DRAFT
EFFECTIVENESS MONITORING COMMITTEE (EMC)
Strategic Plan

Submitted to the California Board of Forestry and Fire Protection

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TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 EMC Charter 2
1.1.1 EMC Current Membership 2
1.1.2 EMC Ground Rules 3
1.2 EMC Annual Reporting 3
1.3 EMC Personnel and Funding 3

2.0 EMC STRATEGIC PLAN OR "ROAD MAP" 4
2.1 Development of Critical Monitoring Questions 5
2.1.1 Board of Forestry and Fire Protection - Committee Priorities 5
2.1.2 Board of Forestry and Fire Protection - Cumulative Effects 5
2.1.3 California Department of Fish and Wildlife 7
2.1.4 State and Regional Water Quality Control Boards 7
2.1.5 California Geological Survey 8
2.1.6 California Department of Forestry and Fire Protection 8
2.1.7 U.S. Forest Service 9
2.1.8 NOAA National Marine Fisheries Service 10
2.1.9 Public Stakeholders 11
2.2 Ecological Performance - Timber Regulation and Forest Restoration Program 11
2.3 EMC Categories and Critical Monitoring Questions 11
2.4 Catalog of Ongoing Cooperative and Individual Monitoring Projects 19
2.5 EMC Proposed Monitoring Projects - 2015 20

3.0 BOARD - ADAPTIVE MANAGEMENT FRAMEWORK 21
4.0 APPROPRIATE SCIENTIFIC METHODS AND REPORTS 23
4.1 Study Design within an Adaptive Management Framework 23
(Moved to 4.2.4) 24
4.2 Appropriate Temporal and Geographic Scale 24
4.2.1 Range of Variability 25
4.2.2 Rare or Large Event Monitoring 27
4.2.3 Anadromous Fish Monitoring 29
4.2.4 Resource Benefit 30
4.3 Scientific Uncertainty 30
4.4 EMC Reports 30
5.0 REFERENCES 32
APPENDIX A: EMC APPOINTED MEMBERS AND STAFF 38
APPENDIX B: ORGANIZATIONAL FRAMEWORK OF AB1492 39
APPENDIX C: ADAPTIVE MANAGEMENT FRAMEWORK CHECKLIST 40
APPENDIX D: PRIORITY RECEIVED FROM BOARDS, DEPARTMENTS & AGENCIES 41
APPENDIX E: SUMMARY OF EMC REVIEWED PROJECTS 51
APPENDIX F: INDIVIDUAL EMC REVIEWED PROJECT(S) 52
APPENDIX G: RANKING OF PROPOSED EFFECTIVENESS MONITORING PROJECTS 66
APPENDIX H: CATALOG OF ONGOING COOPERATIVE AND INDIVIDUAL MONITORING PROJECTS 67

LIST OF FIGURES

1. Monitoring types 5

~~1.~~2. EMC charter goals. 6~~5~~

~~2.~~3. Primary objectives in developing critical monitoring questions. 7

~~3.~~4. Example: EMC critical monitoring question structure. 15

5~~4~~. Adaptive management using EMC sponsored monitoring to better inform Board policy and regulations 21

LIST OF ABBREVIATIONS

ASP	Anadromous Salmonid Protection
BMPs	Best Management Practices
Board	California State Board of Forestry and Fire Protection
CalEPA	California Environmental Protection Agency
CAL FIRE	California Department of Forestry and Fire Protection
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CGS	California Geological Survey
CNRA	California Natural Resources Agency
DSF	Demonstration State Forests
EMC	Effectiveness Monitoring Committee
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FORPRIEM	FPRs Implementation and Effectiveness Monitoring Program
FPA	Forest Practice Act
FPRs	California Forest Practice Rules
HCP	Habitat Conservation Plan
HMP	Hillslope Monitoring Program
LTO	Licensed Timber Operator
LTSY	Long Term Sustained Yield
MCR	Modified Completion Report Monitoring Program
MSG	Monitoring Study Group
NMFS	National Marine Fisheries Service
NPS	Non-point Source
NRV	Natural Range of Variability
Plans	THP and all other harvest documents as defined under 14 CCR 895.1
RPF	Registered Professional Forester
RSC	Research and Science Committee
SWAMP	Surface Water Ambient Monitoring Program
TRFR	Timber Regulation and Forest Restoration Program
UCCE	University of California Cooperative Extension
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Department of Agriculture, Forest Service
Water Boards	State and Regional Water Quality Control Boards
WHR	Wildlife Habitat Relationship
WLPZ	Watercourse and Lake Protection Zone
Working Groups	AB1492 program Working Groups: Ecological Performance Measures, Data and Monitoring, Administrative Performance Measures and Interagency Information Systems.

Commented [SLF1]: The Co-Chair decided to not have the abbreviation as FPRs'. We can discuss further on August 18th.

1.0 INTRODUCTION

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 Act and Rules (EMC Charter 2014, MacDonald et al. 1991). Monitoring is also a crucial component for complying with the "ecological performance" reporting requirements outlined in AB 1492. Over the past 20 years on California's state and private forestlands implementation and limited short-term effectiveness monitoring has focused primarily on water quality related issues (Tuttle 1995, BOF 1999, Cafferata and Munn 2002, Brandow et al. 2006, Longstreth et al. 2008, Brandow and Cafferata 2014). Longer-term cooperative instream monitoring studies have also studied potential impacts from contemporary harvesting practices on water quality and aquatic habitats. These projects have included: the Caspar Creek watershed study (Rice et al. 1979, Ziemer 1998, Lewis et al. 2001, Cafferata and Reid 2013), the Garcia River Instream Monitoring Project (Euphrat et al. 1998, Maahs and Barber 2001, Barber and Birkas 2006), the Little Creek Watershed Study (Skaugset et al. 2012, Loganbill 2013, Dietterick et al. 2015), the Judd Creek Watershed Study (MacDonald and James 2011), and the South Fork Wages Creek Watershed Study (RiverMetrics 2011). Both of these approaches have had limited use for adaptive management, and have only addressed water quality and aquatic habitat concerns. The Effectiveness Monitoring Committee (EMC) was formed in 2014 to develop and implement an effectiveness monitoring program to address both watershed and wildlife concerns and to provide a better active feedback loop to policymakers, managers, agencies, and the public.

Figure 1 Monitoring Types

Commented [SLF2]: Inserted by Co-Chair based on July 8th EMC discussions

- Implementation — Assess whether management practices were conducted as designed and planned.
- Compliance — Monitoring used to determine whether specific rule, regulation, code or policy is being met.
- Effectiveness — Evaluation of whether a specific management practice had the desired effect.
- Project — Assesses the impact of a specific management activity or project. Can be a subset of Effectiveness monitoring.
- Validation — Evaluation of existing data sets or models
- Baseline — To identify temporal variability for planning and future comparison.
- Trend — Conducted at regular, well-spaced intervals to determine long-term trend to evaluate management practices or evaluate models.

(Adapted from MacDonald et al. 1991)

1.1 EMC Charter

The charter directs the EMC to be a collaborative, transparent, and science-based monitoring effort and process-based understanding of the effectiveness of the California Forest Practice Rules and other natural resource protection laws, codes and regulations including the California Endangered Species Act, federal Endangered Species Act, Porter Cologne Water Quality Act, federal Clean Water Act and Fish and Game Code, herein after referred to as the FPRs and associated regulations, in maintaining or enhancing water quality, aquatic habitat, and wildlife habitats (Figure 1).

Commented [SLF3]: Co-chair edits based on July 8th EMC discussion

1.1.1 EMC Current Membership

In 2014, the Board of Forestry and Fire Protection (Board) appointed two co-Chairs, 15~~fifteen~~ committee members and identified five support staff (Appendix A). The members represent a wide range of natural resource expertise from academia, state and federal agencies, private and state forestland owners, and the public. Their expertise includes forest management, hydrology, geology, aquatic ecology, fisheries, wildlife management, and resource monitoring and sampling. The committee has held initial meetings to develop the committee structure and tasks for 2015. Currently the co-chairs are facilitating meetings to ensure all actions and recommendations are made by consensus whenever possible. If failure to reach consensus occurs, the record (i.e. meeting notes) shall specify the key differences and the reasons consensus could not be reached. In 2015, the co-Chairs and Executive Officer of the Board established each committee members respective term duration (Appendix A).

Figure 2~~1~~ EMC charter goals

(a) Provide a framework and support to comply with the reporting requirements of AB 1492 (Appendix B).

(b) Support an adaptive management process by providing feedback to the Board regarding California FPRs effectiveness.

(c) Facilitate and recommend monitoring practices to evaluate how well current practices restore and maintain riparian, aquatic, and terrestrial habitat on private and state forestlands for state and federally listed species and priority species of concern (aquatic and terrestrial).

(d) Ensure that the process is consistent with the goals of the Clean Water Act for water quality on private and state forestlands

(e) Ensure that the process is consistent with the goals of the Federal and State Endangered Species Acts on private and state forestlands.

(f) Ensure that appropriate scientific methods and statistical evaluation, when necessary, are used to evaluate effectiveness of California FPRs and other forestry-related laws and regulations.

(g) Encourage dissemination of information through general public and scientific outlets.

(h) Promote use of State Demonstration Forests for effectiveness monitoring of FPRs, water quality laws and Fish and Game codes, and other forestry-related laws and regulations.

1.1.2 EMC Ground Rules

As described in the EMC Charter, EMC meetings shall be publicly noticed and will be open to all interested parties, following the Bagley-Keene Open Meeting Act requirements. Board appointed EMC members are encouraged to follow meeting "ground rules" to foster a collaborative scientific-based approach to achieving the stated goals and objectives of the EMC.
These ground rules include a commitment to:

(1) Attempt to reach consensus.
(2) Attend all scheduled meetings.
(3) Listen carefully and ask questions to better understand unclear issues.
(4) Have the EMC receive priority attention, staffing, and time.
(5) Have all EMC members clearly define the purposes and goals of their organizations.
(6) Have all EMC members recognize the legitimacy of the goals and differing perspectives of other EMC member organizations.

1.2 EMC Annual Reporting

The EMC will periodically report milestones and accomplishments to the Board. This periodic reporting will typically occur as an annual report to the Board, stakeholders and the public. Annually, the Board provides a report to the Legislature which documents Board and Department progress toward attainment of their previous goals and allows for public input on the direction of future Board goals. It is anticipated that in the first years of the EMC this annual report will be part of the Boards annual report to the Legislature. As significant accomplishments are achieved, the EMC annual report will be a standalone report to the Board.

