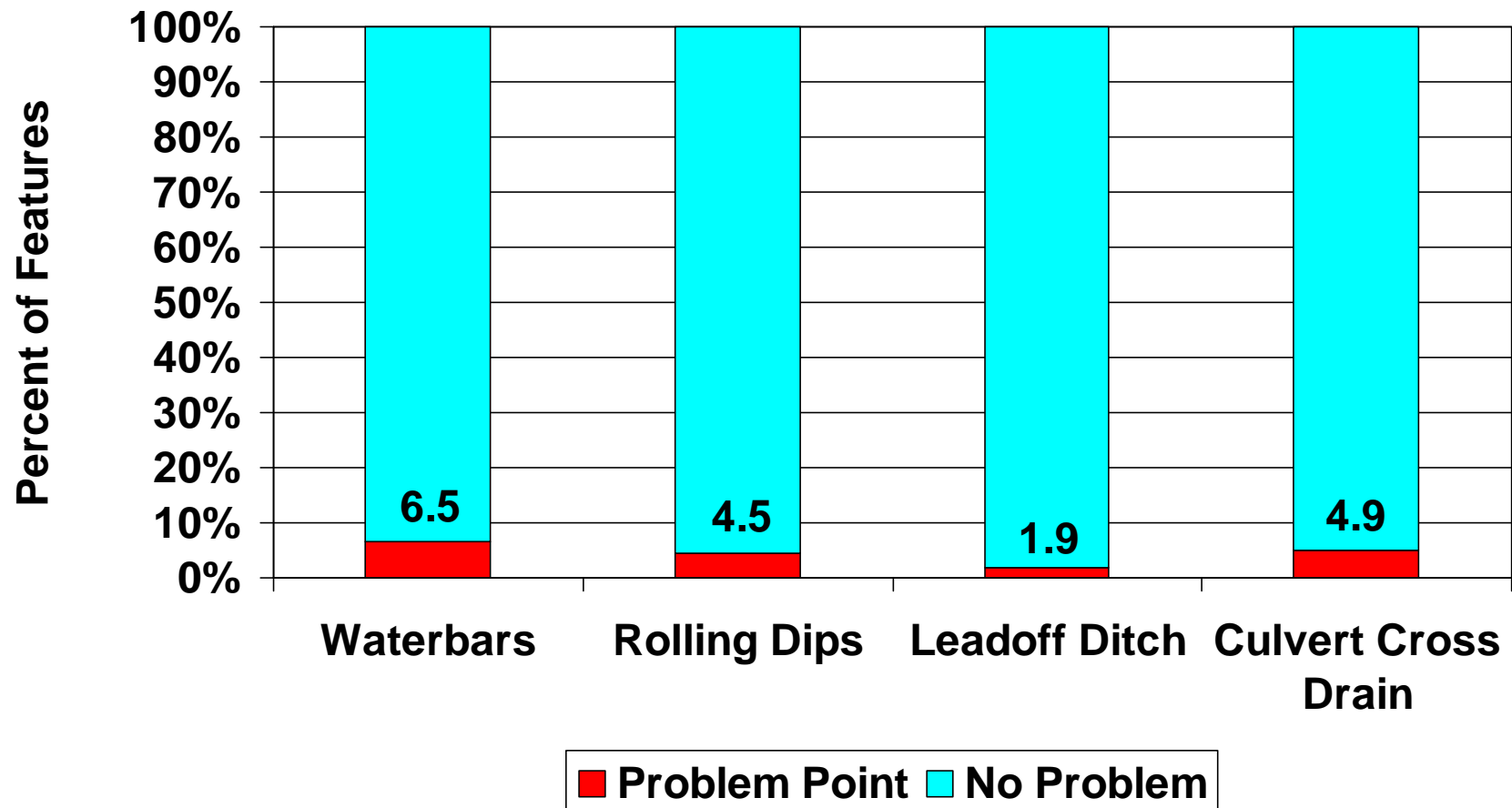
Roads — Sediment Reaching the Channel from Erosion Features



Overall average: 15% of recorded erosion features delivered sediment to the channel. 98% of the time, at road erosion problem points, FPR implementation was rated as less than that required by the rule requirement.

Roads—Drainage Structures

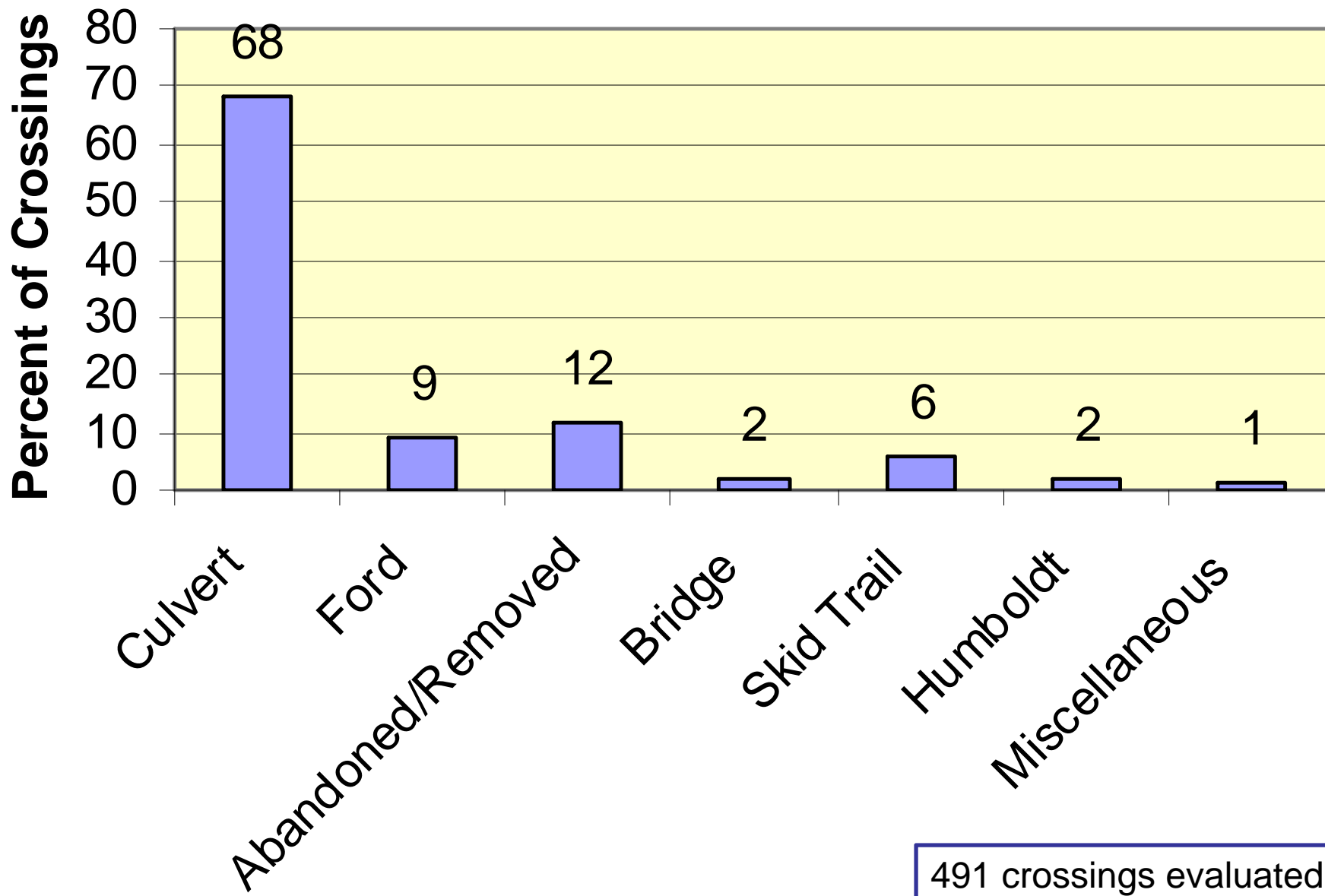
Problem Points and Non-Problem Points



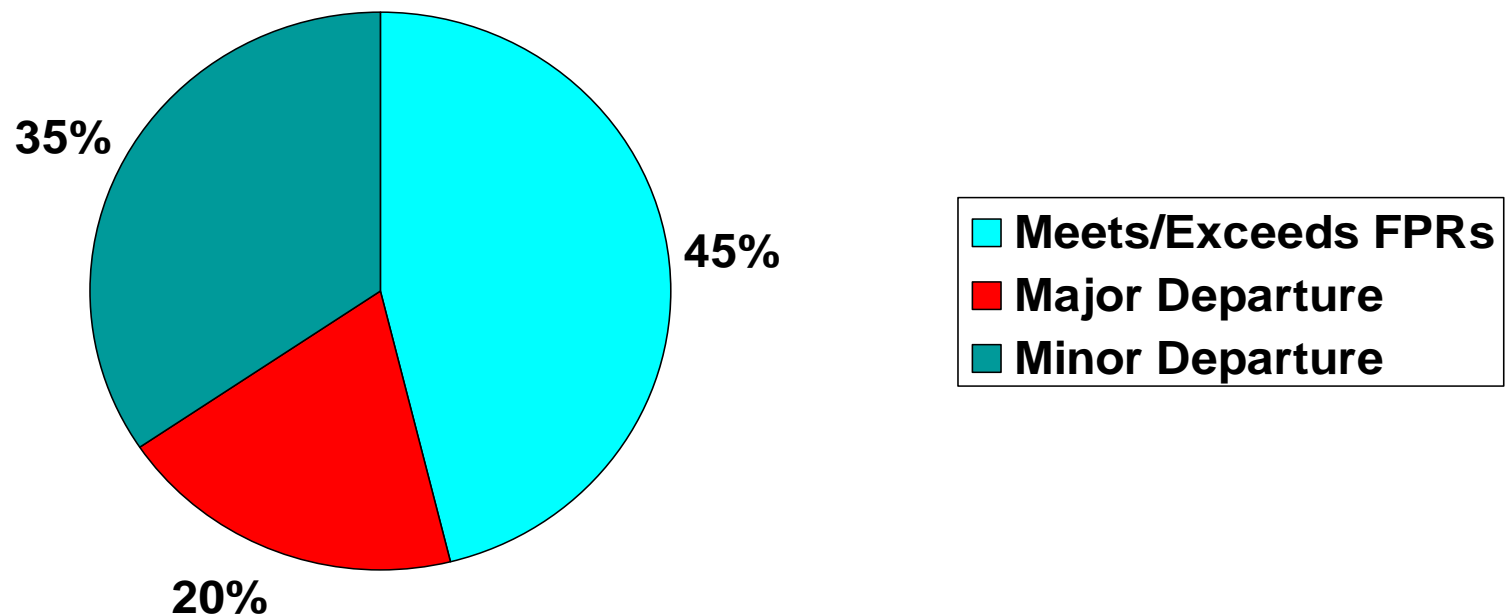
~5% overall had problems

Hillslope Monitoring Program-- Watercourse Crossings





Watercourse Crossings--Major and Minor Departures for FPR Implementation (1996-2001)



Hillslope Monitoring Program:

Summary of Results for 300 Logging Plans

- ◆ **Implementation rates for the FPRs related to water quality were high, averaging 94.5% for all rules rated.**
- ◆ **Individual practices required by the FPRs were generally effective in preventing hillslope erosion features when properly implemented.**
- ◆ **Erosion features were almost always associated with improperly implemented FPRs.**
- ◆ **Erosion problems on skid trails and landings were infrequent and produced minor impacts to water quality.**
- ◆ **Most problems were found on roads and at crossings.**

3. Modified Completion Report Monitoring Program (2001-2004)

- Random sample of completed THPs.
- Sample size was 12.5% of THPs undergoing Completion Report field inspections.
- Used CAL FIRE's Forest Practice Inspectors to collect the monitoring data.

MONITORING STUDY GROUP
CALIFORNIA STATE BOARD OF FORESTRY AND FIRE
PROTECTION

Modified Completion Report MONITORING PROGRAM

Implementation and Effectiveness of
Forest Practice Rules related to Water Quality Protection

MONITORING RESULTS FROM
2001 THROUGH 2004

Ruben Grijalva
Director
Department of Forestry and Fire Protection

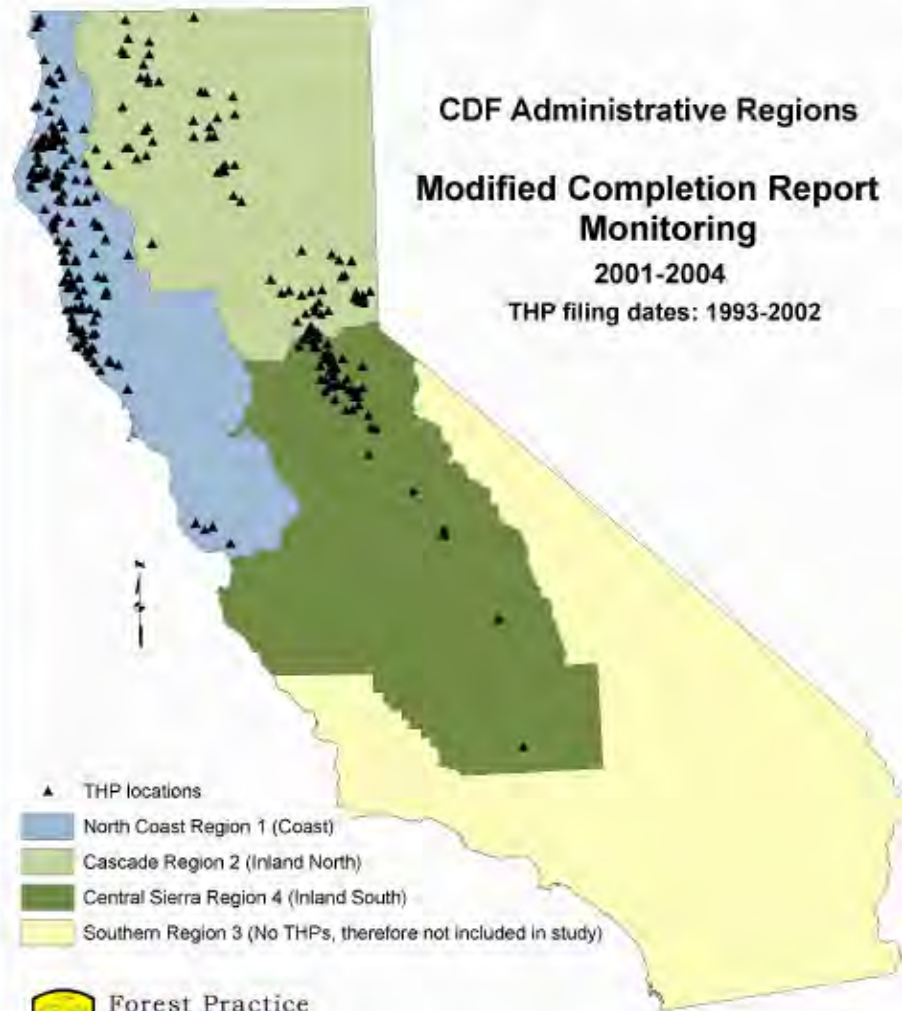
Mike Chrisman
Secretary for Resources
The Resources Agency

Arnold Schwarzenegger
Governor
State of California



July 2006
SACRAMENTO, CALIFORNIA

California Dept. of Forestry and Fire Protection



Forest Practice

GIS

Santa Rosa, California February 17, 2006

**281 THPs
Evaluated**

**52 % in the
Coast Region**

**48% in the
Inland
Regions**

Modified Completion Report Monitoring Locations

- **Watercourse and Lake Protection Zones** (WLPZs) (random 200 ft segment)
 - WLPZ Percent Total Canopy
 - WLPZ Erosion Features
- **Roads** (random 1000 ft segment)
- **Watercourse Crossings** (2 random)



SEP 28 2002

Watercourse Crossing



SEP 25 2002

Road Segment



SEP 26 2002

WLPZ

Average Percent Total Canopy

<i>Class I WLPZs</i>	Total Canopy
Coast (Region 1)	84% n = 29
Inland North (Region 2)	69% n = 18
Inland South (Region 4)	71% n = 5