1.3 EMC Personnel and Funding

The EMC anticipates that dedicated staff and funding may be necessary to achieve some EMC goals and objectives, and support projects reviewed and supported by the EMC. Public agencies and departments including CAL FIRE, CDFW, ~~State and Regional~~ Water Boards, CGS, U.S. Forest Service, NMFS and the California Natural Resources Agency (CNRA) have committed personnel to participate in the EMC discussions and meetings. Private landowners, conservation groups and universities have also committed personnel. CAL FIRE has also committed specific personnel to provide technical support to the EMC. Currently, for fiscal year 2015/2016, Board staff has requested the addition of one staff person funded by the Timber Regulation and Forest Restoration Fund ~~(TRFR)~~ to specifically support EMC efforts.

During development of the EMC Strategic Plan several critical needs for future personnel and funding have been identified. Typically, these critical needs will be necessary when EMC members and stakeholders cannot provide the necessary level of support or specialized technical expertise necessary to complete EMC sponsored projects. Critical needs identified include (not necessarily in order of importance):

- Literature review by technical expert(s).
- Study design or statistical review.

- Specialized statistical analysis or modeling
- Sponsorship of graduate students or contribution to an existing university study(s).
- EMC planning, scheduling, meeting notes, annual reporting and making periodic updates to the EMC webpage.
- Ability to respond to rare and large event monitoring (see Section 4.2.2).
- EMC supported projects that require additional support for participation of university(s), specialized consulting or non-government organizations.
- Support for projects consistent with AB 1492 Working Groups. Also see Section 2.2 for more information related to the TRFR program.
- Funding to reimburse~~for paying~~ EMC members travel costs for meetings.
- Organizing and holding public outreach meetings to share EMC project information.
- Obtaining other sources of data or information for EMC sponsored projects (e.g. LiDAR~~dar~~, aerial photo acquisition).

2.0 EMC STRATEGIC PLAN OR "ROAD MAP"

The EMC Strategic Plan is the "road map" that will guide how the Committee intends to achieve the EMC goals and objectives. It is the intent to use the EMC Strategic Plan as a living document that is periodically updated. The overall EMC Strategic Plan is guided by seven primary objectives described in the EMC Charter which, for the purposes of developing critical monitoring questions, has been edited and summarized in Figure 2.

Figure 3~~2~~ Primary objectives in developing critical monitoring questions

- Seek, accept and consider questions from stakeholders and the interested public.
- EMC members, in conjunction with the Board, should identify critical monitoring questions that address various EMC goals and objectives.
- Develop guidance for appropriate scientific methods and statistical evaluation used to evaluate effectiveness of California Forest Practice Rules.
- Increase understanding of the linkage between forest practices and the resource(s) of concern.
- Provide guidance for the acceptable level of scientific uncertainty across the broad spectrum of monitoring efforts from small-scale short-term monitoring to long-term replicated studies.
- Collaboratively develop methods to prioritize monitoring questions, and based on these methods, help select the highest priority projects to monitor.
- Promote collaborative fact-finding and understanding of scientific results at local, regional, and state levels.

2.1 Development of Critical Monitoring Questions

The first step in developing critical monitoring questions the EMC has sought and accepted ~~was seeking and accepting~~ priorities and monitoring questions from a wide variety of stakeholders including agency(s), department(s), b~~B~~oard(s), EMC members and identifying key areas of concern of the interested public. Development of critical monitoring questions is an open and transparent public process where inclusion of priorities and public comments can followed on the EMC web page (http://bofdata.fire.ca.gov/board_committees/effectiveness_monitoring_committee/). The EMC reviewed the various proposed priorities and monitoring questions and developed critical monitoring questions. The second step was to submit to the Board for review a final list of critical monitoring questions along with a draft Strategic Plan. As part of their review the Board may provide guidance or suggested changes to the draft Strategic Plan. The EMC will consider Board guidance or suggested changes and submit a final list of critical monitoring questions with the Strategic Plan. Appendix D summarizes priorities and monitoring questions received, to date, from various stakeholders. The third step is once critical monitoring questions are finalized, specific monitoring projects described in Appendix E will be evaluated (detailed information on project evaluation process is provided in Appendix G). The final step is to initiate EMC sponsored projects. The following sections~~summaries~~ are ~~intended to be~~ a brief summary of the priorities and monitoring questions listed in Appendix D.

Commented [SLF4]: Co-chair edits based on July 8th EMC discussions.

2.1.1 Board of Forestry and Fire Protection - Committee Priorities

For 2014, the Board's Forest Practice Committee and Management Committee provided six and two priorities, respectively. The Forest Practice Committee priorities focus, not necessarily in order of importance, on roads, cumulative effects and slash treatment. The Management Committee priorities focus on WLPZ effectiveness emphasizing use of Demonstration State Forests as potential sites for monitoring. All Board committee topics are discussed in more detail in the priorities included in Appendix D. Detailed information on how the EMC intends to monitor cumulative effects is provided below.

2.1.2 Board of Forestry and Fire Protection - Cumulative Effects

The Board identified cumulative effects during committee discussions and as priority in their Annual Report (Board 2014). Cumulative impacts originates in CEQA under ~~are defined in the FPRs (~~14 CCR § 15355~~)~~. The EMC recognizes that management practices may have either positive or negative cumulative impacts. The EMC will refer to cumulative effects and cumulative impacts as interchangeable terms.

The Board understands that natural processes are complex and highly variable over time and space. In addition, our understanding of these processes and linkages are imperfect. However, it is known that on-site control of potential impacts offers the most direct and rapid mitigation of potential impacts and provides the best opportunity to increase our understanding of cause-and-effect relationships (i.e. linkages) between management and resources of concern. Also, if potential adverse impacts are minimized at the local scale, there should be reduced potential cumulative effects at a larger scale (MacDonald 2000). To attempt to address this priority the Board made three recommendations relevant to the EMC : (1) focus on effectiveness monitoring activities to support~~provide~~ adaptive management approaches (MacDonald 2000), (2) research new computer modeling to improve analysis

(Benda et al. 2007), and (3) improve collection of information from on-going analysis to create watershed databases for agencies and public use.

The EMC also recognizes that cumulative effects encompass a broad spectrum of natural processes and their linkages over time and space (MacDonald 2000, MacDonald et al. 2004, Reid 1993). The EMC has developed two compatible frameworks regarding how to monitor and evaluate potential cumulative effects. One, to monitor at relatively smaller spatial and temporal scales the causal linkages between FPRs and associated regulations and the resource(s) of concern, with special emphasis on understanding the management impacts on a particular resource and/or controlling natural process(es)(MacDonald and Coe 2007). Also, improved study designs that identify appropriate spatial and temporal scales and identify potential variable interaction and indirect effects can greatly reduce spurious monitoring results (MacDonald 2000). This approach would limit problems that have confounded many previous attempts to manage cumulative effects by monitoring discrete causal linkages between FPRs and associated regulations and resource(s) of concern (MacDonald 2000).

Many aquatic resources including public trust resources can also occupy habitat in larger watersheds and terrestrial resources at large spatial scales. Accordingly, monitoring and evaluating potential cumulative effects is also needed at these relatively larger spatial and longer temporal scales. However, at larger spatial and longer temporal scales understanding of potential cumulative effects are limited by wide variation in study site conditions, forest management effects on different site conditions, limited ability to isolate indirect effects, difficulty in validating predictive models that are typically used at larger scales, and uncertainty of future environmental events over longer temporal scales (MacDonald 2000). To minimize these potential limitations, we propose a second compatible framework that uses a nested approach for monitoring, so that a hierarchy of information can be used to untangle the complexities that are inherent at larger spatial and longer temporal scales (MacDonald 2000). In other words, a hierarchical, nested approach to monitoring would help elucidate important linkages between site and project scale manipulations and ecological response at the watershed and regional scale. With this second compatible framework we can begin to better understand and establish linkages between the FPRs and associated regulations and the ecological performance of public trust resources of concern.

Similarly, many terrestrial public trust resources, including snags, dens, and nest trees for listed and other sensitive wildlife species are assumed to contribute to the overall health of timberlands, and the potential for cumulative effects to such resources are to be evaluated at multiple spatial scales per Technical Rule Addendum No. 2. For example, habitat elements like snags are an important component of wildlife habitat, providing nesting and denning substrate for numerous species and complexity to forest structure, thus contributing to biological diversity. The FPRs contain specific measures to maintain and recruit key habitat elements like snags at the individual logging area scale so that potential adverse cumulative effects can be avoided at the biological assessment area scale (e.g. planning watershed). However, the FPRs also include exceptions to snag retention requirements for fire hazard reduction, safety, and other reasons (14 CCR § 919.1). In general, information regarding the FPRs effectiveness for snag retention is lacking, and is similarly lacking for other wildlife habitat components and characteristics, such as for protection of nest sites, retention and recruitment of large woody debris, hardwood cover, and late seral habitat connectivity. Thus, carefully designed and robust monitoring studies are needed to provide information on the effectiveness of Technical Rule Addendum No. 2 in identifying potential cumulative effects to wildlife habitat, and the opportunity for feedback and adaptive management. Due to the robust monitoring necessary and complexity of monitoring terrestrial

resources across large, biologically relevant scales, that typically include multiple public and private landowners, monitoring of these terrestrial resources may also be appropriate for the AB 1492 Working Groups.

2.1.3 California Department of Fish and Wildlife

The California Department of Fish and Wildlife (CDFW) suggests a number of FPRs have long warranted monitoring for their effectiveness in helping to ensure timber operations do not cause or aggravate significant direct or cumulative effects on the environment and help to conserve public trust resources. In particular, there has been a paucity of information collected on the FPRs effectiveness regarding direct and cumulative effects on terrestrial wildlife resources. These include FPRs intended to protect, in particular, sensitive and other special-status species, maintain and recruit key habitat elements (e.g. snags), maintain late-succession forest stands, and avoid habitat fragmentation and/or maintain habitat connectivity. The effectiveness of the FPRs individually and cumulatively should be demonstrated as meeting the objectives stated under 14 CCR § 897 "Implementation of the Act Intent", including:

"(B) Maintain functional wildlife habitat in sufficient condition for continued use by the existing wildlife community within the planning watershed and, (C) Retain or recruit late and diverse seral stage habitat components for wildlife concentrated in the watercourse and lake protection zones and as appropriate to provide functional connectivity between habitats".

Overall, effective FPRs related to wildlife values should support forest ecosystem function, structure and species composition within defined ranges that constitute properly functioning conditions.