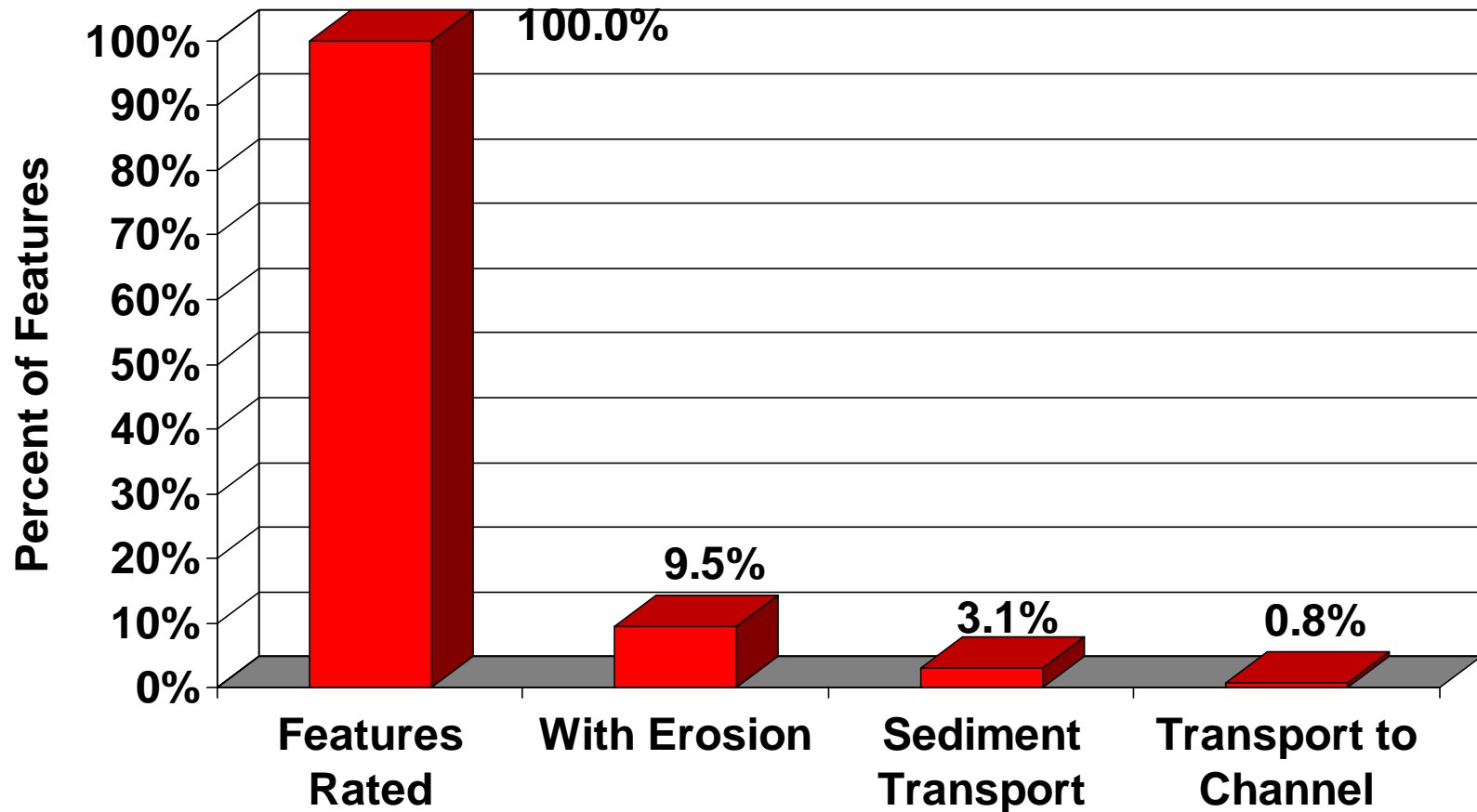
281 THPs sampled, 187 with WLPZs

Modified Completion Report Monitoring Roads: FPR Effectiveness



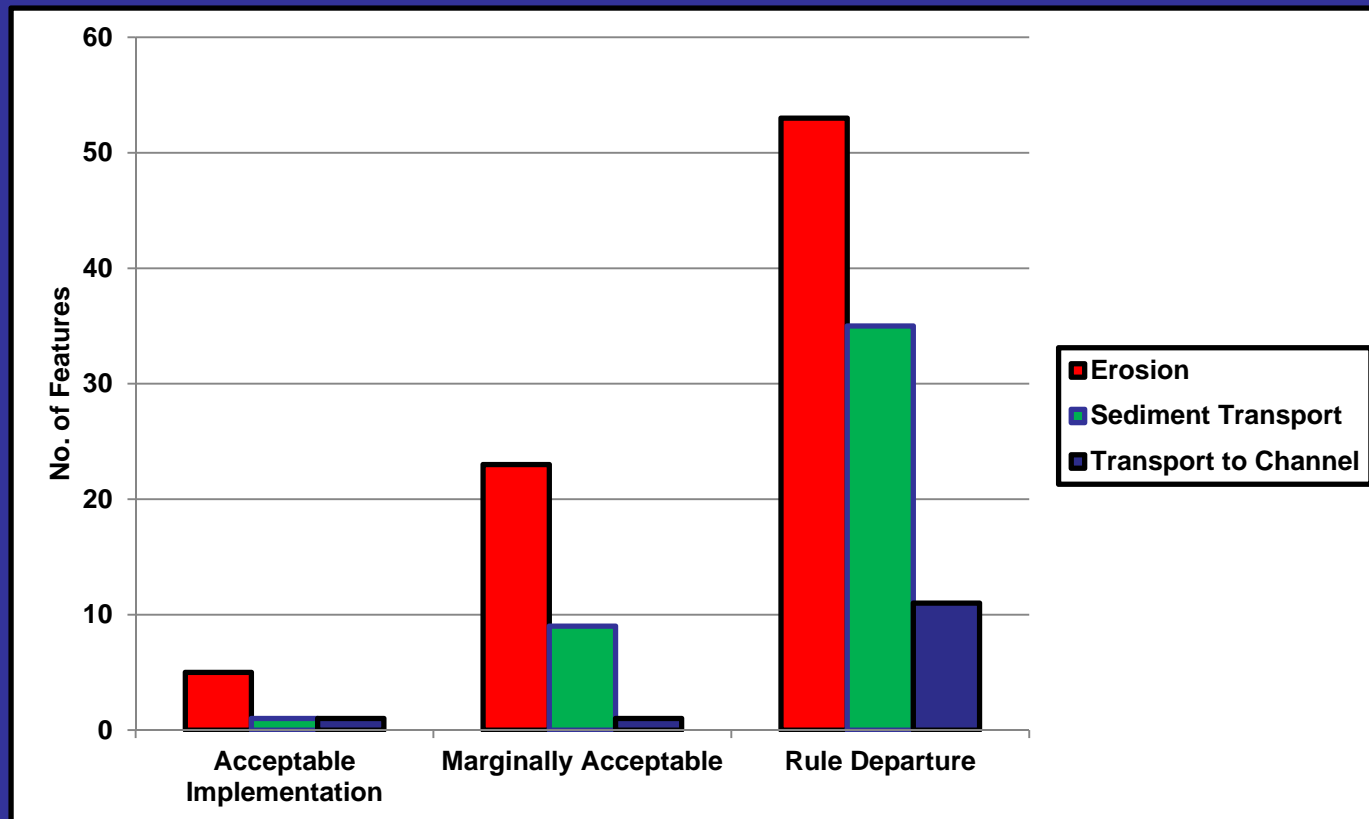
- Of 244 road segments sampled:
 - 130 road segments were rated for effectiveness, after at least one winter period.
 - These 130 road segments include 1,147 road-related features that were rated for effectiveness.

Road Features Rated for Effectiveness as Percentages



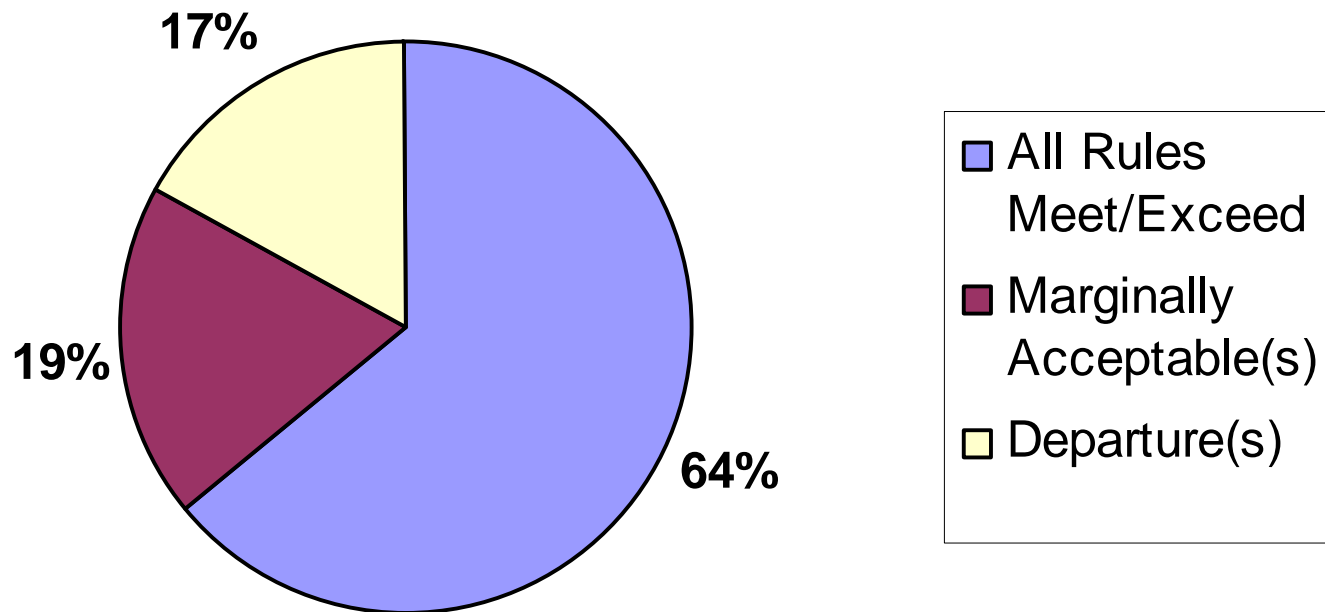
8% of the erosion features delivered sediment to the channel

MCR Road-Related Feature Implementation Ratings vs. Percent of Features with Effectiveness Problems



~10 X higher chance of sediment delivery to a channel if there was a FPR departure from the requirement

MCR Crossing Implementation



357 crossings rated for implementation of the FPRs

MCR Conclusions

1. The rate of compliance with FPRs designed to protect water quality and aquatic habitat was generally high.
2. Post-harvest total canopy cover is high in the coast region and adequate in the inland regions.
3. FPRs associated with roads are effective in preventing erosion, sedimentation and sediment transport to channels when they are properly implemented.
4. Road-related FPR departures were nearly always related to inadequate implementation of road drainage requirements.
5. Crossing implementation and effectiveness ratings were generally similar to HMP results and show substantial amounts of plugging, diversion potential, and scour at the outlet.

HMP and MCR Water Quality Monitoring Program Results (1996-2004)

- ~5% of road drainage structures had poor FPR implementation and erosion problems.
- 8-15% of road erosion features delivered sediment to stream channels, usually when FPRs incorrectly implemented.
- ~20% of the road-stream crossings had significant implementation/ effectiveness problems.



Summary from California Monitoring Work

- Older “legacy” roads that pre-date current Forest Practice Rules are major sources of sediment.
- Roads often produce at least two-thirds of management-related sediment in forested watersheds.
- Usually a small proportion of the total road system produces most of the sediment, and erosion problems are usually associated with required practices that were incorrectly implemented.
- Un-surfaced road segments located within 200 feet of streams that are connected to the channel with inboard ditches are particularly high risk for fine sediment delivery.

4. Interagency Mitigation Monitoring Project

Pilot Project: 2005-2007



BOF Monitoring Study Group

IMMP Goals and Objectives

- Use a multi-agency team approach to provide greater public confidence in monitoring results.
- Evaluate high risk sites, including added mitigation measures and special plan requirements.
- Create a forum for multi-agency teams to reach common understandings and agreement for forestry-related issues.
- Create a Forum that allows interagency team members to cooperate and promote information sharing.

IMMP Pilot Project Goals

- For the Pilot Project, the goal was to develop and test repeatable protocols to evaluate effectiveness of practices.
- We chose to collect data on effectiveness of practices on higher risk (**non-random**) watercourse crossing sites and road segments that drain to crossings within THPs and NTMPs.
- Crossings were selected based on past monitoring results which have shown that they are problem sites for sediment delivery to stream channels.

IMMP Pilot Focused on Crossings and Road Segments that Drain to Crossings

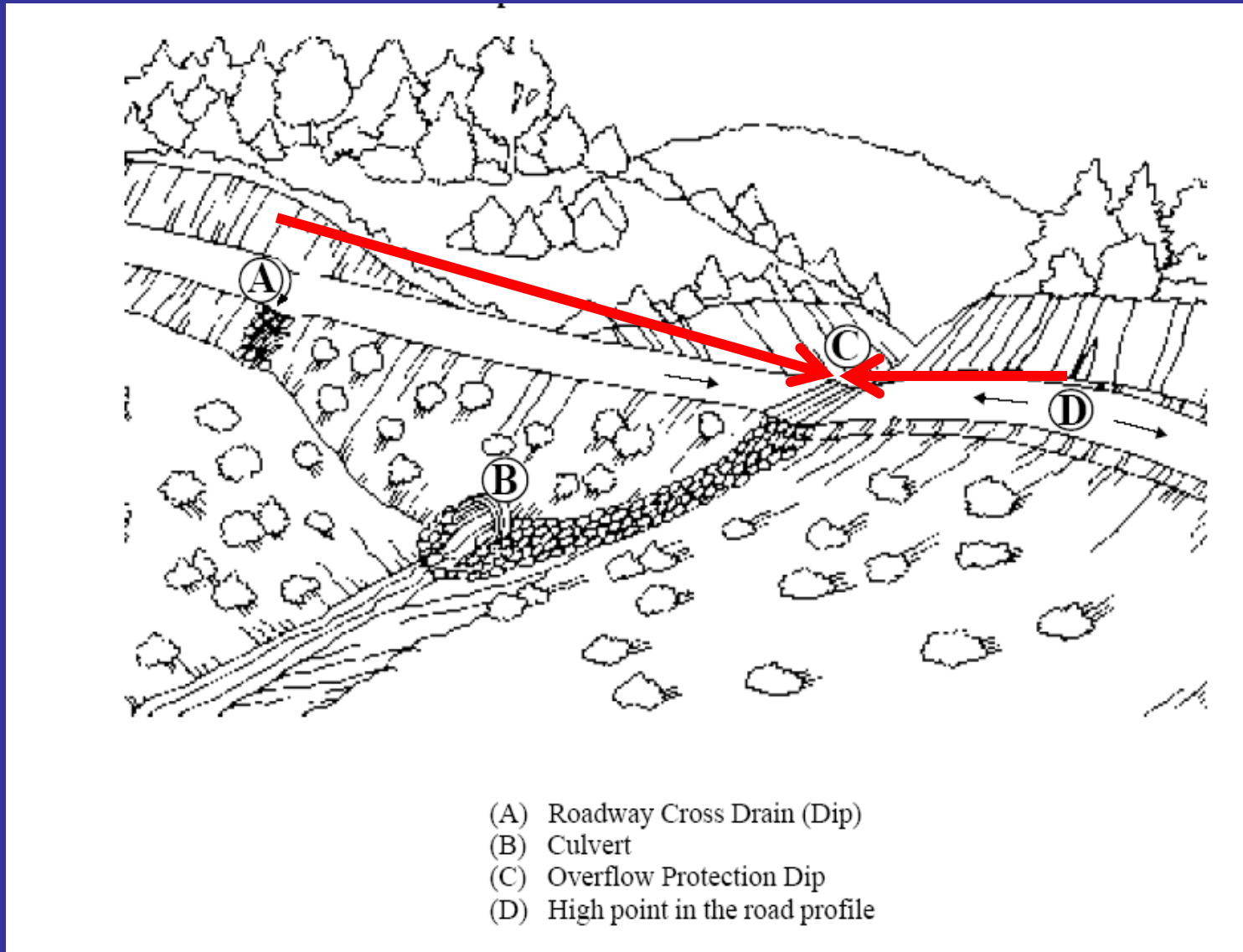


Image: Keller and Sherar 2003

Coast IMMMP Team

D. Longstreth (CGS), A. Lukacic (CAL FIRE),
D. Hope (NCRWQCB), and R. Fitzgerald (DFW)



Inland IMMP Team (2006/2007)

- Shane Cunningham (CAL FIRE)
- Angela Wilson (CVRWQCB)
- Dave Longstreth* (CGS)
- Joe Croteau (DFW) [2006]
- Stacy Stanish (DFW) [2007]