2.1.4 State and Regional Water Quality Control Boards

The ~~State and Regional Water Board Quality Control Boards (~~Water Boards~~)~~ priorities are to participate in and support monitoring studies designed to increase our understanding of the effectiveness of FPRs and associated regulations in protecting the beneficial uses of water from existing and potential impacts of forest management, and facilitate adaptive management to improve those FPRs and associated regulations, as necessary. While modern forestry practices have been substantially improved since the passage of the Z'Berg-Negedly FPA in 1974 (Board 2014), the cumulative effects of past and ongoing land uses have degraded the health and proper function of aquatic ecosystems and beneficial uses of water in forested watersheds throughout the state. The Water Boards priorities for impaired water bodies are to evaluate FPRs and associated regulations effectiveness to prevent or minimize sediment discharge and restore impaired aquatic and riparian function, and preserve and restore cold water through effective shade on watercourses. The spatial and temporal scale of monitoring studies may vary from short-term site or project-specific to long-term watershed or regional scales. Additional monitoring studies are needed to evaluate fuel loading in the WLPZs, restocking requirements, fuel breaks, and best management practices applied during and after timber harvest activities in wildfire-affected areas.

Commented [SLF5]: Water Boards to provide text to further clarify the meaning of preserve in this context.

Monitoring studies should be designed to evaluate both the specific FPRs and associated regulations effectiveness and long-term watershed trends to help inform adaptive management of the FPRs and associated regulations, as they apply to all FPRs projects. Monitoring should be designed with clear

objectives and goals, posing clear questions and using methods that can reasonably be expected to answer specific questions. An important component of the monitoring efforts should be a well-defined process for adaptive management based on study results. To establish reliability and enhance the confidence in the results, studies should use existing data collection standards or protocols linked to accessible data repositories appropriate for the type of data collected.

2.1.5 California Geological Survey

The California Geological Survey's (CGS) priorities focus on increasing our understanding of the FPRs effectiveness with regard to mass wasting, erosion, fluvial processes, and the construction techniques used for facilities such as roads, landings, and watercourse crossings. Management activities that affect these geologic processes have the potential to create local and cumulative effects to resources and in some cases public safety. Due to the diverse geologic, topographic, and climatic conditions across the state, management activities also have the potential to result in different levels of impact in specific terrain (e.g. steep convergent slopes vs. gentle convex slopes), in different portions of the state (e.g. areas with high rainfall and weak geologic materials vs. areas with lower rainfall and strong geologic materials), as well as when the activities are conducted (e.g. during the winter vs. the summer). Where and when management activities are conducted, as well as the practices employed, are critical to FPRs effectiveness. Monitoring activities that evaluate the geologic and construction practices above must take into account the geographic and temporal conditions where they are employed, and recognize that stochastic events (such as significant storms, rain on snow events, large earthquakes, and large wildfires) often have profound effects on the landscape. These events will also have a significant effect on the results of monitoring activities (e.g. monitoring during a drought vs. monitoring following a 20 year recurrence interval storm). Effective FPRs will address management activities such that geologic related impacts are reduced to less than significant. To achieve this, geologic related monitoring studies must include the range of short-term to long-term, of site-specific to regional scales, as well as response to episodic rare or large events.

~~Also, b~~Beyond geologic focused monitoring, aquatic and terrestrial effectiveness monitoring should also identify what appropriate temporal scale or specific rare and large events which may need identification as part of effectiveness monitoring. Identifying the appropriate temporal scale will assist in separating effectiveness of current FPRs versus potential impacts from forest management legacies (see Section 4.2) ~~Also~~Additionally, identifying rare and large events events like landslides and floods or impacts from drought, disease or wildfire can assist in separating effectiveness of current FPRs and associated regulations. Most importantly, some specific FPRs may need to be evaluated for effectiveness following both forest management operations and rare and large events (see Section 4.2.1).

2.1.6 California Department of Forestry and Fire Protection

The California Department of Forestry and Fire Protection (CAL FIRE) monitoring priorities are to evaluate the implementation (i.e., compliance) and effectiveness of the FPRs in protecting water quality, as has been undertaken for the past 20 years (see Section 2.4, Appendix H), and also to evaluate the FPRs effectiveness in protecting wildlife habitat for Board-listed sensitive and other important species.

Based on the results of previous monitoring programs, CAL FIRE encourages the EMC to undertake specific projects to determine the FPRs effectiveness related to WLPZ, road, and watercourse crossing requirements in maintaining acceptable water temperatures and nutrient inputs, as well as reducing management-related sediment inputs. More rigorous and scientifically defensible tests of the effectiveness of individual practices are needed. For example, monitoring of unstable area identification and unstable area prescription effectiveness is needed. ~~Post-mortem m~~Monitoring specifically for roads and watercourse crossings following large hydrologic events (e.g. storm recurrence intervals exceeding 20 years covering a large hydrologic basin) is needed to test the effectiveness of contemporary forest practices (see Section 4.2.2~~1~~). The current FPRs effectiveness for meeting Basin Plan water quality objectives should also be an EMC priority. Further information is needed on chronic turbidity durations and spatial distributions at a watershed scale, and on their impacts to anadromous salmonid growth and survival.

Interactions between riparian conditions and in-stream nutrient dynamics must be better understood to appropriately manage riparian zones. Improved understanding is needed on how differences in riparian stand structure and composition affect seasonal light levels and nutrient availability, which influence primary production and thus salmonid production. On-going debates over appropriate levels of timber harvest in riparian zones make this a high priority research item for CAL FIRE. Factors affecting headwater stream temperatures also need to be better understood, particularly related to effectiveness of FPR protection measures for Class II watercourses. Additionally, the effectiveness of aquatic restoration projects needs more rigorous testing. Habitat restoration is critical for the survival of listed anadromous fish species in the Coast Ranges and CAL FIRE supports continued effectiveness monitoring of large wood enhancement projects undertaken to improve habitat for salmonids.

CAL FIRE believes that wildlife habitat effectiveness monitoring should be a high priority for the EMC. For example, CAL FIRE ~~the Department~~ encourages the EMC to develop monitoring efforts to determine the effectiveness of measures used to ensure take avoidance and avoid significant adverse impact for Board-listed sensitive and other important species. CAL FIRE will work through the EMC to collaborate with the other agencies on current wildlife monitoring efforts and to develop new monitoring approaches for sensitive species.

Commented [SLF6]: Based on July 8th EMC discussion

Finally, CAL FIRE supports effectiveness monitoring efforts in watersheds selected as pilot projects under AB 1492. CAL FIRE is beginning work with the other Review Team agencies to test a pilot approach for assembling available data on the planning watershed level to assess cumulative effects and identify opportunities for restoration of habitat for listed anadromous salmonids. Implementation of a proposed 'Watershed Pilots Program' will be used to develop strategies for data assembly and sharing for consistent THP preparation and review, to identify needs and opportunities for restoration, and to enable the development of forest practice ecological performance measures.

2.1.7 U.S. Forest Service ~~Federal Agency(s) and Public Stakeholders~~

The U.S. Forest Service (USFS), our state university system and the public have a mutual interest in supporting monitoring efforts that are well designed, advance our scientific understanding of natural processes and are re-integrated through adaptive management into the FPRs. Also, the USFS is embracing an "all-lands" approach - working with adjacent landowners to reach common management

goals. Several of the environmental factors that the USFS are required to monitor occur across administrative and ownership boundaries. The appropriate scale for monitoring will often include adjacent public and private lands. The EMC has an opportunity to develop shared monitoring between public and private lands.

In addition, the 2012 U.S. Forest Service Planning Rule (http://www.fs.usda.gov/planningrule) (36 CFR Part 219) requires the National Forests to create a monitoring program as part of new Land and Resource Management Plans. "...Each plan monitoring program must contain one or more monitoring questions and associated indicators addressing each of the following:

(i) The status of select watershed conditions.
(ii) The status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems.
(iii) The status of focal species to assess the ecological conditions required under § 219.9.
(iv) The status of a select set of the ecological conditions required under § 219.9 to contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern.
(v) The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.
(vi) Measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area.
(vii) Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities.
(viii) The effects of each management system to determine that they do not substantially and permanently impair the productivity of the land (16 U.S.C. 1604(g)(3)(C)~~). [36 CFR § 219.12]~~..."

2.1.8 NOAA National Marine Fisheries Service

NOAA's National Marine Fisheries Service (NMFS) supports the Board's EMC charter goal of ascertaining whether the FPRs and associated regulations maintain or enhance water quality and aquatic habitat, particularly habitat that supports salmon and steelhead listed under the federal Endangered Species Act. NMFS also supports the overarching goal of SB 1642 to create a unified effectiveness monitoring strategy to serve as a "road map" for focusing effort on the most urgent issues.

Seven species of salmon and steelhead are federally listed as threatened or endangered in California. Timber harvest is identified as a contributing factor that negatively impacts these listed species and their habitat. Recovery plans for these species recommend that the FPRs and associated regulations be evaluated and, if needed, modified to achieve sufficient habitat condition and population abundance necessary for recovery. NMFS encourages the Board to evaluate the effectiveness of FPRs and associated regulations addressing the rate of timber harvest and cumulative effects.

Examining a single FPR may not be the most effective approach in determining the effectiveness of regulating cumulative impacts in all cases. Rather, examining a suite of FPRs and associated regulations which are intended, collectively, to contribute to controlling cumulative impacts may be more informative. In addition, a proper examination of cumulative impacts likely involves study at site,

watershed, and regional scales by tracking trends in important indicators of species population health and habitat condition. While cumulative impacts may be avoided or minimized through site- or project-level controls (such as those found at FPRs within the 14 CCR 916 series), validating whether such controls are effective at avoiding significant cumulative impacts, or degree to which they are minimized at various scales, is important for informed regulation of timber harvest in watersheds supporting listed salmonids.

2.1.9 Public Stakeholders

Commented [sf7]: Co-chair inserted Section 2.1.9 based on July 8th EMC discussions.

For the purposes of this Strategic Plan, public stakeholders include citizens, private landowners, universities and colleges, and a wide variety of interest groups. Because no one persons or entity can speak on behalf of public stakeholders, this summary is intended describe input received from public stakeholders during the development of the Strategic Plan. Since continued input from public stakeholders is welcomed by the EMC, the Strategic Plan will be updated annually.

One consistent comment received from multiple conservation groups and individuals is to have the EMC Strategic Plan development, committee discussions, and public meetings as open and transparent as possible. To meet this public expectation, all EMC meetings are publically noticed with meeting agendas, previous meeting notes, and all EMC documents posted on the Board website under the EMC webpage. In addition, all EMC meetings are broadcast live via webinar with the goal of continuing to improve internet broadcast of meetings and interaction with the public.

In general, public stakeholders support monitoring efforts that are well designed, advance our scientific understanding of natural processes and are re-integrated through adaptive management into the FPRs and associated regulations. Accordingly, the EMC Strategic Plan places a strong emphasis on identifying well designed scientific studies (Section 4.0) that will be able to inform review of existing FPRs through an Adaptive Management Framework (Section 3.0).

2.2 Ecological Performance - Timber Regulation and Forest Restoration Program

The Timber Regulation and Forest Restoration (TRFR) Program is directed by AB 1492 to develop ecological performance measures for state and private forestland management. The program is at only the very initial stages of this work, having released draft charters in late 2014 for several working groups, including the Ecological Performance Measures Working Group and the Data and Monitoring Working Group. Ultimately, the ecological performance measures will drive the monitoring questions that the TRFR Program needs to answer. In addition to relying on monitoring data currently being collected by a wide range of entities, the TRFR Program may be able to allocate resources from the TRFR Fund to develop additional monitoring that may be needed to support the ecological performance measures. Based on the draft Working Group charters, it will be some time in the future—mid-2016 at the earliest—that the working set of ecological performance measures will be developed.

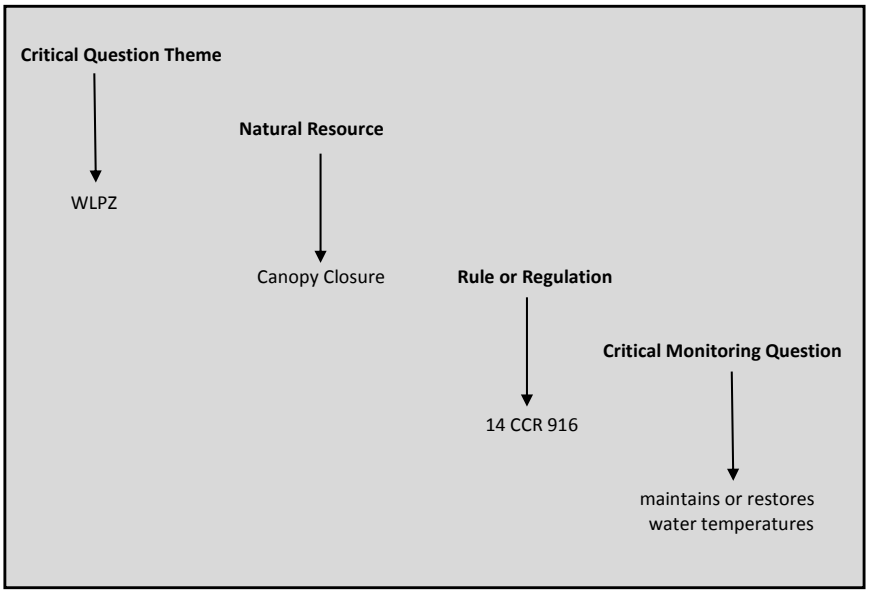
2.3 EMC Categories and Critical Monitoring Questions

EMC members, in conjunction with the Board, have reviewed priorities and monitoring questions provided by a wide variety of stakeholders and how they may achieve various EMC goals and objectives

(See Appendix D for more detail). The specific FPR for each priority or monitoring question and associated regulation or policy is also described in Appendix D. The EMC has transformed the priorities into ~~categories and~~ critical monitoring questions following a specific structure which is intended to improve understanding and allow better comparisons between multiple monitoring questions (Figure 4). ~~. Each critical monitoring question is structured to identify: (1) Forest Practice Rule, Water Quality Objective, Fish and Game Code or Regulation, (2) Management Practice, (3) Temporal or Geographic Scope or Scale, (4) Natural Resource, and (4) Public Resource (Figure 3). The following critical monitoring questions are proposed and summarized by categories.~~

Figure 43 Example: EMC critical monitoring question structure

Commented [SLF8]: To attempt to reduce confusion the Co-chair did not make changes in track change within the text box



During the development of critical monitoring questions the EMC summarized the questions by critical question themes~~resource categories~~. The ~~critical~~ monitoring questions were summarized into a total of ten individual themes~~resource categories~~. Also, to provide the Board and public with a better understanding of the EMC member discussions, the EMC then prioritized each of the ten ~~individua~~individual themes~~l resource categories~~. EMC members prioritized the themes~~resource categories~~ based on their own individual professional judgement. This prioritization was intended to provide initial focus to High and Medium themes~~resource categories~~. Depending on funding opportunities, existing monitoring projects already underway, and other considerations, lower priority themes~~resource categories~~ may also be EMC supported. The prioritization followed a general categorical scale of High, Medium or Low priority~~relative importance~~, and the themes~~resource categories~~ were prioritized as follows:

High	WLPZ Riparian Function, Watercourse and Channel Sediment, Road and WLPZ Sediment and Wildfire Hazard.
Medium	Mass Wasting Sediment, Fish Habitat and Wildlife Habitat: Cumulative Effects
Low	Wildlife Habitat: Species and Nest Sites, Wildlife Habitat: Seral Stages and Wildlife Habitat: Structure.

Theme~~Cate~~ 1: WLPZ Riparian Function

One goal of the FPRs is to consider THPs in the context of planning watersheds to ensure watershed integrity and to consider potential adverse cumulative impacts, including impacts on the quality and beneficial uses of water (14 CCR § 897). Also, the intent of the FPRs is to ensure that timber operations do not potentially cause significant adverse site-specific and cumulative adverse impacts to the beneficial uses of water, native aquatic and riparian-associated species, functions of riparian zones or result in an unauthorized take of listed aquatic species (14 CCR § 916). Specifically, watercourse and lake protection (14 CCR § 916) provide measures to ensure timber operations meet the goals and intent of the FPRs. Riparian areas occur dynamically within watersheds adjusting to successional vegetation changes and annual hydrologic events and other disturbances (e.g. wildfires, wind, insect, diseases). Accordingly, the following critical questions should focus on the natural processes and function of WLPZs and have allowances for the dynamic nature of these management areas.

Commented [sf9]: Co-chair inserted introduction text for each Theme based on July 8th EMC discussions. Text is intentionally paraphrased from existing FPR goal, intent or rule language.

Critical Questions:

Are t~~T~~he FPRs and associated regulations ~~and Water Board Objectives~~ effective in … ~~ness on private forestlands and Demonstration State Forests in all Districts to …..~~

(a) maintaining and restoring canopy closure. ~~within the natural range of variability~~ *(Implementation and Compliance)*

(b) maintaining and restoring stream water temperature. ~~within the natural range of variability~~ *(Effectiveness)*

(c) retaining predominant conifers in WLPZs. (*Implementation and Compliance*) and monitor large woody debris input to watercourse channels (*Effectiveness)*

(d) retaining of conifer and deciduous species to maintain or restore riparian shade, maintaining or restoring water temperature, and ~~within the natural range of variability~~ maintaining or restoring primary productivity.

(e) maintaining or restoring~~e~~ input of organic matter to maintain or restore primary productivity as measured by macroinvertebrate assemblages. *(Note: Monitoring may also be appropriate for the AB1492 Working Groups).*

(f) maintaining and restoring~~e~~ riparian function of Class II-L watercourses in the Coast District.

(g) maintaining and restoring~~e~~ riparian function of Class II-L watercourse in the Northern District.

(h) WLPZ management to reduce or minimize potential fire behavior and rate of spread.

(i) filtering sediment that reaches~~for~~ WLPZs. ~~to filter sediment.~~

Commented [SLF10]: Moved from Theme 3

Theme~~Category~~ 2: Watercourse Channel Sediment

One goal of the FPRs is to consider THPs in the context of planning watersheds to ensure watershed integrity and to consider potential adverse cumulative impacts, including impacts on the quality and

beneficial uses of water (14 CCR § 897). Also, the intent of the FPRs is to ensure that timber operations do not potentially cause significant adverse site-specific and cumulative adverse impacts to the beneficial uses of water, native aquatic and riparian-associated species, functions of riparian zones or result in an unauthorized take of listed aquatic species (14 CCR § 916). Specifically, silviculture practices (14 CCR § 913), harvesting practices and erosion control measures (14 CCR § 914), watercourse and lake protection (14 CCR § 916), and logging roads, landings and logging road watercourse crossings (14 CCR § 923) provide measures to ensure timber operations meet the goals and intent of the FPRs.

Critical Questions:

Are t~~T~~he FPRs and associated regulations effective in ~~and Water Board objectives effectiveness on private forestlands and Demonstration State Forests in all Districts in~~ minimizing management-related sediment delivery from forest management activities to watercourse channels by …

(a) monitoring at watershed and sub-watershed level in managed watersheds.
(b) monitoring individual Plans to evaluate channel response to forest management prescriptions and additional mitigation measures.

(Note: Monitoring may also be appropriate for the AB1492 Working Groups).
(see Section 4.2 for discussion of appropriate scale(s)).

Theme~~Category~~ 3: Road and WLPZ Sediment

One goal of the FPRs is to consider THPs in the context of planning watersheds to ensure watershed integrity and to consider potential adverse cumulative impacts, including impacts on the quality and beneficial uses of water (14 CCR § 897). Also, the intent of the FPRs is to ensure that timber operations do not potentially cause significant adverse site-specific and cumulative adverse impacts to the beneficial uses of water, native aquatic and riparian-associated species, functions of riparian zones or result in an unauthorized take of listed aquatic species (14 CCR § 916). Specifically, silviculture practices (14 CCR § 913), harvesting practices and erosion control measures (14 CCR § 914), watercourse and lake protection (14 CCR § 916), and logging roads, landings and logging road watercourse crossings (14 CCR § 923) provide measures to ensure timber operations meet the goals and intent of the FPRs.

Critical Questions:

Are the ~~The~~ FPRs and associated regulations~~, Water Board Objectives, and Fish and Game Code regulations~~ effective in … ~~ness on private forestlands and Demonstration State Forests in all Districts … (see Section 4.2 for discussion of appropriate scale(s)).~~

(a) ~~to~~ reducinge or minimizinge management-related generation of sediment and delivery to watercourse channels.
~~(b) for WLPZs to filter sediment.~~
(b~~c~~) ~~of Road Rules 2013 to~~ reducinge generation and sediment delivery to watercourse channels when timber operations implement the Road Rules 2013 measures.~~.~~

Commented [SLF11]: Moved to Theme 1

(cd) ~~to~~ reducinge the effects of large storms on landslides as related to roads, watercourse crossings and landings.

(de) ~~to~~ maintaining or improvinge fish passage through watercourse crossing structures.

(see Section 4.2 for discussion of appropriate scale(s))

ThemeCategory 4: Mass Wasting Sediment

One goal of the FPRs is to consider THPs in the context of planning watersheds to ensure watershed integrity and to consider potential adverse cumulative impacts, including impacts on the quality and beneficial uses of water (14 CCR § 897). Specifically, timber operations shall be planned and conducted to provide mitigation measures to minimize sediment delivery from unstable geologic features (14 CCR § 923).