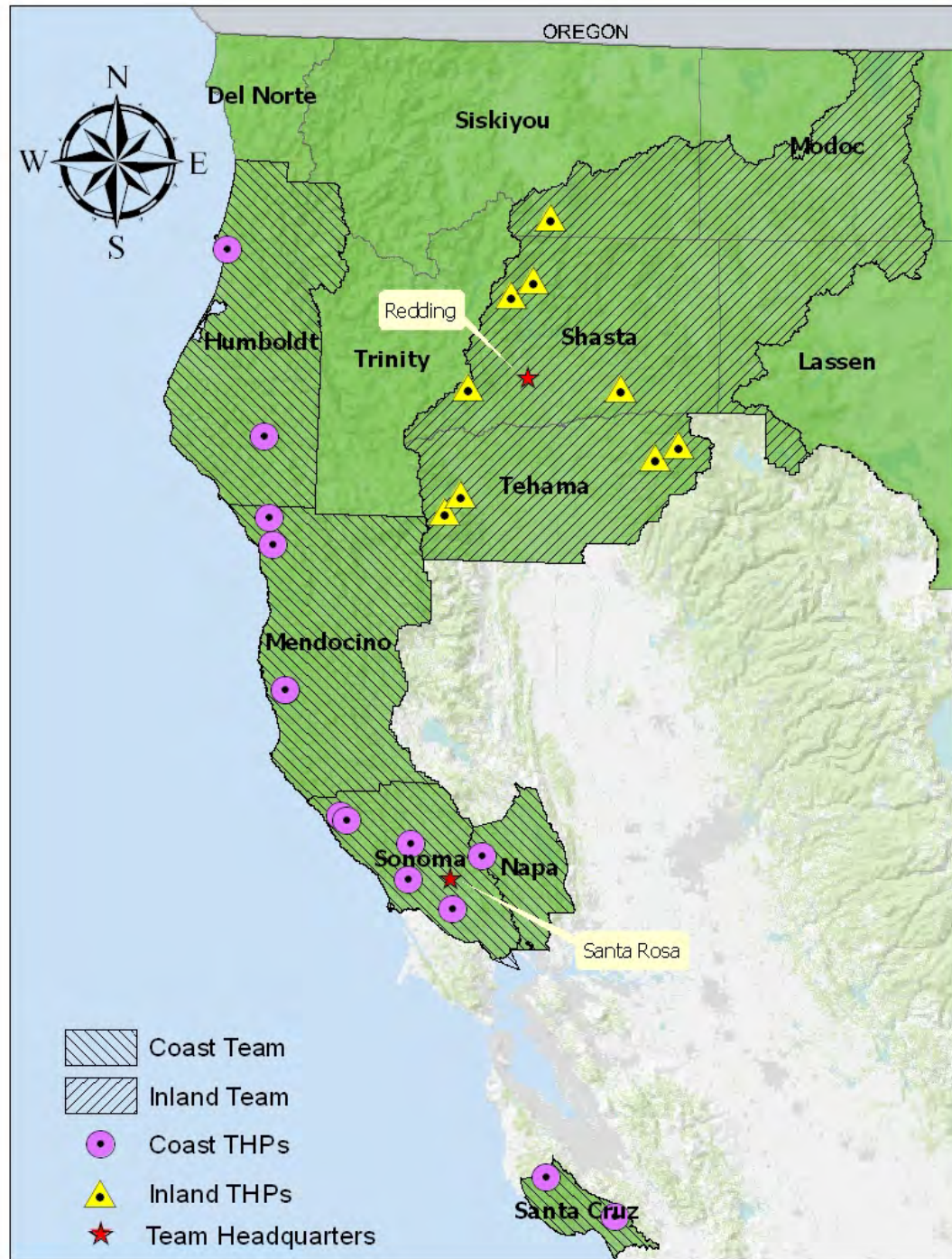


Crossing Selection Procedure

- High risk, non-random sample based on:
 - Types of practices used for crossing construction.
 - Design/mitigations needed for complex conditions.
 - Beneficial uses of water present (e.g., fish).
 - Physical setting factors (e.g., soil types, geologic considerations, slope).

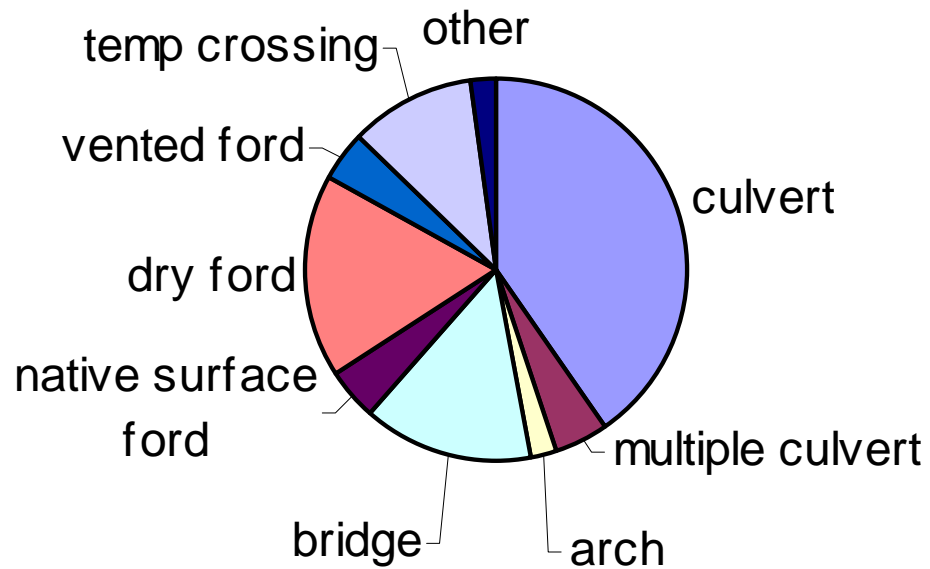
Summary of Pilot Project Field Testing

- 22 plans visited in 2006 and 2007 (all THPs except 2 NTMPs).
- 2 THPs associated with timberland conversions.
- 54 crossings evaluated with IMMP protocol questions over 2 years by the two teams.
- Performance-based effectiveness evaluations performed; field protocol consisted of 270 questions.



Location
of the 22
plans:
9 interior;
13 coastal

Crossing Types Evaluated in 2006



Approximately 40% were culverts, 25% different types of fords, 15% bridges, and 11% temporary crossings



Culvert



Ford

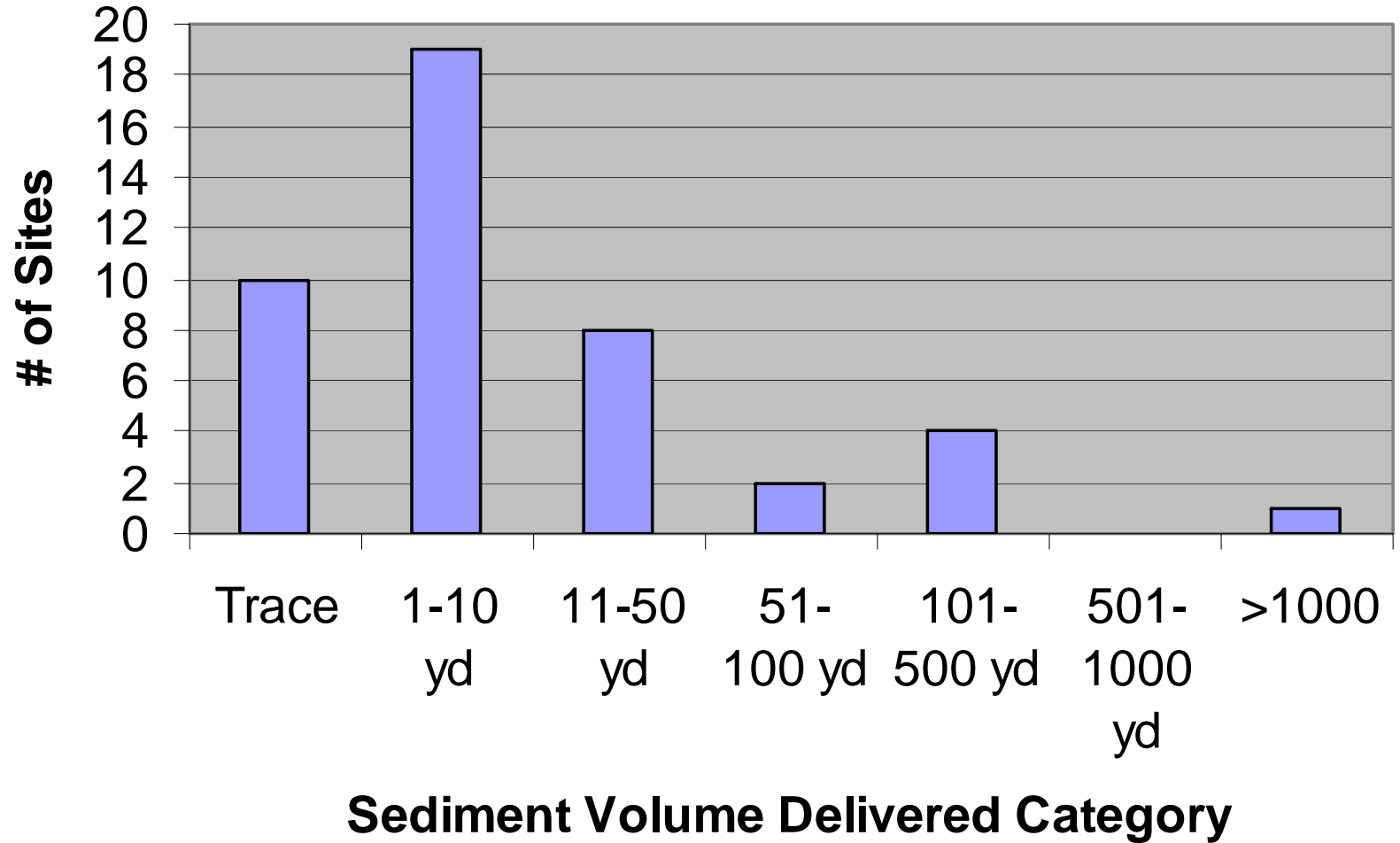


Bridge



Temporary Crossing

IMMP Crossing Sediment Delivered



IMMP Pilot Project Findings

- Virtually all crossings and/or road approaches to crossings deliver some sediment to watercourses, even when the FPRs are properly applied.
- Improper installation and/or maintenance of crossings and drainage structures near crossings, and improper removal, are the major causes of sediment input.
- Road approaches near crossings produce a high percentage of sediment deposition problems.

Current Monitoring Work Being Conducted

Monitoring Study Group

Main Current Monitoring Components

- **Forest Practice Rules Implementation and Effectiveness Monitoring (FORPRIEM).**
- **Cooperative Instream Monitoring Projects.**

5. Forest Practice Rules Implementation and Effectiveness Monitoring Program (FORPRIEM)

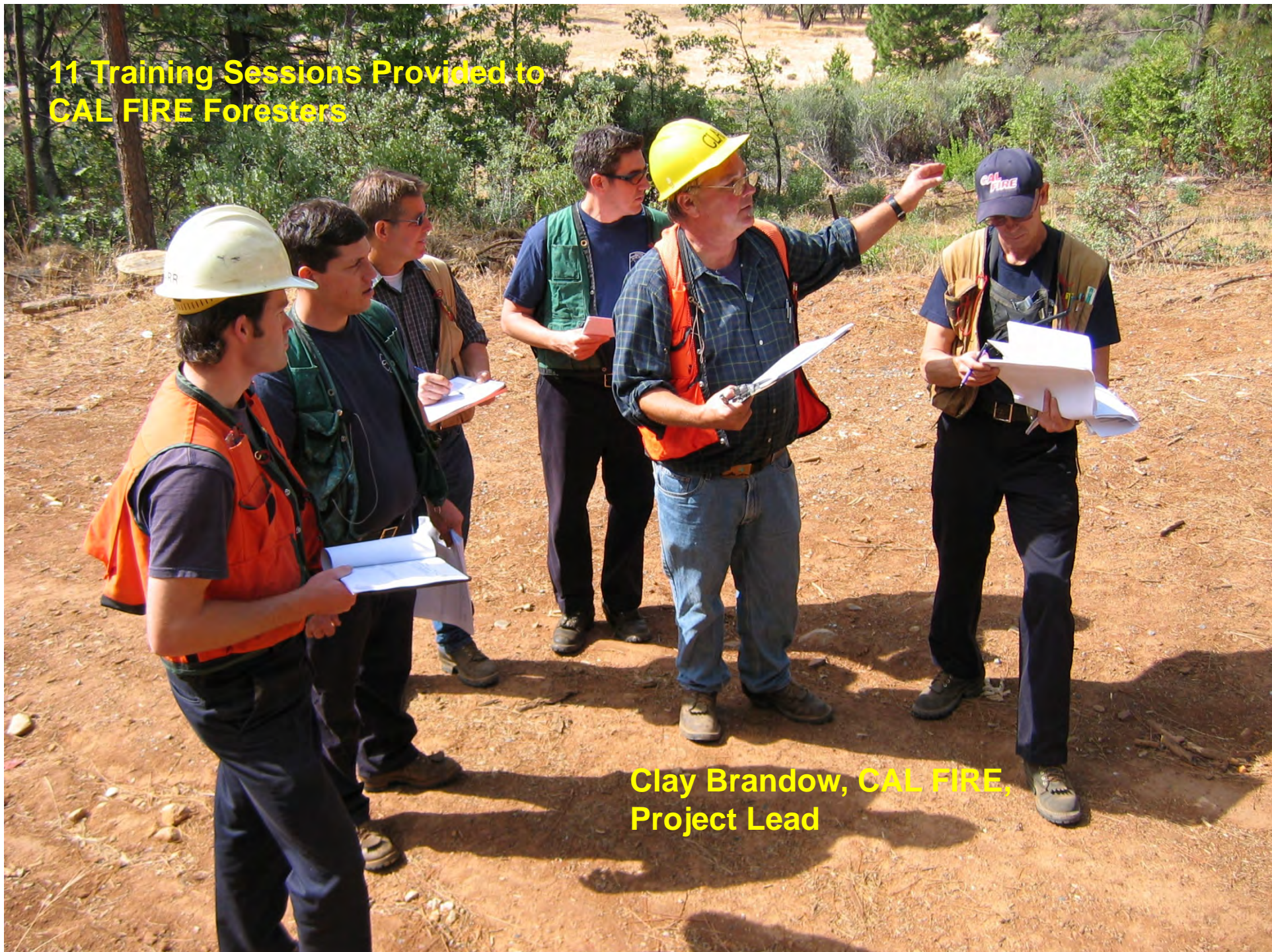
2008 to the Present



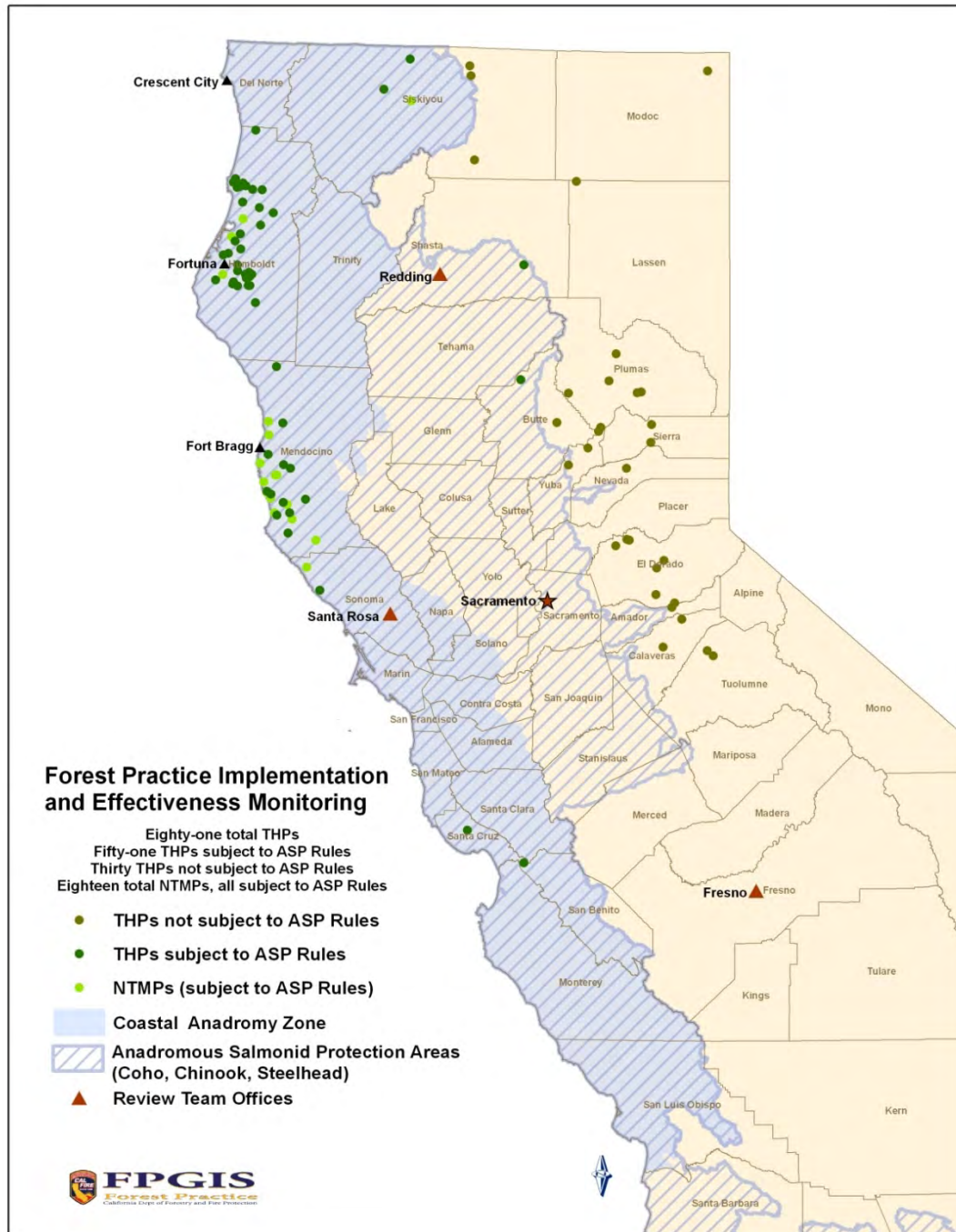
FORPRIEM Monitoring

- **Similar to earlier MCR monitoring program.**
- **CAL FIRE Forest Practice Inspectors conduct the monitoring.**
- **Random 10% sample of THPs completed since July 1, 2008.**
- **Random sample in a THP of one road segment (660 ft), one WLPZ segment (200 ft), and two watercourse crossings.**
- **Data collected on 121 THPs to date; 22 NTMP-NTOs.**
- **Summary report to be written this winter.**