Critical Questions:

Are the ~~The~~ FPRs and associated regulations effective in minimizing sediment delivery from …~~ness on private forestlands and Demonstration State Forests in all Districts to minimize sediment delivery from~~…

(a) existing chronic unstable geologic features to maintain water quality.

(b) mass wasting during episodic rare events and/or large storms to maintain water quality *(See Section 4.2.2~~1~~)*

(c) mass wasting from high risk ~~vulnerable~~ geologic features.

ThemeCategory 5: Fish Habitat

One goal of the FPRs is to consider THPs in the context of planning watersheds to ensure watershed integrity and to consider potential adverse cumulative impacts, including impacts on the quality and beneficial uses of water (14 CCR § 897). Specifically, timber operations shall be planned and conducted to provide protection for water temperature control, streambed and flow modifications by large woody debris, filtration of organic and inorganic material, upslope stability, bank and channel stabilization, and spawning and rearing habitat for salmonids (14 CCR § 916.4(b)).

Critical Questions:

Are ~~The~~ FPRs and associated regulations effective in …~~ness on private forestlands and Demonstration State Forests in all Districts in …~~

(a) describing and mapping the distribution of foraging, rearing and spawning habitat for anadromous salmonids (*Implementation and Compliance).*

(b) maintaining and restoring the distribution of foraging, rearing and spawning habitat for anadromous salmonids (*Effectiveness*).
(Note: Monitoring may also be appropriate for the AB1492 Work Groups).

~~(c) describing and mapping distribution of foraging, rearing and spawning habitat for other cold-water species (*Implementation and Compliance).*~~

Theme~~Category~~ 6: Wildfire Hazard

A goal of the FPRs is the production and maintenance of forests which are healthy and naturally diverse (14 CCR § 897). Specifically, minimum stocking standards (14 CCR § 912.7), special silvicultural methods and stocking requirements (14 CCR § 961), silvicultural objectives and regeneration methods (14 CCR § 913), logging slash and hazard reduction (14 CCR § 917), exemptions which facilitate removal of dead, dying or diseased trees (14 CCR § 1038), emergency notices which also facilitate removal burned, dead, dying or diseased trees (14 CCR § 1052) and fuel hazard reduction (14 CCR § 1051), all provide measures to ensure timber operations meet the goals and intent of the FPRs.

Critical Questions:

Are the~~The~~ FPRs and associated regulations effective~~ness~~ in ~~wildfire hazard reduction on private forestlands and Demonstration State Forests in all Districts for~~…

(a) treating post-harvest slash and slash piles to modify~~reduce~~ fire behavior.
(b) treating post-harvest slash and retaining wildlife habitats structures including snags and large woody debris.
(c) management of fuel loads,~~-~~ vegetation patterns and fuel breaks for fire hazard reduction.

Theme~~Category~~ 7: Wildlife Habitat: Species and Nest Sites

One goal of the FPRs~~The FPRs~~ is to maintain functional wildlife habitat in sufficient condition for continued use by the existing wildlife community within the planning watershed (14 CCR § 897). More specifically the FPRs require that timber operations shall be planned and conducted to maintain suitable habitat for wildlife species (14 CCR § 919).

Commented [SLF12]: Co-chair edits based on July 8th EMC discussion.

Critical Questions:

Are the FPRs and associated regulations effective at protection of nest sites…

(a) following general protection measures in~~following~~ 14 CCR § 919.2(b)
(b) following species specific habitat and disturbance measures in~~following~~ 14 CCR § 919.3

Are the FPRs and associated regulations effective ~~The FPRs and guidance effectiveness~~ for the Northern spotted owl ~~on private forestlands and Demonstration State Forests in Northern District~~ to…

(a) ensure take avoidance ~~of~~ following 14 CCR § 919.9 and 14 CCR § 919.10.
(b) ensure take avoidance ~~of~~ following 14 CCR § 919.9(g).
(c) maintain adequate amounts of suitable habitat to protect and conserve owls.
(Note: Monitoring (c) may also be appropriate for the AB1492 Working Groups).

Theme~~Category~~ 8: Wildlife Habitat: Seral Stages

One goal of the FPRs~~The FPRs~~ is to maintain functional wildlife habitat in sufficient condition for continued use by the existing wildlife community within the planning watershed (14 CCR § 897). More specifically the FPRs require that timber operations shall be planned and conducted to maintain suitable habitat for wildlife species (14 CCR § 919). Also, the FPRs require a Cumulative Impacts Assessment (14 CCR § 898) to be completed that includes, but not limited to, the overall biological habitat condition within both the THP and planning area. Technical Addendum No. 2 provides specific guidance that the assessment of biological habitat conditions should consider: snags and den trees, down, large woody debris, multistory canopy, road density, hardwood cover, later seral forest characteristics and later seral habitat continuity (14 CCR § 912.9)

Commented [SLF13]: Co-chair edits based on July 8th EMC discussion.

Critical Questions:

Are the FPRs and associated regulations effective at…

(a) retaining and recruiting late and diverse seral stage habitat components in WLPZs for wildlife.

(b) maintaining or increasing ~~of~~ the amount and distribution of late succession forest stands for wildlife.

(c) maintaining or recruiting adequate amounts of early- and mid-seral habitats.
(Note: Monitoring may also be appropriate for the AB1492 Working Groups).

Theme~~Category~~ 9: Wildlife Habitat: Cumulative Impacts

One goal of ~~The~~ the FPRs is to maintain functional wildlife habitat in sufficient condition for continued use by the existing wildlife community within the planning watershed (14 CCR § 897). More specifically the FPRs require that timber operations shall be planned and conducted to maintain suitable habitat for wildlife species (14 CCR § 919). Also, the FPRs require a Cumulative Impacts Assessment (14 CCR § 898) to be completed that includes, but not limited to, the overall biological habitat condition within both the THP and planning area. Technical Addendum No. 2 provides specific guidance that the assessment of biological habitat conditions should consider: snags and den trees, down, large woody debris, multistory canopy, road density, hardwood cover, later seral forest characteristics and later seral habitat continuity (14 CCR § 912.9)~~including Technical Rule Addendum No. 2 effectiveness on private forestlands and Demonstration State Forests in all Districts in…~~

Commented [SLF14]: Co-chair edits based on July 8th EMC discussion.

Critical Questions:

Are the FPRs and associated regulations effective at…

(a) characterizing and describing terrestrial wildlife habitat and ecological processes.

(b) avoiding significant adverse impact to terrestrial wildlife species.
(Note: Monitoring for (a) may also be appropriate for the AB 1492 Working Groups).

Theme~~Category~~ 10: Wildlife Habitat: Structures

One goal of ~~The~~ the FPRs is to maintain functional wildlife habitat in sufficient condition for continued use by the existing wildlife community within the planning watershed (14 CCR § 897). More specifically the FPRs require that timber operations shall be planned and conducted to maintain suitable habitat for wildlife species (14 CCR § 919). Also, the FPRs encourage retention of structural elements or biological legacies through the implementation of Variable Retention silviculture (14 CCR § 913.4(d)).

Critical Questions:

Is the Variable Retention silviculture effective in meeting:

(a) ecological objectives including co-benefits.
(b) social objectives.
(c) geomorphic objectives.

Are the FPRs and associated regulations effective in retaining a mix of stages of snag development that maintain properly functioning levels of wildlife habitat.

Are the FPRs and associated regulations effective in retaining native oaks where required to maintain wildlife habitat (14 CCR § 959.15).

2.4 Catalog of ~~and Review of Past and~~ Ongoing Cooperative and Individual Monitoring Projects

Numerous ongoing California watershed and wildlife-related monitoring projects and projects planned for implementation in the near future need to be considered by the EMC to avoid duplication and help focus priorities for critical monitoring questions. This catalog displayed in Appendix H builds on and updates the catalog developed by Coe (2009) for the Board~~OF's~~ Monitoring Study Group titled "Water Quality Monitoring in the Forested Watersheds of California: Status and Future Directions." Only major studies being conducted on non-federal timberlands related to topics being considered by the EMC are included. The EMC may also studies conducted in mixed ownership landscapes or conducted on federal timberlands. General background/trend monitoring projects without specific objectives/hypotheses are omitted, as are Waiver/General Waste Discharge Report~~WDR~~-related monitoring.

The catalog is divided into two sections. This first part lists cooperative studies being undertaken (i.e., those with participation from multiple monitoring entities). In this document, "cooperative" implies that significant resources (i.e., funding, staffing, and/or equipment) are provided by all the partners involved with the project. The second section lists monitoring projects being conducted primarily by individual entities. Projects listed are those that EMC member and staff were aware of as of June 2015. It is recognized that the catalog is incomplete and will change over time, since (1) a comprehensive survey of potential forest monitoring entities was not undertaken, and (2) land ownership changes will occur. The EMC Strategic Plan is considered a "living document" that we anticipate updating annually, including this monitoring catalog. Critical information necessary to update the catalog includes the monitoring entity(s) conducting the project, study title, general monitoring objectives/hypotheses being investigated, principle investigator(s), and brief sources of additional information (e.g., website links, references).

Commented [SLF15]: Co-chair edits based on July 8th EMC discussion.

Commented [SLF16]: Co-chair edits for this Theme 10 were made with track change off by mistake.

Commented [SLF17]: Co-chair edits based on July 8th EMC discussions.

2.5 EMC Proposed Monitoring Projects - 2015

See Appendix G for the process that will be used to determine which critical monitoring questions will be selected for initial study by the EMC.

3.0 BOARD - ADAPTIVE MANAGEMENT FRAMEWORK

The Board has previously discussed the benefits of implementing an Adaptive Management Framework (Board 2014[p], EMC 2014). The Adaptive Management Framework is and overall strategy designed to consider scientific information provided by the EMC to better inform Board policy (Figure 4). Specifically, the Board will review results of EMC sponsored scientific studies to determine how effective the FPRs and associated regulations are in meeting goals and objectives of the FPRs, Water Quality Objectives, and Fish and Game Code and regulations. In addition to results of scientific studies, the Board will consider the following four goals as part of the Adaptive Management Framework:

Commented [SLF18]: Co-chair edits based on July 8th EMC discussions.