**11 Training Sessions Provided to
CAL FIRE Foresters**



**Clay Brandow, CAL FIRE,
Project Lead**



Plot of Randomly Selected Plans (THPs and NTMP NTOs with WLPZs

Anadromous Salmonid Protection (ASP) area cross-hatched

~2/3rds of THPs in ASP area; 1/3 in Non-ASP area

Choose Form

- Watercourse Crossing Site Information Form 1
- Watercourse Crossing Implementation Form 1
- Watercourse Crossing Effectiveness Form 1
- Watercourse Crossing Site Information Form 2
- Watercourse Crossing Implementation Form 2
- Watercourse Crossing Effectiveness Form 2
- Road Site Information Form
- Road Implementation Form
- Road Effectiveness Form
- WLPZ Canopy Sampling Form
- WLPZ Erosion Features Form

Choose THP

- 1-02-218
- 1-02-236
- 1-02-245
- 1-03-024
- 1-03-117
- 1-03-126
- 1-03-177
- 1-03-224
- 1-03-233
- 1-04-016
- 1-04-026
- 1-04-097
- 1-04-124
- 1-04-130
- 1-04-139
- 1-04-235
- 1-04-262

Load Form

Maintenance

- Observers
- THPs
- Forms
- Items
- Responses

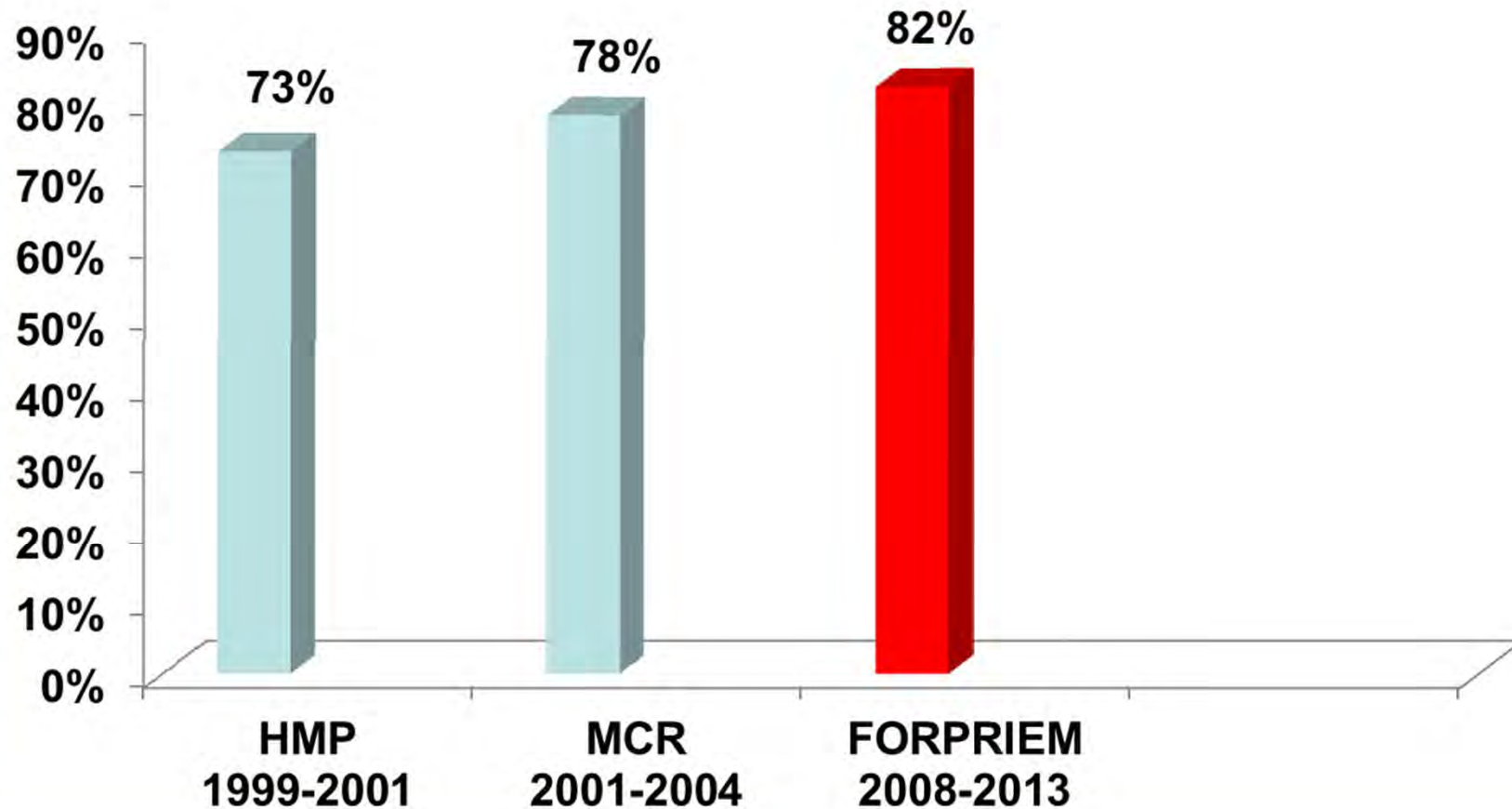
Add Responses to an Item

Add Items to a Form

Reports

FORPRIEM Database:
Main Menu

Trend in Class I WLPZ Total Canopy (Statewide)

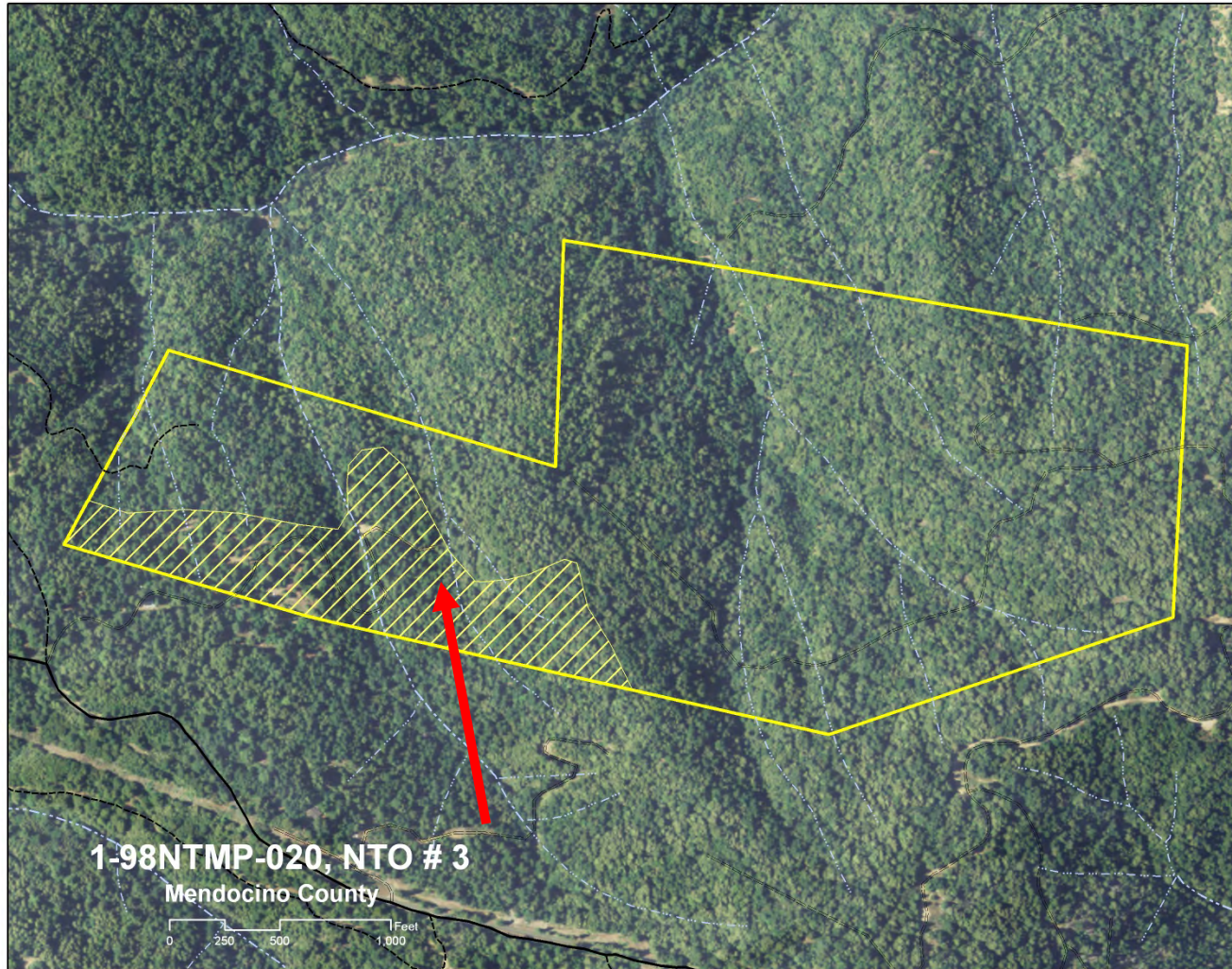


FORPRIEM Data Analyzed for NTMPs

What is an NTMP?

- **Nonindustrial Timber Management Plans (NTMPs) are long-term timber harvest plans for landowners with less than 2,500 acres of timberland in California.**
 - “one-time permit” from CAL FIRE
- **They are limited in scope to “light touch forestry” (no clearcutting or other types of even-aged silviculture).**
- **NTMPs must comply with the NTMP-specific provisions and applicable California Forest Practice Rules (FPRs).**

Example of an NTO Selection Harvest Area within a NTMP



30 ac
NTO;
190 ac
NTMP



1-97NTMP-018
MEN, NTO #6
Aug 16, 2011
Mill Creek NTMP

**Ken Margiott, CAL FIRE,
measuring total canopy for
FORPRIEM (92%). WLPZ
harvesting had occurred as
part of the NTMP NTO.**

Examples of NTMP Roads Evaluated





**1-97NTMP-018 MEN;
NTO #6
August 16, 2011
Mill Creek NTMP**

**Random
crossing “D” –
36 inch CMP**

**Major
problems:**

**-Significant
scour at the
outlet**

**-Diversion
potential**

Preliminary Results for FORPRIEM NTMP Monitoring (2011)

- 19 random NTMP NTOs were evaluated by December 31, 2011 in the North Coast Region.
- ~75% in Mendocino County, 20% in Humboldt County, 5% in Sonoma County.
- 19 random road segments evaluated, 31 crossings, and 16 WLPZ segments.
- WLPZ Class I and II total canopy = 92%.
- ~ 10% of total road segment length had surface erosion; 20% of the crossings had major effectiveness problems.
- NTMP NTO roads and watercourse crossings are comparable to THPs from a water quality standpoint.

CAL FIRE/BOF/MSG Cooperative Instream Monitoring Projects

1. **Caspar Creek Watershed Study**—1962 to present (USFS-PSW and CAL FIRE)
 - <http://www.fs.fed.us/psw/topics/water/caspar/>
2. **Judd Creek** – 2004 to present (Sierra Pacific Industries and CAL FIRE)
 - http://www.bof.fire.ca.gov/board_committees/monitoring_study_group/msg_archived_documents/msg_archived_documents/judd_creek_final_prospectus_msg_maps.pdf
3. **Little Creek Watershed Study** – 2001 to present (Cal Poly San Luis Obispo, CAL FIRE, and others)
 - http://www.spranch.org/research_watershed.ldml
4. **SF Wages Creek** – 2004 to present (Campbell Timberland Management and CAL FIRE)
 - http://www.bof.fire.ca.gov/board_committees/monitoring_study_group/msg_archived_documents/msg_archived_documents/sfwages_progress-mar-2004.pdf

These projects are documenting the water quality impacts of contemporary logging practices.