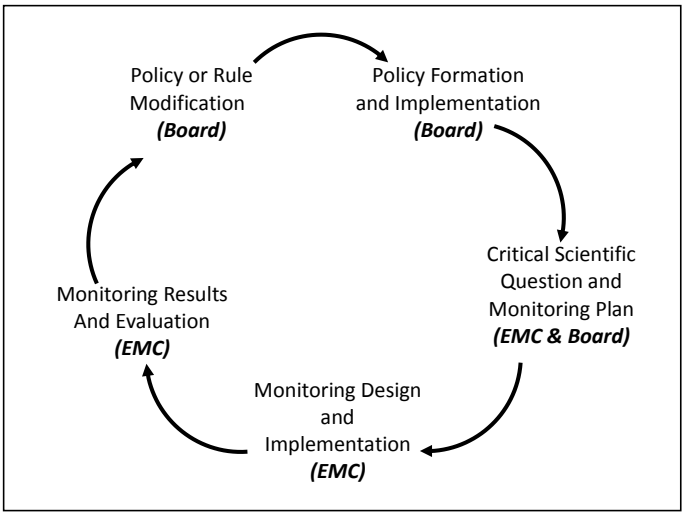
(1) To provide compliance with the state and federal Endangered Species Acts for species found on state and private forestlands.

(2) To maintain and restore forest-dependent species on state and private forestlands.

(3) To meet the requirements of the federal Clean Water Act and Porter-Cologne Water Quality Control Act on state and private forestlands.

(4) To keep private forestlands economically viable in the State of California.

Figure 4 The Adaptive Management Framework using EMC sponsored monitoring to better inform Board policy and regulations.



When the Board reviews scientific information from EMC sponsored studies it is important for Board members to understand the overall context and implications of the research. To achieve this objective

the Board shall review information provided in the scientific report and additional information provided by the EMC that describe:

(1) The scientific or policy relevance of the study.

(2) The overall quality of the study design and results.

(3) Confidence in results explaining the effectiveness of the FPRs, Water Quality Objectives, or Fish and Game Code or regulations.

In addition, the Board has discussed a scientific report review checklist in more detail. Appendix C contains a detailed description of this checklist. One portion of the checklist refers to scientific questions appropriate for the EMC while the Board portions of the checklist refers to more policy based questions.

4.0 APPROPRIATE SCIENTIFIC METHODS AND REPORTS

4.1 Study Design within an Adaptive Management Framework

The goal of any effectiveness monitoring study design is to determine if the FPRs and associated regulations related to natural resources are maintaining and/or restoring desired ecological conditions ~~performance~~. Monitoring studies in California will need to be able to detect changes in the environment from both individual and cumulative activities that are both spatially and temporally distributed on the landscape, and results will be used in an adaptive management framework to inform forest management policies and practices.

Because of the complexity and uncertainty surrounding natural resource management, study protocols will be embedded within an adaptive resource management model, summarized as:

(1) Defining the objectives and scope of management;
(2) Developing operational p~~P~~lans to meet the objectives;
(3) Implementing plans;
(4) Collecting information about the impacts of the p~~P~~lans;
(5) Evaluating the collected information in light of stated objectives; and
(6) Adjusting p~~P~~lans in light of new information.

Adaptive management "provides a framework for making good decisions in the face of critical uncertainties, and a formal process for reducing uncertainties so that management performance can be improved over time." (Williams et al. 2009). Each of the steps of the adaptive resource management cycle, and its relevance for the EMC, is elaborated below.

Defining the objectives and scope of management issue – Studies considered by the EMC need to be designed to address: (1) existing or proposed forest management practices and; (2) objectives as defined through legislation (e.g. ESA, FPA), FPRs and associated regulations, and/or by stakeholders. Studies should state the management objectives that they are addressing, and include relevant answerable research questions. These research questions can include ecological, economic, and social considerations, as appropriate.

Developing operational plans to meet the objectives and **implementing plans** – The EMC will evaluate impacts from forest management activities planned and implemented by landowners, managers, and researchers. Research designs may be observational (testing existing management or conditions or analyzing existing datasets) or based on experimental designs. In either case, the anticipated outcomes of forest management and contribution toward achieving defined objectives will be stated upfront, based on a thorough literature review outlining existing knowledge and research gaps.

Monitoring studies must have valid designs, allowing for proper inferences about the phenomenon of interest. There are several broad potential approaches to designing effectiveness monitoring studies. One involves sampling populations, typically by comparing response variables from one set of treatments with another set of treatments (e.g. control-treatment). A second approach is through the use of experiments where treatments are deliberately prescribed and randomly assigned to experimental units. The advantage of the experimental approach is that the treatments may be of

greater forest management intensity than the current FPRs allow and the results of an experiment can provide information that would not be available from a sample.

Studies will need a careful sampling design based in previous literature or pilot tests to determine population variability, and to perform statistical power analysis for determining adequate sample sizes. The high natural variability commonly found in natural systems can make finding appropriate comparative groups (e.g. control and treatment) difficult, as the goal is to have these groups as similar to each other as possible to allow for the detection of differences.

Collecting information about the impacts of the plans – The EMC will rely on information collected through monitoring, which can take multiple forms, including baseline monitoring (measuring current conditions); trend monitoring (measuring attributes over time); effectiveness monitoring (measuring whether objectives of a project have been met); and validation monitoring (testing whether models are accurate).

Evaluating the collected information in light of stated objectives – The EMC will evaluate data for evidence of consistency with identified objectives. Evaluation will frequently take the form of statistical testing, using either frequentist or Bayesian statistical methods. However, data will take multiple forms and they will be analyzed according to the research questions posed and to the expertise available. At times, statistical stringency may be less important than bringing appropriate knowledge to bear on pressing issues.

Adjusting plans in light of new information – Findings of the EMC should have means for integration into future forest management plans, through changed policy, landowner outreach, or other means. In addition, findings of the EMC should supplement existing and ongoing research conducted by other researchers (see Appendix H).

Because of the multiple, competing objectives for forest lands in the state of California, the EMC will not be able to objectively state the "best" course of action for policy makers or managers. Rather, the EMC will collect as much information as possible to evaluate the impacts of forest policies and management decisions in light of identified management objectives. The adaptive management process facilitates learning "not by trial and error, but by a structured process," resulting in reduced uncertainty (Allen and Gunderson 2011).

~~4.1.1 Resource Benefit~~ (Moved to 4.2.4)

Commented [SLF19]: Moved based on July 8th EMC discussion.

4.2 Appropriate Temporal and Geographic Scale

This section provides guidance for selecting appropriate spatial and temporal scales when designing a monitoring study. Spatial scale defines the geographic area of a study such as a road segment, hillslope, or watershed. Temporal scale defines the time period of interest. In forest practice, this may be as short as one storm event or span several decades. Most FPR effectiveness monitoring studies conducted to date have focused on the site scale (e.g. road segment, harvest unit, stream reach) and are directed at prescription effectiveness over one to four year periods (e.g. Brandow and Cafferata 2014).

The selection of appropriate spatial and temporal scales for a monitoring study requires a review of current knowledge, understanding of the issue and professional judgment. Scale selection must correspond to the specific study objectives, which should define the resource of concern (e.g. water quality), the controlling factors affecting the resource of concern, and the scale of those controlling processes (e.g. hillslope, reach or watershed scale). For time scales, controlling processes should be identified as deterministic or stochastic. Deterministic processes are finite and produce the same result for a given set of input variables whereas stochastic (probabilistic) processes are indeterminate – they produce a range of possible outcomes defined by a probability distribution. The temporal scale of a study should be at least as long as the duration (including lag times) of controlling processes relevant to the study objectives. Temporal and spatial scale are not effortlessly separated, and knowledge of variability over time and space is necessary to effectively allocate monitoring efforts (Bunte and MacDonald, 1999).

Typically, monitoring at large spatial or temporal scales increases the number and complexity of controlling processes, making it difficult to discern specific linkages between a controlling process and resource of concern. This can add uncertainty to study findings (MacDonald and Coe 2007). Consequently, monitoring projects should focus on the smallest spatial and temporal scales necessary to achieve the study objectives. Using an adaptive management framework, experience and refinements made from initial study phases can be used to adjust temporal and spatial scales so that study objectives are achieved. To address more complex study objectives, a monitoring plan framework of nested and cross-referenced monitoring studies at a range of scales can be applied (MacDonald 2000). Such a monitoring plan framework can be used to identify scale linkages and increase certainty in cause and effect relationships for complex studies, as well as save on costs and resources over the long-term (Cafferata and Reid 2013).

4.2.1 Range of Variability

Natural variability is an inherent characteristic of healthy ecosystems and plays a beneficial role in maintaining ecosystem functions and processes (Holling and Meffe, 1996). Natural variability is a product of:

(1) Ecosystem processes functioning at different spatial scales and differing rates and vary by several orders of magnitude;

(2) The spatial attributes of ecosystems (e.g. productivity, species composition, seral stages), which are not constant and are scale dependent;

(3) Ecosystems may display multiple stable states, instead of single equilibria, which maintain overall structure and diversity (Hollings and Meffe, 1996); and,

(4) Disturbance regimes (including frequency, spatial arrangement and severity of disturbance)(Swanson et al. 1993).

Approaches and concepts used to characterize natural variability include historical range and variability (Keane et al., 2009), natural range of variability (Landres et al., 1999), and the use of properly

Commented [SLF20]: The sub-committee did significant edits to this section 4.2.1 Co-Chair apologizes that I could not preserve the original versus changes when the new 4.2.1 was inserted into the document.

functioning condition (PFC) matrices (NMFS, 1996; Marshall, 2001) or assessments (Prichard, 1998). All these approaches seek to acknowledge and quantify natural variability, with the goal of providing guidance and context and direction for managing healthy and resilient ecosystems (Landres et al., 1999; Keane et al., 2009). In this section we use the term 'natural range of variability' (NRV) to characterize these concepts, but do not adhere to any particular approach expressed in the literature.

Characterizing NRV requires an understanding of how controlling ecosystem processes vary over time and space, and how these processes affect the ecosystem resource(s) of concern. As such, the concept of NRV can provide a basis for evaluating the feasibility of achieving desired management outcomes, the impacts and tradeoffs that might occur from different management alternatives, and may ultimately improve our capacity to manage dynamic ecosystems (Landres et al., 1999). In application, NRV assessments are often broad in scope and can be limited by available data, scale effects, assessment methodology, and study complexity (Keane et al., 2009). NRV assessments typically include an approach to optimize the use of available data, such as the identification of key indicator variables to quantify management impacts (Marshall, 2001; Hillman and Giorgi, 2002) or the use of a 'weight-of-evidence' approach (NCRWQCB, 2006). NRV assessments must be carefully tailored to temporal and spatial scales appropriate for the resource(s) of concern and controlling processes. Key indicator variables or PFCs may not be transferable over time and space. For example, in forest practice, anthropogenic effects caused by land development, fire suppression and climate change can significantly alter the historical NRV and affect study design for long-term (decade-scale) assessments.