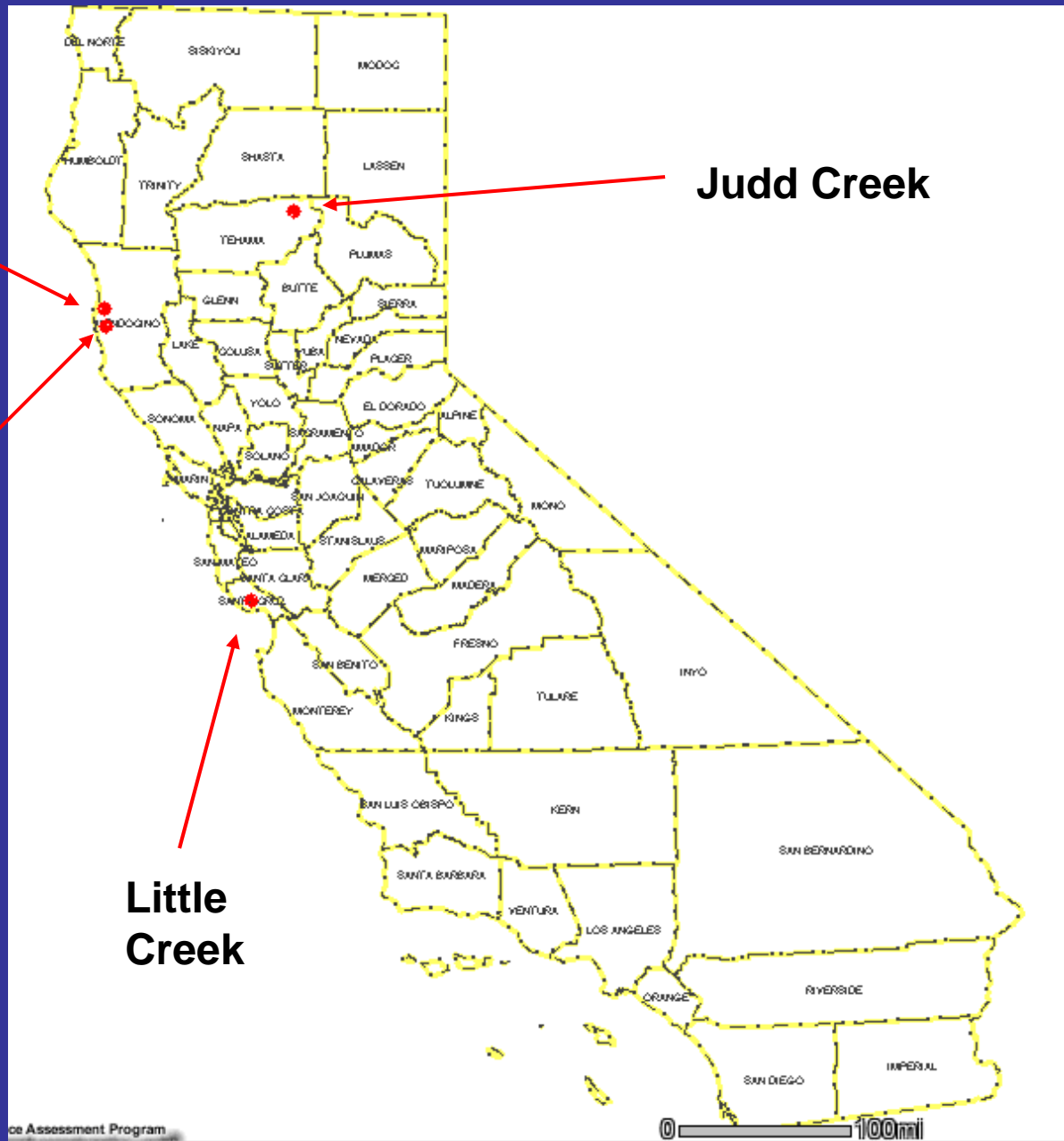
**Wages
Creek**

**Caspar
Creek**

Judd Creek

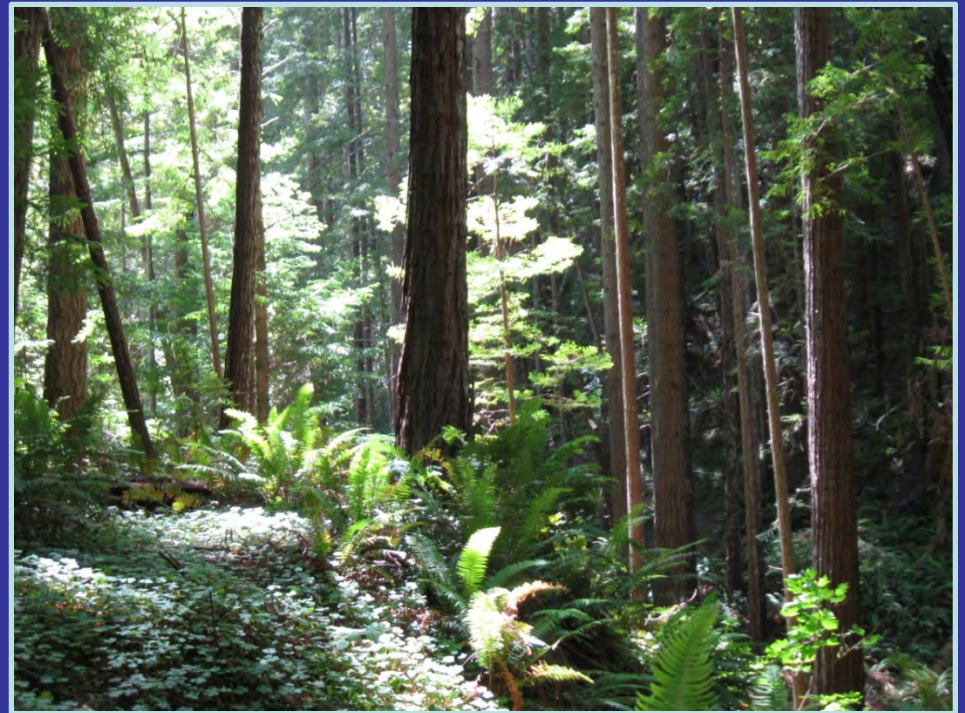
**Locations of
Cooperative
Instream
Monitoring
Projects**

**Little
Creek**



1. Caspar Creek Watershed Study

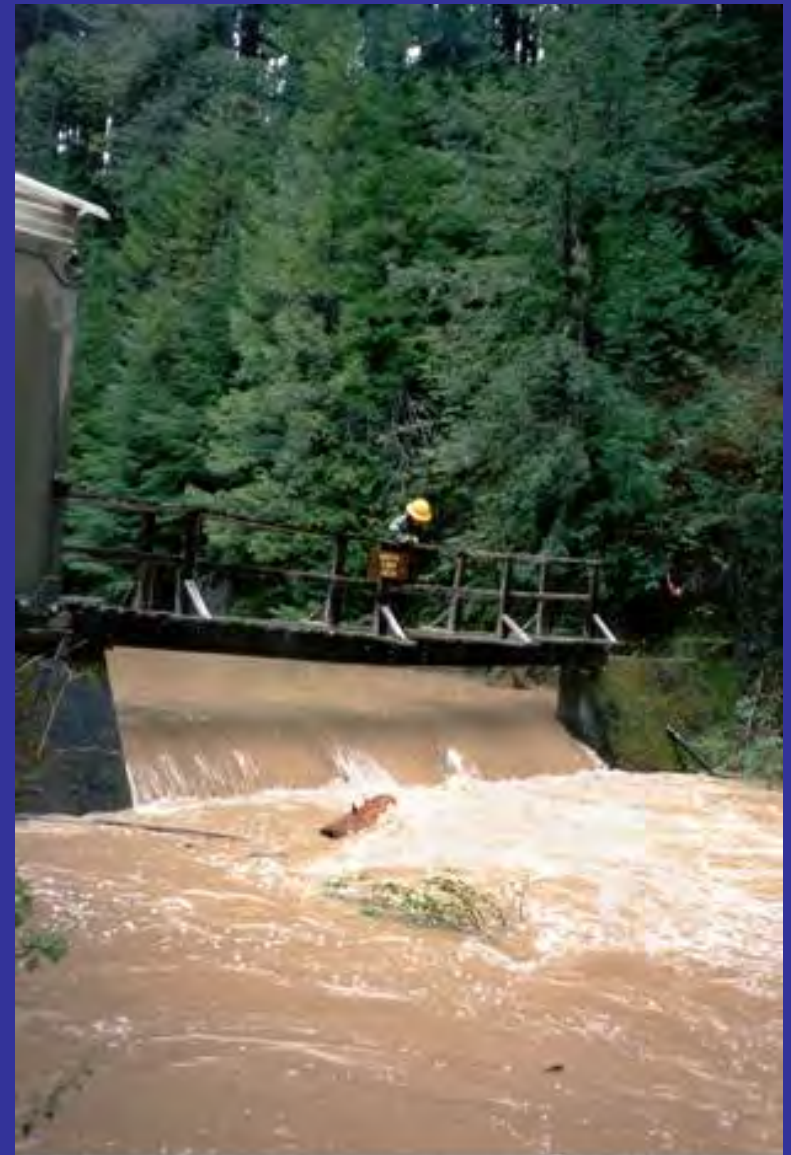
- **Cooperative study began in 1962 (50 years of data) with USFS PSW.**
- **Only long-term forested watershed study in California.**
- **100-yr agreement to continue study to 2099 (signed in 1999).**
- **Over 150 published papers, theses available online.**
- **2 main experiments to date—
South Fork (1962-1985) and
North Fork (1985-present).**



Caspar Creek Watershed Study: Cooperative Project with the USFS-PSW since 1962

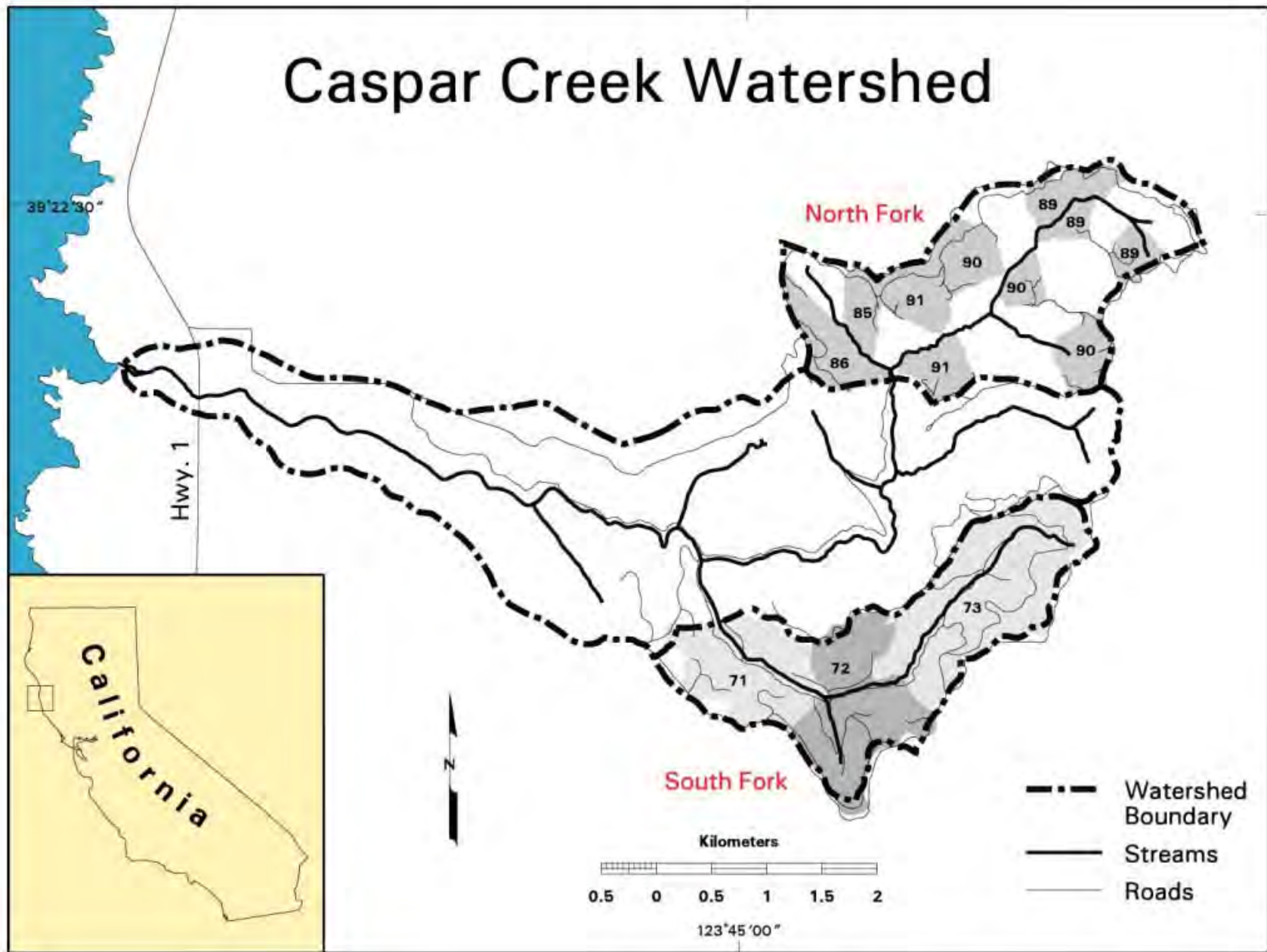


North Fork weir under varying flow conditions



North Fork Caspar Cr., NFC weir, stormflow

Caspar Creek Watershed—Located on Jackson Demonstration State Forest (90%)



South Fork Caspar Creek Road Construction -- 1967



About 360 feet of streambed was disturbed by tractors directly in the channel (Krammes and Burns 1973)



August 12, 1967

South Fork Caspar Creek Tractor Logging -- Watershed Sale No. 2 -- 1972

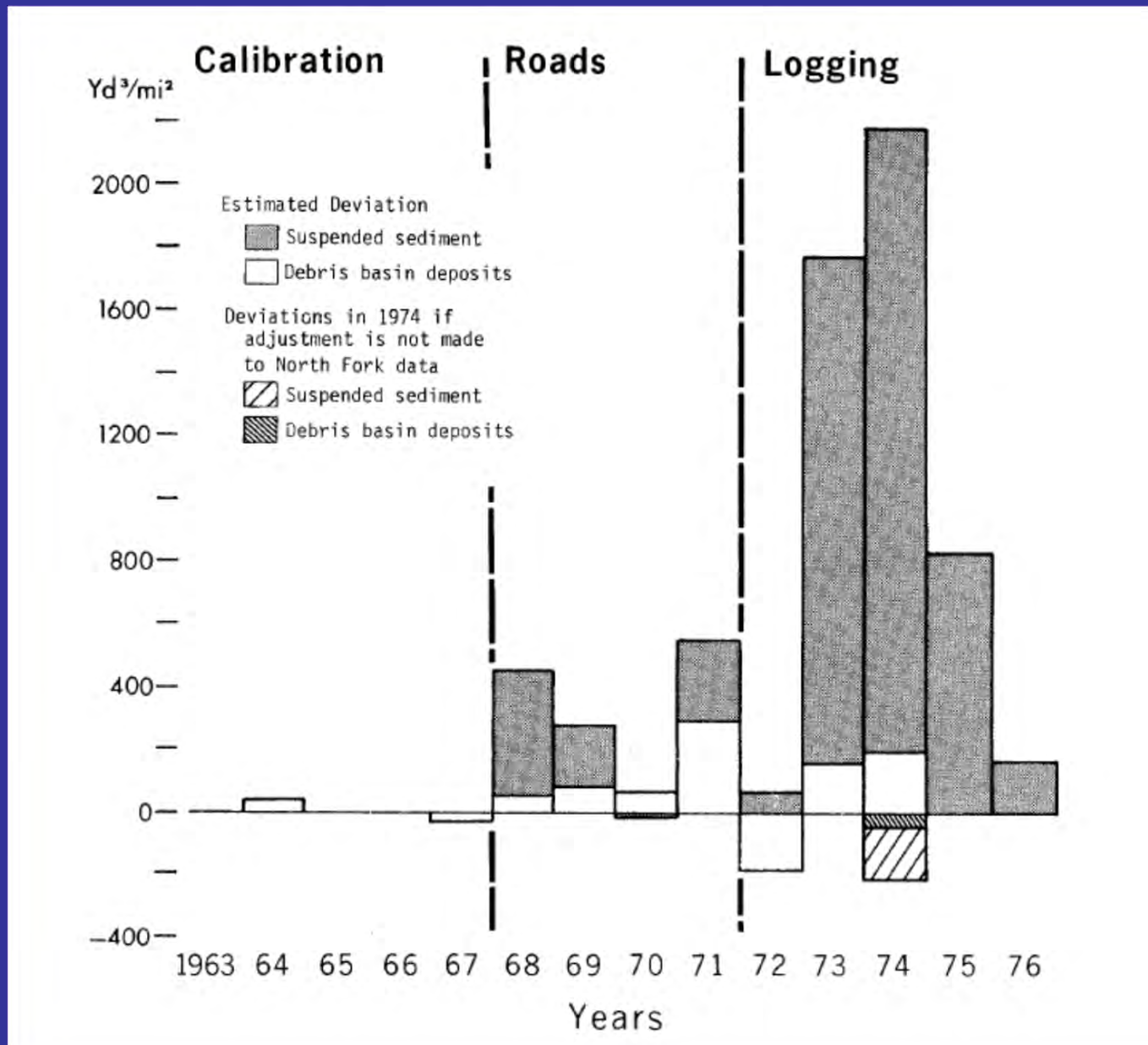


**South Fork Caspar Creek Tractor Logging --
Residual Stand Watershed Sale No. 1 -- 1971**



South Fork Sediment Results to 1990

- Suspended sediment yields after road construction (1968-1971) were about **twice** those expected for pre-treatment conditions (complicated by SF splash dam failure in December 1967) [biggest increase the first winter].
- Suspended sediment yields increased **4 to 5 times** those expected for the first 6 years after tractor logging, then returned to pre-treatment levels by about **1980**.
- Landslides related to roads, landings, and skid trails were responsible for most of the sediment (66 slides noted in 1975).