Range of Variability and Effectiveness Monitoring

A primary goal of the EMC is to determine the effectiveness of the FPRs and associated regulations in achieving regulatory standards and possibly identify a need to modify the standards based on scientific, verifiable monitoring results. Many of these regulatory standards are based on a central tendency (average) or narrow range of values that represent an optimum or static resource condition, and are typically applied uniformly across large areas. Thus, the use of regulatory standards runs counter to the notion of natural variability, which emphasizes the dynamic character of ecosystems (Hollis and Meffe, 1996; Reeves et al., in press). Currently, the FPRs and associated regulations address NRV to only a limited extent by providing classifications that represent an average condition for a particular range of spatial and temporal variability. For example:

1. Productivity of the land is reflected in stocking rules such that less productive lands have lower stocking standards,

2. FPRs and associated regulations protecting watercourse zones vary, in part, based on flow, presence of aquatic life, and domestic water use, and

3. Geographic variability in climate and soil conditions is broadly represented by specific rules that apply to distinct forest districts (Coast, Northern and Southern).

It is recognized that monitoring the effectiveness of different forest practices in achieving a regulatory standard and consideration of whether those practices maintain the resource of concern within its natural range of variability are two fundamentally different questions that may be incompatible within a monitoring study. For example, historical range of variability is best defined at spatial scales ranging

Commented [TTE21]: This last phrase is adapted from the EMC Charter, Item 1(4) (on page 1).

from approximately 40 to 400 square miles (Keane et al., 2009); however, this scale of analysis may not be compatible or feasible within a monitoring study design that assesses management practice effectiveness at the hillslope or planning watershed scale. In some cases, incorporating NRV into a monitoring study may provide additional insight into the effectiveness of management practices in achieving desired resource goals and objectives.

A NRV analysis may also point out whether the regulatory standards being monitored fall within a biologically relevant range. Additionally, monitoring may show a practice fails to meet a regulatory standard, but the effect may be biologically insignificant as the outcome is within the range of NRV. All of these will potentially assist the Committee in reporting rule effectiveness to the Board.

If NRV is to be included in an effectiveness monitoring study then its limitations must be considered, such as the frequent paucity of data to characterize NRV for ecosystem processes at a variety of scales (Keane et al., 2009).

Except as discussed above, due to the scope and scale of NRV in monitoring studies, it is not anticipated that effectiveness monitoring studies will address NRV unless data exist for the process or resource(s) of concern. If quantifying NRV for a given process or ecological condition becomes a high priority need, then a larger effort will likely be required with a specific study design at an appropriate scale to address the problem. Finally, if one is unable to define NRV, then a greater effort will need to be part of every project to describe biologically relevant changes.

4.2.2 Rare or Large Event Monitoring

Monitoring in most forested areas is typically too short-lived to sample the variability of natural and disturbed hydrologic systems, and has a low probability of documenting environmentally significant events such as large floods, landslides and debris flows. Dispersed monitoring seldom captures the linkages between large natural disturbance events with the transitory effects of forest practice activities (Dunne, 2001). A comprehensive monitoring program should have a component that addresses the intersection of management and stressing events so that the effectiveness of forest practices can be evaluated across the widest range of environmental conditions. These events are not just hydrologic events, but can be from a variety of natural phenomena or may be from a combination of natural events such as those listed below:

(1) Rain-on-snow events that cause rapid increase in stormwater runoff, which can overwhelm drainage systems.
(2) A single storm or sequences of storms that saturate the soils that promote conditions where landslides can deliver a variety of sizes of sediment and woody debris to streams.
(3) Earthquakes that can instantaneously trigger land sliding through ground shaking, or an steepen slopes and/or weaken hillslope materials to where instability is triggered in subsequent rainfall events.
(4) Drought that can cause significant low flow that may compromise passage of aquatic organisms through estuaries and drainage structures, or can increase the likelihood of stream dewatering during water drafting operations.

(5) Drought that may lead to conditions where dense riparian conditions can result in higher burn intensities within WLPZs and increased spread within watersheds.
(6) Large wildfires that affect large components of a bioregion or watershed, affecting significant numbers of aquatic and terrestrial organisms.
(7) Episodic forest pest and/or disease-induced tree mortality exacerbated by prolonged periods of drought and/or higher than normal temperature regimes; and
(8) Wind storm events causing loss of mature trees to windthrow across very large areas.

An effectiveness monitoring program that relies on annual measurements may not capture the information necessary to determine the effectiveness of these practices relative to larger events. Kirchner et al. (2001) found that catastrophic erosion events are infrequent and of short duration, but can control long-term sediment yield. They also noted that land use activities may alter the probability or magnitude of catastrophic events. Since these events are rare they should be proactively targeted for effectiveness monitoring.

Therefore, a different approach to standard monitoring is needed that will be able to respond to the large or rare events immediately following their occurrence and for some period of time after. This type of monitoring will require that a reserve of funds be set aside to respond immediately to the sites following the occurrence of a rare or large event to determine the effectiveness of the modern practices; an approach referred to as "post-mortem" monitoring (Stewart et al., 2013). Examples of past monitoring after large flood events include Furniss et al.'s (1998) evaluation of watercourse crossing performance in Washington, Oregon and northern California, and Robison et al.'s (1999) review of landslide impacts from large storms in western Oregon. In California, specific research questions can be addressed, such as (1) are unstable area prescriptions (e.g., canopy retention, leave areas within unstable landforms) effective for mitigating against mass wasting during high magnitude, low frequency storm events; or (2) are flows in culverts and their outlets meeting their minimum depth requirement for organism passage during low flows or do flows become hyporheic that results in the culverts and their outlets becoming a barrier. These are examples of using infrequent events to determine the effectiveness of the FPRs and associated regulations related to natural resources. Categories of rare events need to be created so that when they occur in California, a pre-approved effectiveness monitoring or research plan will be enacted to study the performance of the FPRs and associated regulations.

We recommend that effectiveness monitoring or research plans be prepared in advance of these events. A critical component of any monitoring or research design is to identify the rare or large event that triggers "post-event" monitoring. Resources must be allocated prior to event occurrence so that resources can be deployed when a rare or large event occurs. The types of resources required will be determined by the pre-approved monitoring or research plan. The goal is to immediately respond to the opportunities as they arise to maximize the ability to detect the performance of the FPRs and associated regulations during these rare or large events. Timing can be critical, as much of the forestry monitoring or research evidence can quickly fade away or be lost during restoration activities or other management activities. Once a rare or large event has occurred, the following procedure will be implemented:

(1) Determine that the rare event has occurred; the authority to make this determination will be the EMC.

(2) Notify the appropriate response team and deploy other necessary resources, (i.e., a road failure, a landslide, or a post-fire assessment will require specific sets of skills). These will be preselected and could be available on an on-call contractual basis.

(3) After review of the rare or large event, a pre-approved study plan will be reviewed and modified to best match the conditions that resulted from the rare or large event. Minor adjustments to the monitoring or research plan can be made and then executed without delay.

4.2.3 Anadromous Fish Monitoring

Commented [SLF22]: Based on previous EMC meeting comments, edits provided by Stacy S. and sub-committee on turbidity.

Chinook and coho salmon and steelhead trout in California have complex life cycles, not only among the different species, but also among the different runs of species. As anadromous fish, meaning those that reside most of their adult lifes rear in the ocean and return to freshwater to spawn, adults and juveniles and adults of some species may hold in freshwater for extended periods while others spend more of their life history in the ocean. Fisheries managers typically monitor adult escapement and juvenile outmigrants to determine the status and trends of fish populations. State, federal, and local agencies, tribes, and various private entities and landowners have collected and some are currently collecting fish population data in California. Available data varies from long-term and , abundant data to data that is typicallyare limited spatially and temporally. Determining impacts to fish populations requires intensive, multi-year monitoring, as trends may not be determined for many years due to high natural variability as well as the complexity of fish life cycles. For example coho salmon typically have a three year life cycle so a minimum of nine years of population data would be required to capture a minimum three year trend for each cohort. Also due to the complexity of fish life cycles, the quality and/or abundance of available data, and other confounding factors (such as climate change, ocean conditions, predator-prey dynamics, etc.), it may be difficult to make any correlations betweenfrom timber harvesting impacts or restoration projects to fisheries populations, particularly at a reach or watershed scale.

Similarly, fishery biologists and other resource professionals monitories managers use stream habitat parameters and indicators such as habitat typing, benthic macroinvertebrate assemblages, spawning substrate, stream temperature, suspended sediment, flow regimes, turbidity, and riparian vegetation data to make inferences about determinations of project impacts toon fish populations. As with monitoring fish populations data, this type of monitoring is widely conducted across California by government agencies and private entities using accepted protocols. Habitat data are relatively easy to collect, less costly, and less intensive than fish population monitoring. It is also easy to document any changes, either positive or negative, from timber harvesting or restoration projects on a reach or watershed scale within a short time frame. Sediment filling in pools and changes in stream temperature can rapidly document negative impacts from projects and similarly changes in pool-riffle ratios and macroinvertebrate assemblages can provide quick results to determine project success. Elevated stream turbidity can impact growth and survival of fish by reducing their ability to forage and affecting gill function and condition. Continuous turbidity monitoring provides information on the magnitude and duration of those values that can negatively impact fish. These various This types of monitoring allows managers to make inferences on impacts to fish populations from timber operations. For these reasons, the EMC will focus primarily on streamfisheries habitat monitoring and, when available, will use fish population data as a basis to evaluate the effectiveness of specific FPRs and associated regulations'.another line of evidence to document any changes.

4.2.4~~1.1~~ Resource Benefit

So Board members can better evaluate cost of implementing the existing FPRs and associated regulations, the Board has requested the EMC to also evaluate resource benefit of EMC sponsored projects. As an example, the Board has requested that the FPRs Road Rules 2013 be evaluated for effectiveness in providing resource benefit and an economic cost of rule implementation. The EMC reviewed this request by the Board and determined that, if appropriate, relevant, and feasible, ~~every~~ EMC sponsored projects should also include an evaluation.

For each individual EMC sponsored project an evaluation may~~will~~ be completed of the resource benefit and economic cost of implementing the specific existing FPRs and associated regulation. This evaluation may be completed by the principal investigator or the EMC. The evaluation could~~will~~ be completed using the following guidance:

(1) The amount of detail should be tailored to the overall potential economic cost to landowners. (e.g. Higher potential economic cost requires more detail)
(2) If relevant, the evaluation should attempt to distinguish between land owner types; state vs. private and large versus small landowners.
(3) If relevant, the evaluation should attempt to distinguish between Plan types: THP, MTHP, NTMP, PTEIR, WFMP, Emergency Notice or Exemptions.
(4) The evaluation should describe geographically by Region or County, if appropriate, where resource benefits and economic cost of the existing FPRs and associated regulations may be different.