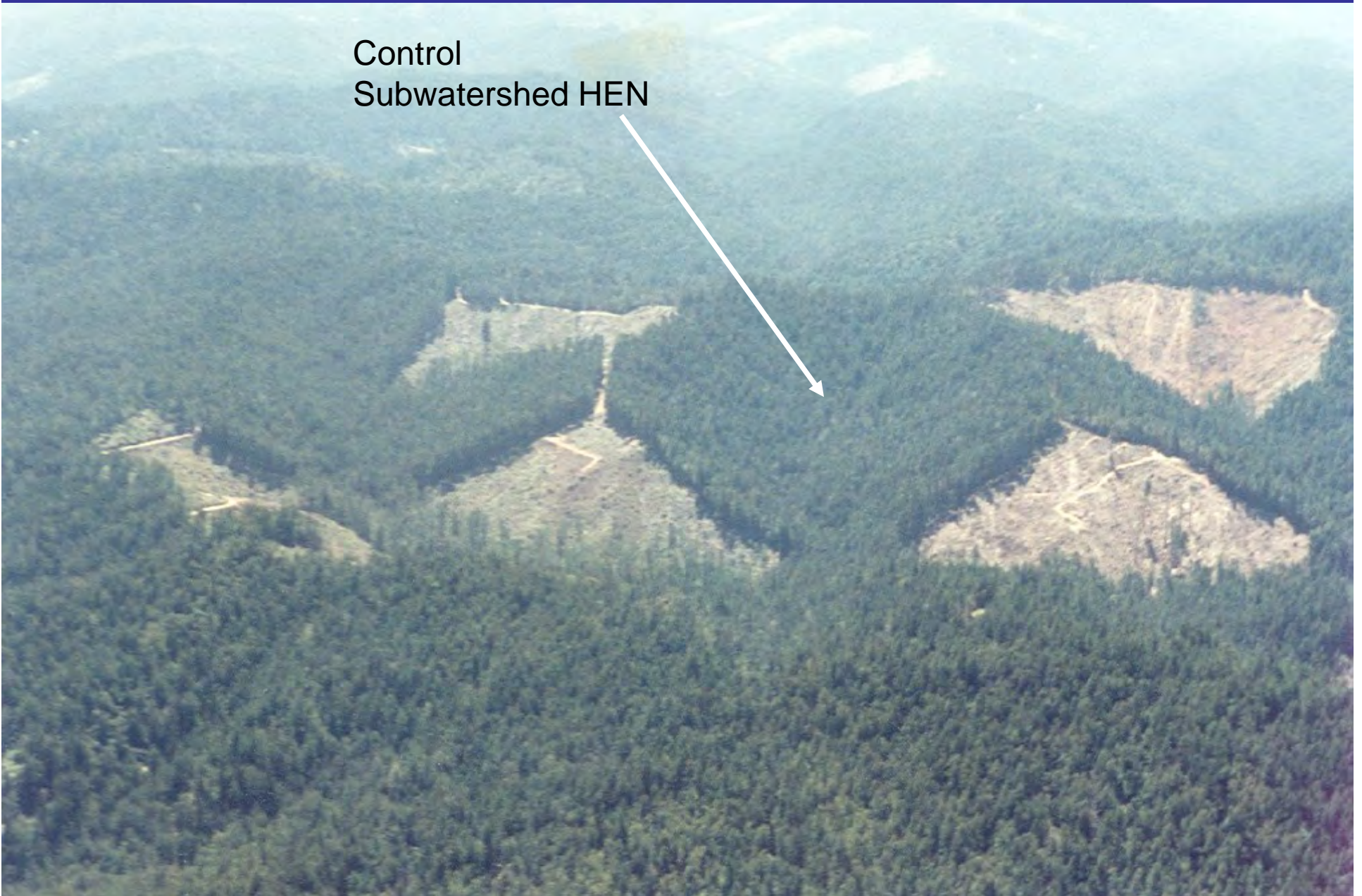
Deviations of sediment yield in the South Fork from amounts predicted

Cable Yarding Subwatershed G, North Fork Caspar Creek, July 1991



North Fork Caspar Creek Watershed: Clearcut Units K, L, J, E, and V; 1991

Control
Subwatershed HEN





**Unit Z North
Fork Caspar
Creek
Landslide -
Jan 1995**

**4700 cubic
yards**

North Fork Sediment Results

- Median increase in suspended sediment load was **109%** in North Fork clearcut tributaries to 1995 (mean = 212%).
- North Fork Caspar weir: suspended sediment increased **89%** the first 4 yrs after logging -- mainly from the January 1995 large landslide.
- Even with the North Fork landslide, South Fork selective tractor logging conducted without the modern Forest Practice Rules (FPRs) produced **2.4 to 3.7** times more sediment than the North Fork cable clearcut harvesting conducted under modern FPRs.
- Suspended sediment increases in the North Fork were most strongly related to increases in **storm flow volumes** (lesser degree—length of intermittent channel logged or burned).

North Fork Erosion Results

- **In-channel erosion** (gullyng, channel incision, bank erosion) is the major source of sediment during periods without major landslides.
- The main sediment inputs are from **landslides** and **in-channel erosion**, not road surface erosion.

Gully Headcut



Caspar Creek Results—Biological Results

- In the South Fork, salmonid juvenile abundance declined after road construction, but returned to near pre-disturbance levels after 2 years.
- Variability was high, but no dramatic changes in the abundance of coho salmon or steelhead trout were recorded after the North Fork logging.
- North Fork logging produced little or no evidence of sediment impacts to aquatic insect communities (stoneflies, mayflies, and caddisflies).

Mean Annual Abundance of Young-of-the-Year Steelhead in North and South Fork Caspar Creek (Nakamoto 1998)

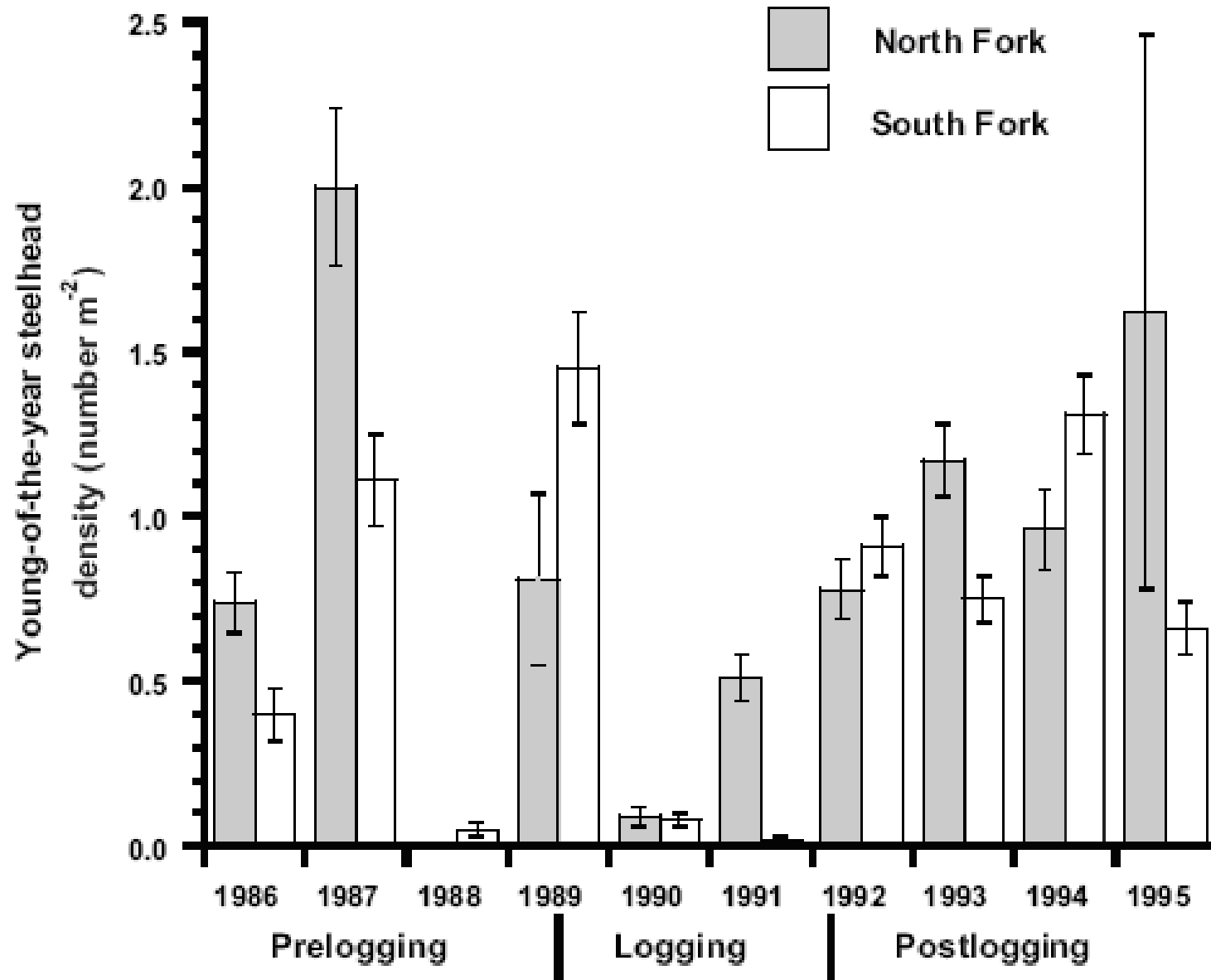
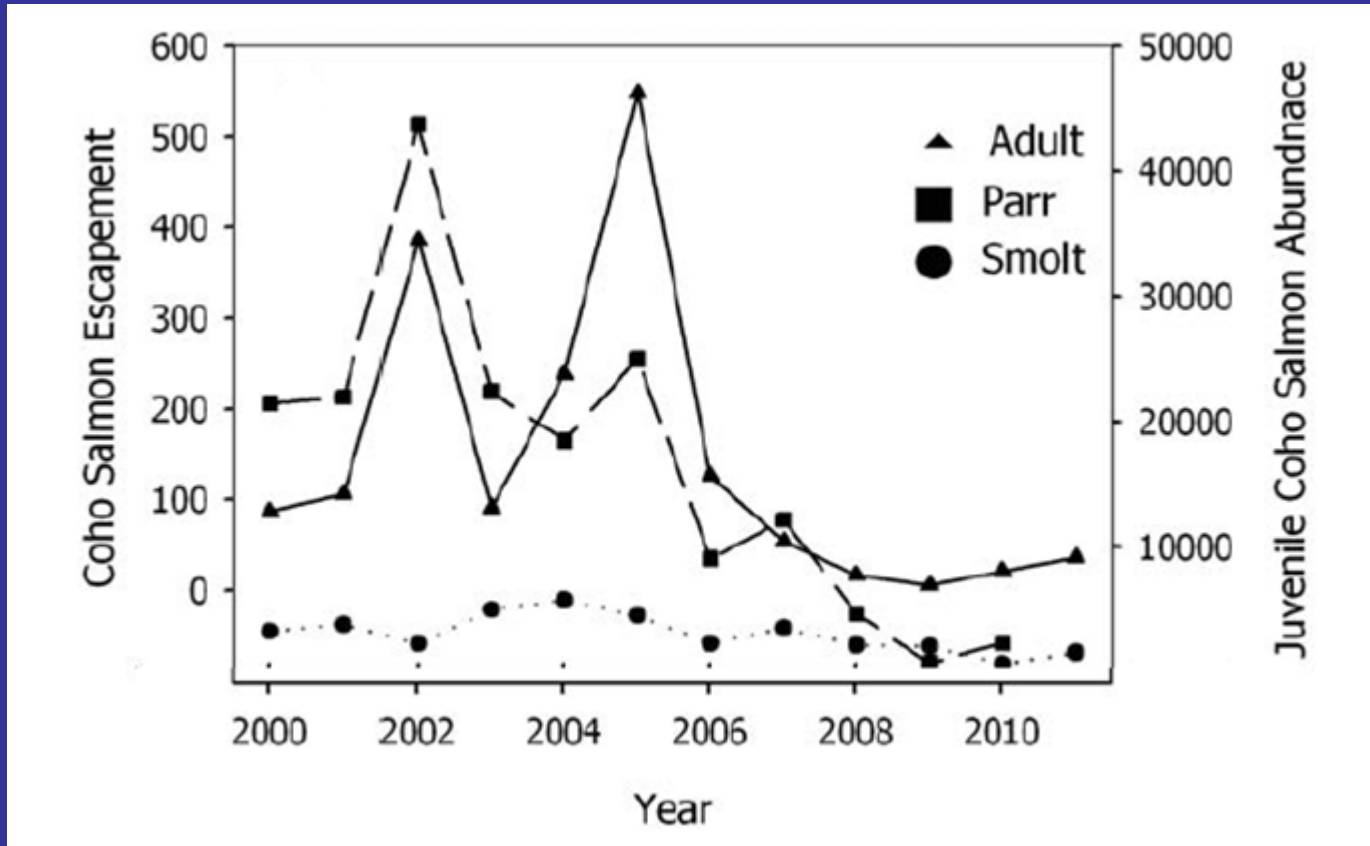


Photo: Knechtie, DFW



Juvenile Steelhead Trout Trapped in the Lower Caspar Creek—Fisheries Monitoring by DFW

Life Cycle Monitoring at Caspar Creek (downstream of the weirs) Gallagher et al. 2012



Marine Survival Drives Coho Salmon Populations

Winter Habitat Appears to be Limiting

State of California
The Natural Resources Agency
Department of Forestry & Fire Protection



**APPLICATIONS OF LONG-TERM WATERSHED
RESEARCH TO FOREST MANAGEMENT IN
CALIFORNIA:
50 YEARS OF LEARNING FROM THE CASPAR CREEK
EXPERIMENTAL WATERSHEDS**

California Forestry
Report No. 5

Peter H. Cafferata and Leslie M. Reid

May 2013



North Fork Caspar Creek weir, summer 2010

- **Overview of the first two experiments**
- **Brief summary of the key lessons learned for 12 topics**
- **Implications for management**
- **Appendices for specific applications**

http://calfire.ca.gov/resource_mgt/downloads/reports/California_Forestry_Report_5.pdf

How Have Caspar Creek Data Been Used in California?

**THPs, NTMPs, Habitat Conservation Plans (HCPs),
TMDLs, EIRs, Forest Management Plans**

[How big of an effect will a given project have?]

TMDL Documents



U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IX

GARCIA RIVER SEDIMENT TOTAL MAXIMUM DAILY LOAD

MARCH 16, 1998

APPROVED BY:

ORIGINAL SIGNED _____

Alexis Strauss
Acting Director
Water Division
EPA Region IX

_____ Date

Examples of Documents that Have Used Caspar Creek Data Extensively



U.S. Environmental Protection Agency
Region IX

Noyo River Total Maximum Daily Load for Sediment

Approved by:

original signed by _____

Alexis Strauss
Director, Water Division

16 December 1999

_____ Date



**Freshwater Creek
Watershed Analysis**

Prepared for:

Pacific Lumber Company (PALCO)
Scotia, CA

Prepared by:

Watershed Professionals Network

January 2001



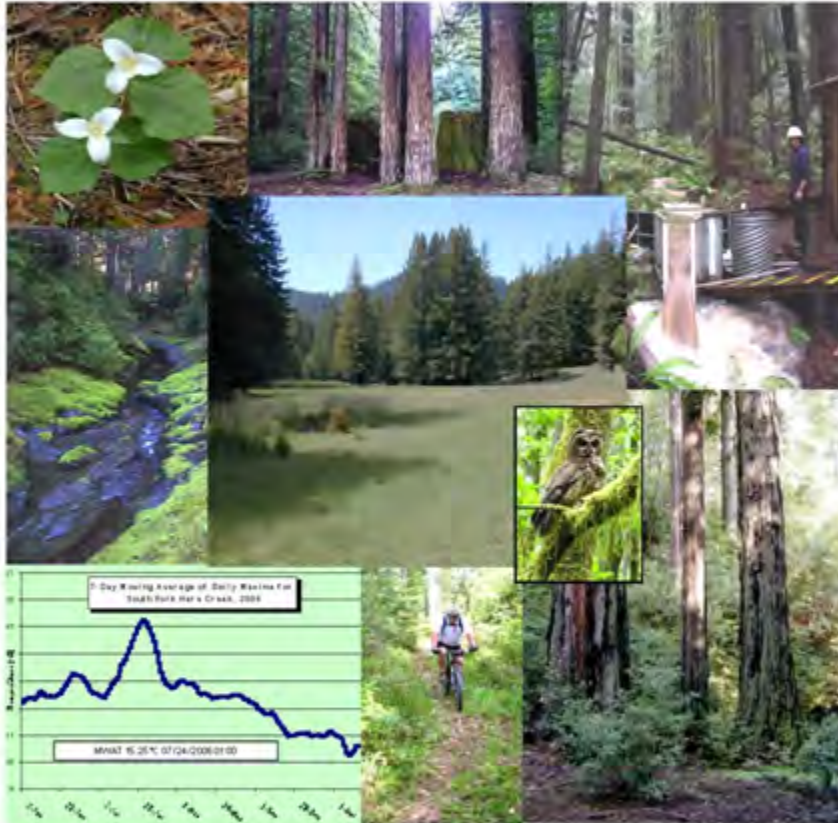
**Third Administrative Draft
Environmental Impact Statement/Program
Timberland Environmental Impact Report
for
Authorization of Incidental Take and
Implementation of the Mendocino Redwood
Company Habitat Conservation Plan/Natural
Community Conservation Plan and Timber
Management Plan**



March 2012

Jackson Demonstration State Forest Management Plan

January 2008



California Department of Forestry and Fire Protection
The Resources Agency
State of California

Management Plans, Conversion Documents

FAIRFAX CONVERSION PROJECT

SCH# 2004082094

DRAFT ENVIRONMENTAL IMPACT REPORT VOLUME 1

PREPARED FOR
THE CALIFORNIA DEPARTMENT OF FORESTRY
AND FIRE PROTECTION

NOVEMBER 2007

PREPARED BY
RANEY PLANNING & MANAGEMENT, INC.



1401 HALYARD DRIVE, SUITE 120, WEST SACRAMENTO, CA 95691

Vineyard Conversion Assessment, Napa County

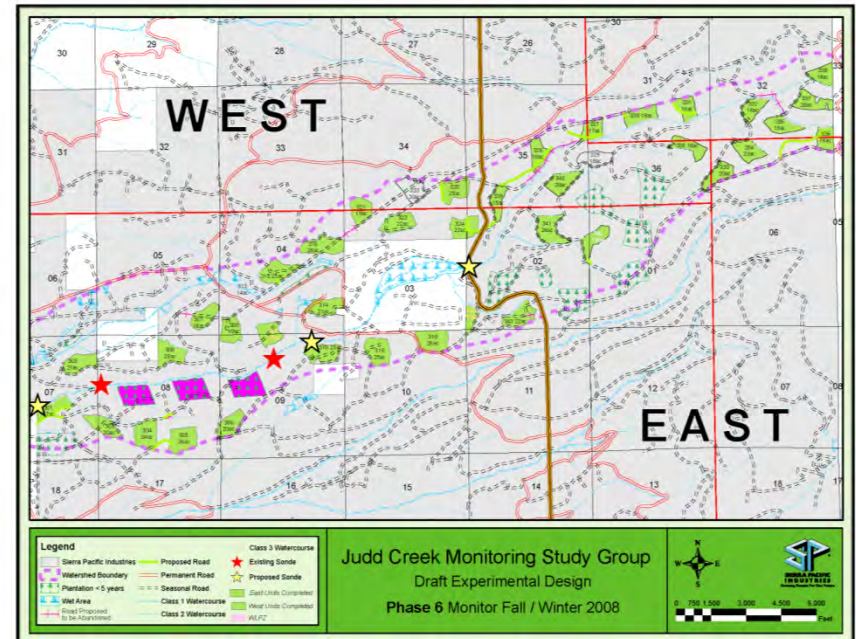


2. Judd Creek: Cooperative Instream Monitoring Project with Sierra Pacific Industries



Judd Creek Preliminary Results

- In 2007 extensive road work was conducted. In 2009, 16% of the watershed was clearcut in 34 units.
- Annual suspended sediment yields available for water years 2001-2012.
- Data analysis indicates that there is no signal from roading work in completed 2007 or timber harvesting undertaken in 2009.
- Sediment yields are controlled primarily by inter-annual variations in precipitation (MacDonald and James 2012).



4350
acre
basin



MSG Meeting June 13, 2012
Judd Creek Watershed
Cooperative Instream
Monitoring Project
SPI and CAL FIRE



3. Little Creek: Cooperative Instream Monitoring Project with Cal Poly San Luis Obispo/ Swanton Pacific Ranch



**Little Creek
Watershed with 4
stream gaging
stations**

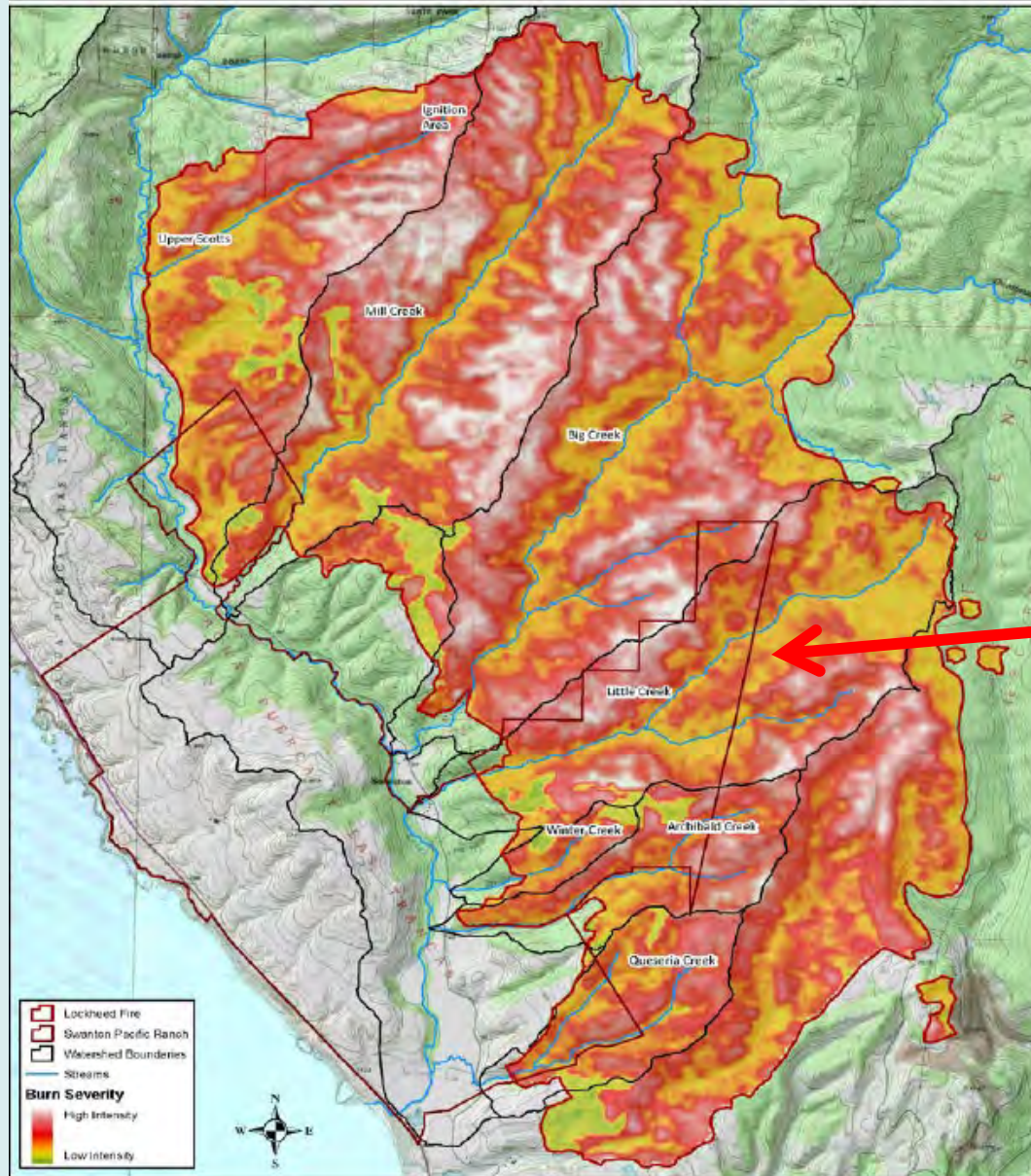
**1900 acre
drainage area**

**Santa Cruz
Mountains north of
Davenport, CA**

Image: Gaedeke 2006

Lockheed Fire Burn Severity

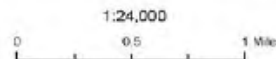
Swanton Pacific Ranch - Cal Poly



Little Creek watershed

>90% burned in 2009

Area Burned	Acres	Percent
Lockheed Fire Total	7,819	—
Scotts Creek Watershed	6,735	35%
Swanton Pacific Ranch	1,142	35%



Burn Severity from USFS BARC
Fire perimeter from CAL FIRE
September 8, 2009
DP, RW

Little Creek Results to Date

Dietterick 2011, Loganbill 2013

- 7 yrs of baseline data prior to 2008 harvest.
- 1st year data showed minimal changes in sediment yield.
- 2009: >90% of the watershed burned.
- No significant changes in water quality the first year after the Lockheed Fire.



4. South Fork Wages Creek: Cooperative Instream Monitoring Project with Campbell Timberland Management



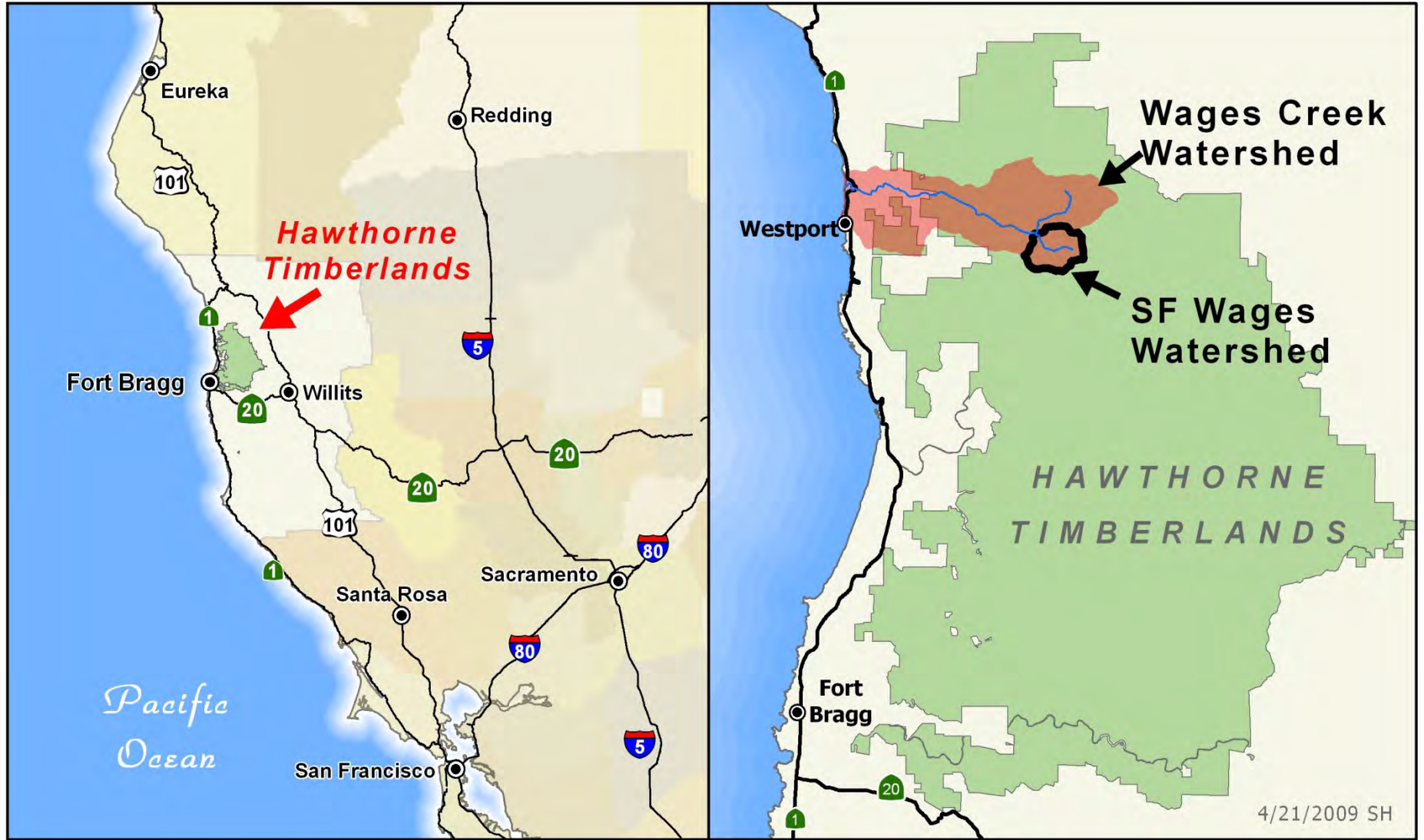


Image: Faucher, CTM

4. Monitoring Report Availability and Information Sharing Approaches

MSG Report Availability

- Twelve MSG monitoring reports and 40 MSG supported reports are available online at the MSG website:
http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/
- These reports contain information, analyses and summaries of the data.



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- [Interagency Forestry Working Group](#)
- [Research and Science Committee](#)

MONITORING STUDY GROUP MORE INFO...

MSG MONITORING REPORTS

- [Draft Monitoring and Tracking Subcommittee Report--November 2009 \(1.5MB PDF\)](#)
- [Interagency Mitigation Monitoring Program Pilot Project Final Report -- Longstreth et al. 2008 \(5.0 MB\) \(5.0MB PDF\)](#)
- [IMMP General Framework Report 2006 \(751KB PDF\)](#)
- [MCR Report 2006 \(1.6MB PDF\)](#)
- [HMP Final Report 2002 \(1.3MB PDF\)](#)
- [BOF Interim HMP Report 1999 \(553KB PDF\)](#)
- [PMP Summary of Long Term Monitoring Program 1997 \(195KB PDF\)](#)
- [Hillslope PMP Report 1995 \(2.8MB PDF\)](#)
- [Rae Pilot Instream PMP Report 1995 \(12.0MB PDF\)](#)
- [Pilot Geological Input for HMP, PMP Report 1995 \(51KB PDF\)](#)
- [MSG-Kier Rec's for Pilot Monitoring Project Report 1993 \(11.2MB PDF\)](#)
- [BEAC Report 1991 \(3.8MB PDF\)](#)



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**MONITORING
STUDY GROUP
MORE INFO...**

MSG Supported Reports

Archives: **Current Data** ▼

2009 SUPPORTED REPORTS

- [Composition of the Suspended Load as A Measure of Stream Health - Wilzbach and Cummins 2009 \(687KB PDF\)](#)

2008 SUPPORTED REPORTS

- [Measuring the effects of Increasing Loads of Fine Sediment from Timber Harvest and Road Building on Aquatic Populations of Dicamodon Tenebrosus \(Pacific Giant Salamander\) in California's Redwoods- Pogue M.S. Thesis 2008 \(640KB PDF\)](#)
- [Cooperative Monitoring for Turbidity and Suspended Sediment Monitoring and Research on Three Tributaries of Elk River, California Hydrologic Years 2004-2006-Robison 2008 \(8.8MB PDF\)](#)

2007 SUPPORTED REPORTS

- [The Significance of Suspended Organic Sediments to Turbidity, Sediment Flux, and Fish-Feeding Behavior - Madej, Wilzbach, Cummins, Ellis, and Hadden 2007 \(1.3MB PDF\)](#)
- [Comparisons of Turbidity Data Collected with Different Instruments-Lewis, Eads and Klein 2007 \(3.0MB PDF\)](#)

2006 SUPPORTED REPORTS

- [Garcia River Trend and Effectiveness Monitoring: Spawning Gravel Quality and Winter Water Clarity in](#)

Examples of Supported Monitoring Projects

- Testing Indices of Cold Water Fish Habitat (Chris Knopp, USFS)
- V* and other instream parameter evaluations (Dr. Tom Lisle, USFS-PSW)
- Evaluation of Road Stream Crossings (Sam Flanagan, BLM)
- Sediment Composition as an Indicator of Stream Health (Drs. Mary Ann Madej, USGS, and Peggy Wilzbach, HSU)
- Watershed Reference Catalog (internal MSG Workgroup)

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Caspar Creek Experimental Watershed Study



Located on the [Jackson Demonstration State Forest](#) near Fort Bragg, California, the North Fork (473 ha) and South Fork (424 ha) tributary watersheds of Caspar Creek (39° 21' N, 123° 45' W) serve as research sites for evaluating the effects of timber management on streamflow, sedimentation, and erosion. Established in 1961 as a cooperative effort between the [California Department of Forestry and Fire Protection](#) (CAL FIRE) and the United States Forest Service Pacific Southwest Research Station (PSW), the Caspar Creek study has evolved from a simple paired watershed study into one of the most comprehensive and detailed investigations of its kind. PSW and CAL FIRE have a 100-year Memorandum of Understanding to continue research at the site at least through 2099. Caspar Creek is one of 11 USFS Experimental Forests and Ranges selected in 2007 to complement the national network of Long Term Ecological Research sites.

The half-century-long record from the North and South Forks of Caspar Creek is unique in providing long-term hydrologic data from small, rain-dominated watersheds located in 2nd- and 3rd-growth conifer forests. Because of the kinds of research carried out, the lengthy record, and the relevance of site conditions to major water supply sources, the Caspar Creek Experimental Watersheds have long provided information used both to extend basic knowledge and to guide land management practices.

- About the Caspar Creek Experimental Watersheds**
- Caspar Creek Data**
- Caspar Creek Publications & Products**
- Research contact**



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<http://www.fs.fed.us/psw/topics/water/caspar/>

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Water & Watersheds: Caspar Creek Watershed Study

[^ Main Topic](#) | [CALFED](#) | [Caspar Creek Watershed Study](#) | [Turbidity Threshold Sampling Study](#) | [Fine Sediment in Pools](#)

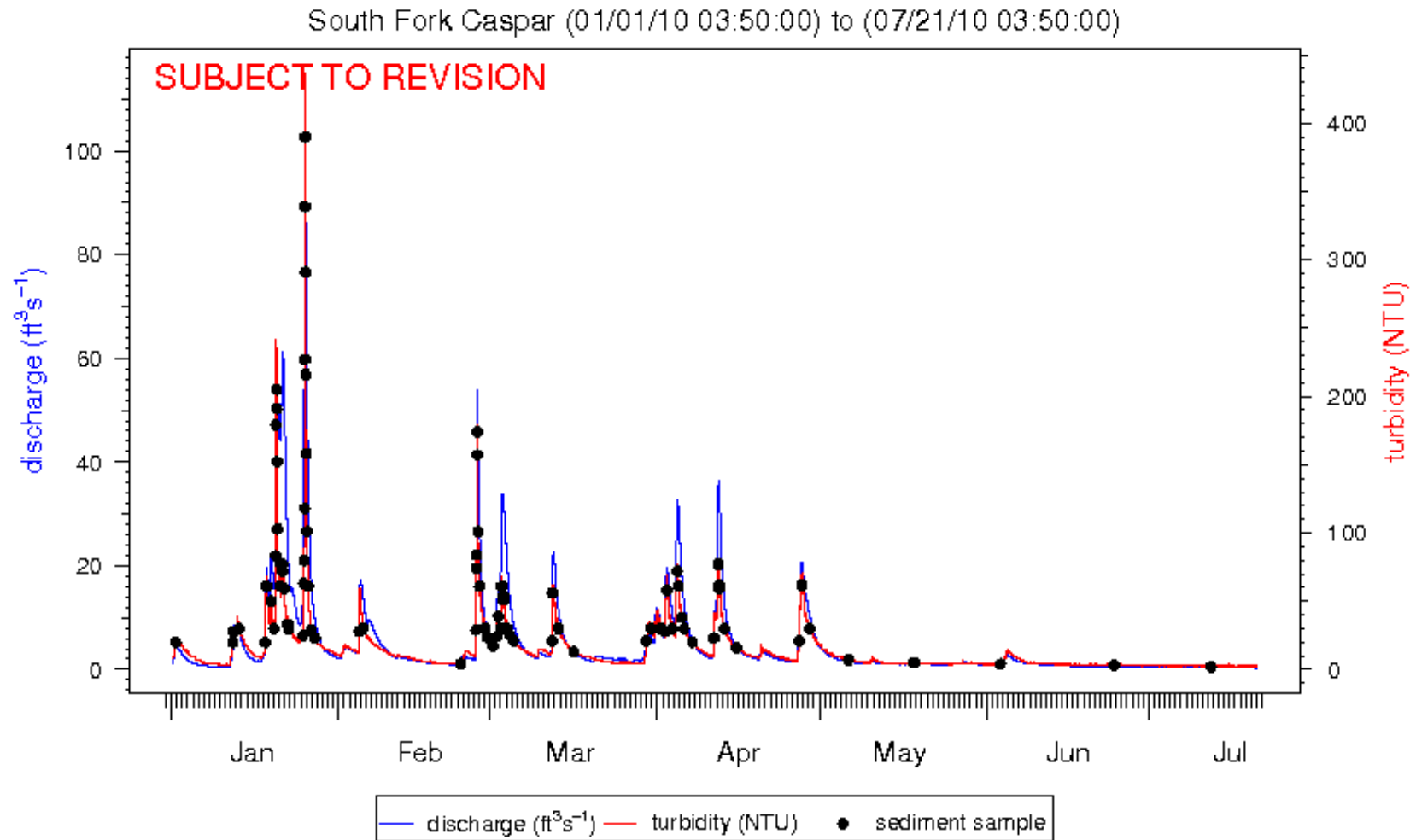
The Caspar Creek Experimental Watershed Study, located on the [Jackson Demonstration State Forest](#) near Fort Bragg, California, is a cooperative venture of the [Redwood Sciences Laboratory](#) and the [California Department of Forestry and Fire Protection](#) that has been operating continuously since 1962.

Caspar Creek Data:

- [Plot current streamflow, sediment, rainfall, and temperature](#)
- Caspar Creek Experimental Watersheds Hydrologic and Climatic Data
 - Note:** due to technical problems, data downloaded before 8/16/02 contained errors that have now been corrected. [Details.](#)
 - [1962 - 1997](#)
 - [1986 - 2004](#) (1986 - 2004 for Rainfall, 1989 - 2003 for Temperature, 1996-2003 for Streamflow) Complete data sets are available on CDs released in May 1998 and in June 2001. For a copy, contact our Data Manager, [Jayme Seehafer](#).
These data files now include:
 - Streamflow
 - Sediment
 - Rainfall
 - Solar
 - Air and water temperature
 - Channel cross-sections
 - Subsurface hydrology
 - Detailed streamflow and sediment data for 13 tributary stations that were installed in the North Fork in August 1985.
- Fish surveys
 - [2004-2005 adult salmonid estimates from redd surveys](#)
 - [1987-2005 juvenile salmonid counts from downstream migrant traps](#)
- Maps of Caspar Creek
 - [Entire Caspar Creek watershed](#)
 - [Topography of North and South Forks Caspar Creek](#)
 - [North Fork Caspar Creek](#)
 - [South Fork Caspar Creek](#)
[Information about the names of the South Fork Tributaries.](#)
 - [Longitudinal profile of North Fork stream channels](#)
 - Geologic and Geomorphic Features Related to Landsliding, North and South Forks of Caspar Creek, Mendocino County, California. California Division of Mines and Geology Open File Report OFR 95-08.

DATA

Caspar Creek Real-Time Discharge and Turbidity Data Plot: January 1, 2010 to July 21, 2010



Other Forms of Monitoring Results

Dissemination

- Professional conference presentations.
- Journal and conference published papers.
- Newsletters.
- Training workshop presentations.

Flared Metal End Sections

- Flared ends at the inlet of a culvert improve flow by guiding the water into the culvert, minimizing turbulence.
- Flared metal end sections have the same headwater discharge relationship as a metal pipe with a headwall.
- Flared metal end sections do not improve the hydraulic performance of culverts appreciably over the performance of a mitered inlet.

RPF/Landowner Watercourse
Crossing Workshop
March 11, 2008; Redding, CA



Interagency Watercourse Crossing Workshop, Nov. 30, 2007, Santa Cruz, CA



5. Planned Activities in 2013

- **Expand Effectiveness Monitoring**
 - **Effectiveness monitoring and adaptive management are necessary for the protection and restoration of aquatic resources (Coe 2009).**
 - **Discussion by MSG for 2 years regarding need for improved effectiveness monitoring.**

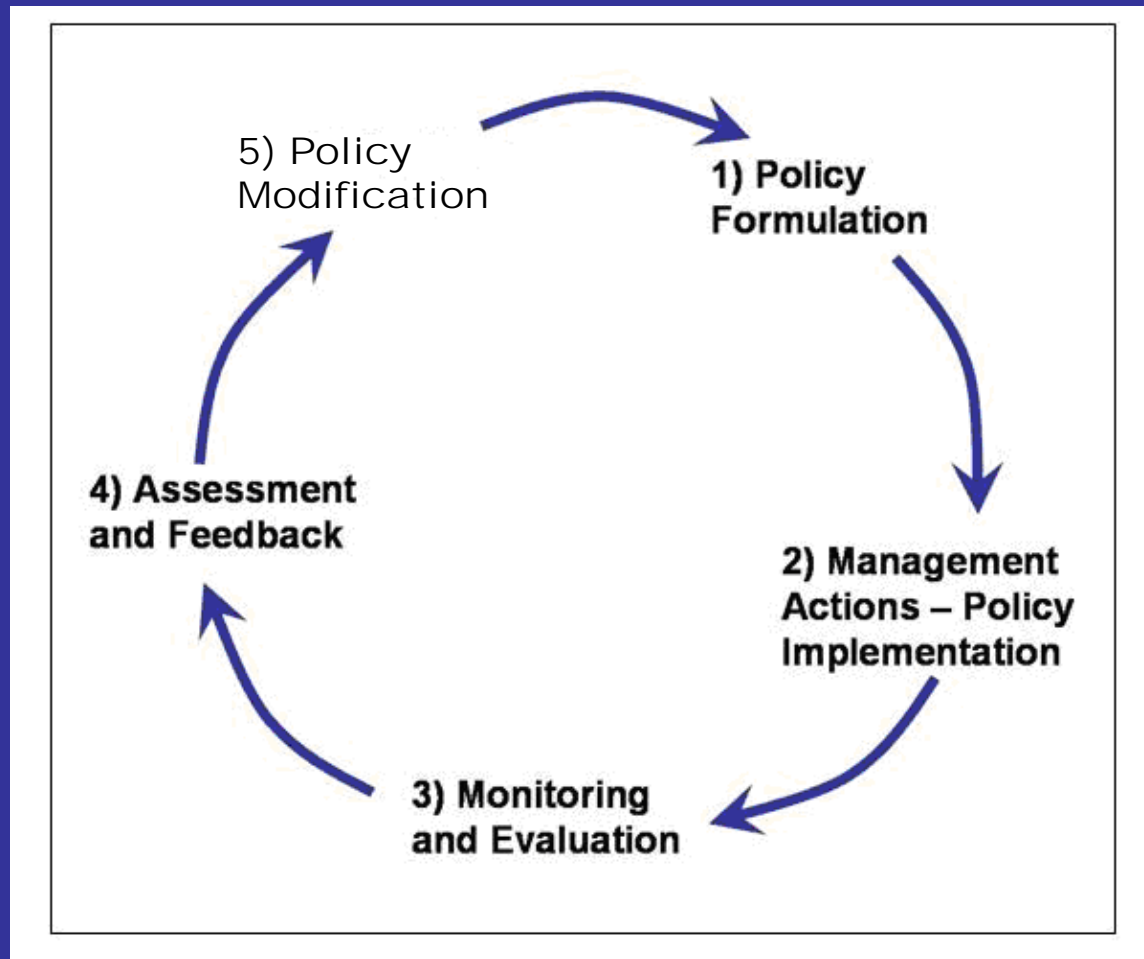
Effectiveness Monitoring Committee (EMC)

- A review of existing monitoring programs in California (Coe 2009) did not provide evidence of a consistently effective feedback loop between monitoring data and decision-making.
- A good example of how California can apply scientific research findings to generate science-based regulations is found in Washington.
 - Timber/Fish/Wildlife Group Process

Effectiveness Monitoring Committee (EMC)

- Development of an Effectiveness Monitoring Committee (EMC) will be used to determine if recently adopted FPRs are effective in protecting beneficial uses such as salmonid habitat, or if further modification is required.
 - Build a water quality-related effectiveness monitoring program that can provide an active feedback loop to policymakers, managers, agencies, and the public.
 - Use scientific findings consistently by applying an approach similar in concept to that utilized by the Adaptive Management Program in the state of Washington.

Iterative Cycle of Policy Development and Implementation in Adaptive Management



Allows monitoring data to inform management and regulation



Charter of the Effectiveness Monitoring Committee (EMC)

I. Necessity

Effectiveness monitoring is a key component of adaptive management and is necessary for assessing if management practices are achieving the various resource goals and objectives set forth in the California Forest Practice Rules. Monitoring is also a crucial component for complying with the "ecological performance" reporting requirements outlined in AB 1492. Despite an increase in forestry-related monitoring in the past decade, there is relatively little information regarding the type, distribution, rigor, scientific relevance, or cost-effectiveness of monitoring on private and state forestlands of California. A large amount of water quality-related monitoring is currently being undertaken, as well as monitoring efforts for terrestrial wildlife or botanical resources. For both water/aquatic habitat and terrestrial/botanical resources, it is clear that: (1) a monitoring framework needs to be implemented to comply with the reporting requirements of AB 1492, (2) agency and private landowner conducted monitoring needs to be better coordinated and reported; (3) increased scientific rigor, agency participation, and monitoring transparency is required to increase stakeholder acceptance of the extensive monitoring being conducted on private and state forestlands; and (4) a process is needed that provides for the scientific evaluation of existing California Forest Practice Rules and other forestry-related laws and regulations to be evaluated and possibly modified based on scientific, verifiable monitoring results. A recent review of existing monitoring programs in California did not provide evidence of a consistently effective feedback loop between water quality-related monitoring data and decision making (Coe 2009). The State of Washington provides an example of how California could apply scientific research findings to generate science-based forest practice regulations (Cafferata et al. 2007).¹

The Effectiveness Monitoring Committee (EMC) will provide the Board of Forestry and Fire Protection (Board) and the Natural Resource Agencies with a science-based committee whose charter is to better understand if specific requirements of the California Forest Practice Rules and other laws and regulations related to forest resources are effective in achieving resource objectives (i.e., ecological

¹ The Adaptive Management Program has been used for several years in the state of Washington to provide science-based recommendations and technical information to assist their Forest Practice Board in determining if and when it is necessary or advisable to alter forest practice rules (WFPB 2005).

**Charter
approved by
the Board of
Forestry and
Fire Protection
in August 2013**

Effectiveness Monitoring Committee (EMC) Charter

- **Appointed** members with voting privileges:
 - Representing the main stakeholder groups
 - public,
 - timber industry,
 - environmental groups, etc.
 - Members will be well respected applied scientists or resource management professionals representing each stakeholder group.
 - Chair and Vice-Chair will be appointed by the BOF.
 - Agency representatives will act as technical specialists rather than direct members.

Effectiveness Monitoring Committee (EMC) Funding Sources

- Expected to come from:
 - AB 1492 (lumber tax effective Jan. 1, 2013)
 - Evaluation of Ecological Performance [Sec. 4629.9 (a)(8)(F)].
 - One component: monitoring the effectiveness of the laws and regulations in promoting ecological benefits.
 - State and private sources
 - Grants

EMC Data Collection

- Forming **State agency teams** to monitor long-term improvements in ecological health, evaluating:
 - Water quality,
 - Aquatic habitat, and
 - Wildlife habitats.
- Utilizing data produced by **existing landowner programs**, given sufficient agency oversight.
- Utilizing data from **existing state agency monitoring programs** where and when appropriate (e.g., SWAMP).
- Hiring **contractors** to address issues requiring special expertise or short-turn around time.

Timeline for EMC Establishment

- August 2013: The draft EMC Charter was sent to the full Board for their review.
 - The Board approved the Charter on August 8th in Ventura.
- September 2013:
 - Discussion with SWRCB Chair Felicia Marcus to gain wider support for the EMC and its Board approved Charter.
 - Other efforts to build “grass roots” support.
- November 2013: Initial meeting of the EMC (planned).
- December 2013: Initial report to the Board by the EMC Chair.

MSG to continue to function—primarily as an information sharing venue

6. Summary Points

Over the past 50 years, much has been learned from forestry-related water quality monitoring work in California, including:

- **Individual practices required by the FPRs are generally effective in preventing hillslope erosion features when properly implemented.**
- **Forest road drainage and proper watercourse crossing design, construction, and maintenance are areas of concern and require improvement.**
- **Implementation of the modern FPRs (post-1975) have substantially reduced water quality impacts (Caspar Creek results).**

Summary Points (continued)

- 12 MSG monitoring reports have been produced from 1990 to 2013 and are available online.
- Currently, four cooperative instream monitoring projects complement hillslope monitoring work and provide water column data related to timber operations.
- A new Effectiveness Monitoring Committee with **appointed** members will be formed in 2013 to develop of a program to provide answers regarding the effectiveness of recent regulations, providing a feedback loop to policy makers for adaptive management.



Thanks for Your Attention!

Pete Cafferata
Watershed Protection Program Manager
California Department of Forestry and Fire Protection
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(916) 653-9455