In summary, the purpose of evaluating economic costs is to enable analysis of resource benefits within the context of resulting landowner economic burdens~~, recognizing that there is frequently a tradeoff between existing FPRs and regulations and maintaining a viable private forestland management economy.~~

4.3 Scientific Uncertainty

The Board recognizes there is overall scientific uncertainty concerning how forested ecosystems function within the framework of managed forestlands. There is also uncertainty in how various ecosystem components and processes might relate to one another. Therefore, the EMC and Board recognize that while we will attempt to increase our scientific understanding of ecosystem components or processes in managed state and private forestlands, we may never fully understand these processes. Even with these known uncertainties, the EMC and Board will pursue a better understanding of how effective the FPRs and associated regulations, Water Quality Objectives and Fish and Game codes and regulations are in achieving their goals

4.4 EMC Reports

Members of the EMC or principal investigators conducting monitoring will synthesize the results into final reports for the EMC. The reports shall include descriptions of purpose and need, scientific

methods, results and technical analysis, evaluation of implications for resources and forest management operations, and disclosure of any possible limitations of results and any scientific uncertainty. The reports shall not provide policy or regulatory recommendations, other than ideas for potential further refinement of study methods to address any significant limitations and remaining scientific uncertainty. All final reports will be made available to the public on the EMC webpage.

All reports shall discuss the statistical, physical and biological relevance of the monitoring and results. Due to relatively small sample sizes and lack of controls for both dependent and independent variables associated with "specific question" studies, statistically rigorous testing of water-quality, aquatic habitat and wildlife resource questions is often difficult. However, well developed resource monitoring questions can improve scientific monitoring designs so that they limit spurious results and enhance the range of inference. Both statistical and biological relevance of the monitoring and the resulting acceptable level of scientific uncertainty should be clearly stated in each monitoring proposal and final report.

Results and findings of individual EMC reports are to be reviewed and discussed by the Board's Research and Science Committee (RSC). However, review by the RSC is for the specific purpose of developing long-term strategic planning by the RSC. Development of possible rule language options (see Section 3.0) based on results and findings of EMC reports, if necessary, shall be proposed by or brought before the Board's Forest Practice Committee for review and comment prior to submittal to the full Board.

Commented [SLF23]: Co-chair comment, some EMC members were not aware that the RSC does still exist and functioning.

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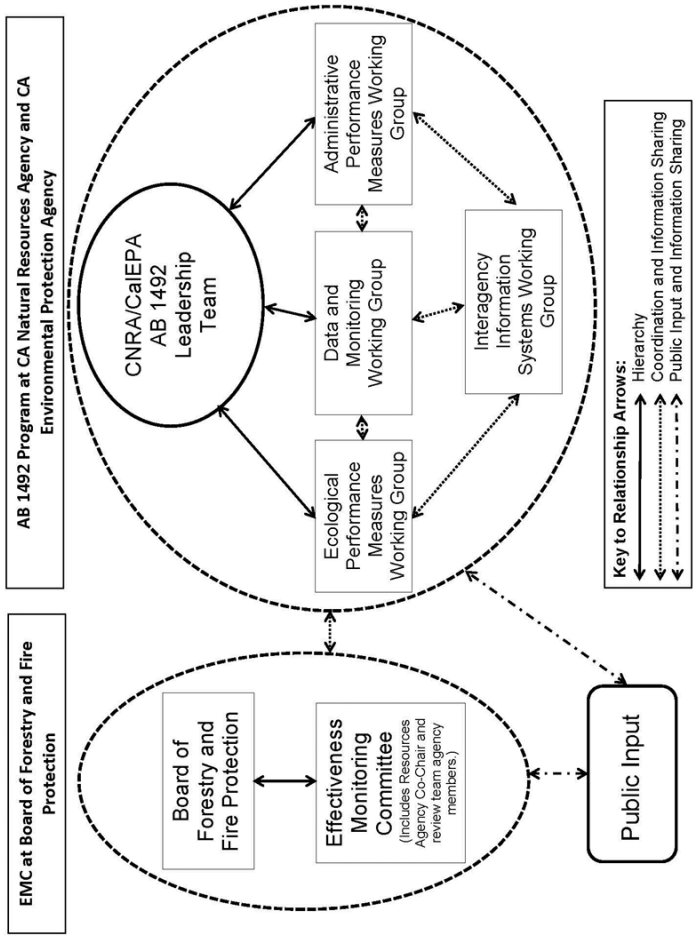
APPENDIX A: EMC APPOINTED MEMBERS AND STAFF

Name	Specialty	Affiliation	Term Expiration
Russ Henley	Co-Chair RPF 2560	California Natural Resources Agency	
Stuart Farber	Co-Chair RPF 2585	Board of Forestry and Fire Protection	
Agency Representatives			
Matthew Bokach	Wildlife	USFS	
Bill Condon	Wildlife RPF 2461	CDFW	
Drew Coe	Hydrology/Forestry RPF 2981	CAL FIRE	
René Leclerc	Geology/Hydrology	CVRWQCB	
Clarence Hoestler	Fisheries	NOAA/NMFS	
Nick Kunz	Water Quality	SWQCB	
Bill Short	Geology/Watersheds	California Geological Survey	
Jim Burke Fred Blatt	Geology/Water Quality	NCRWQCB	
Monitoring Community			
Kevin Boston	Forestry/Engineering RPF 2370	Oregon State University	7/1/2017
Erin Kelly	Forest Policy/Economics RPF 3001	Humboldt State University	7/1/2017
Brian Dietterick	Forest Hydrology	Cal Poly San Luis Obispo	7/1/2016
Tom Engstrom	Wildlife/Botany RPF 1936	Sierra Pacific Industries	7/1/2016
Matt House	Hydrology/Fisheries	Green Diamond Resources Co.	7/2/2017
Sal Chinnici	Wildlife	Humboldt Redwood Company	7/2/2017
Ed Smith	Forest Ecology	The Nature Conservancy	7/1/2016
Support Staff			
Matt Diaz	ActingExecutive Officer RPPF 2773	Board of Forestry and Fire Protection	
Pete Cafferata	Hydrology/Forestry RPF 2184	CAL FIRE	
Stacy Stanish	Biology/Fisheries RPF 3000	CAL FIRE	
Bill Solinsky	Forestry RPF 2297	CAL FIRE	
Dave Fowler	Geology/Water Quality	NCRWQCB	

APPENDIX B: ORGANIZATIONAL FRAMEWORK OF AB1492



APPENDIX C: ADAPTIVE MANAGEMENT FRAMEWORK CHECKLIST

Framework Responsibility	Adaptive Management Checklist
EMC	**Overall Scientific or Policy Relevance** 1. Does the study better inform understanding of effectiveness of FPR's? 2. Does the study better information understanding of Water Quality Objectives and Fish and Wildlife Code or regulations? 3. Does the study contribute to understanding achievement of numeric or performance targets set by agencies or departments?
EMC	**Overall quality of the study design and results** 1. Was the study design and analysis of results consistent with EMC recommendations? 2. Are study results scientifically relevant and significant?
EMC	**Confidence in results explaining effectiveness of FPR's** 1. What is our previous scientific understanding and how have the results better informed our current scientific understanding? 2. What scientific uncertainty remains in our current understanding? 3. What is the relationship between this study and other that may be planned, underway or recently completed? 4. Feasibility of obtaining additional information to better inform policy and what will the additional information provide? 5. What will additional information or studies cost and timelines for completion?
BOARD	**Review scientific results and additional EMC information** 1. Develop appropriate management policy from information provided by EMC. 2. If management policy action is necessary, identify options and determine how feasible each option is from an operational and regulatory perspective. 3. If Board action is necessary, identify whether appropriate for Committee development or full Board review.

APPENDIX D: PRIORITY RECEIVED FROM BOARDS, DEPARTMENTS & AGENCIES

(Priorities received have been grouped by critical question themy~~resource category~~).

Theme	Sub-theme ~~& Category~~	Critical Question Theme	Natural Resource	Rule or Regulation	Priority or Monitoring Question	Submitted by and Year	Associated~~Related Statute,~~ Regulation, or Policy
1	*1.1*	WLPZ	Canopy closure	916.5 [936.5, 956.5] (e) G, I 916.9 [936.9, 956.9] (a)(7) 916.9 [936.9, 956.9] (f)(2)(A),(B),(C) 916.9 [936.9, 956.9] (f)(3)(A),(B),(C),(D),(F) 916.9 [936.9, 956.9] (f)(4)(A),(B),(C) 916.9 [936.9, 956.9] (g)(2(B)(1) 916.9 [936.9, 956.9] (g)(2)(B)(2)(iii)	WLPZ effectiveness in maintaining canopy closure and water temperature?	MSG (2009)	FGC § 1602(a) & 1603(a)
	1.2	WLPZ	Canopy closure	916.5 [936.5, 956.5] (e) G, I 916.9 [936.9, 956.9] (a)(7) 916.9 [936.9, 956.9] (f)(2)(A),(B),(C) 916.9 [936.9, 956.9] (f)(3)(A),(B),(C),(D),(F) 916.9 [936.9, 956.9] (f)(4)(A),(B),(C) 916.9 [936.9, 956.9] (g)(2(B)(1) 916.9 [936.9, 956.9] (g)(2)(B)(2)(iii)	Evaluate adequacy of FPR canopy retention standard in preserving pre-harvest effective shade; in particular, whether the minimum canopy retention provided on Class I and II-L watercourses preserves or restores site specific potential effective shade.	Water Boards (2015)	FGC § 1602(a) & 1603(a)
	1.3	WLPZ	Canopy closure	916.5 [936.5, 956.5] (e) G, I 916.9 [936.9, 956.9] (a)(7) 916.9 [936.9, 956.9]	FORPRIEM (revised) - Implementation and compliance of WLPZ canopy requirements~~shade~~	CALFIRE (2014)	FGC § 1602(a) & 1603(a)

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Commented [SLF28]: , shade is not emphasized in the FPRs - canopy is the parameter that is enforceable.

				(f)(2)(A),(B),(C) 916.9 [936.9, 956.9] (f)(3)(A),(B),(C),(D),(F) 916.9 [936.9, 956.9] (f)(4)(A),(B),(C) 916.9 [936.9, 956.9] (g)(2(B)(1) 916.9 [936.9, 956.9] (g)(2)(B)(2)(iii)			
	1.4	WLPZ	Canopy closure	916.5 [936.5, 956.5] (e) G, I 916.9 [936.9, 956.9] (a)(7) 916.9 [936.9, 956.9] (f)(2)(A),(B),(C) 916.9 [936.9, 956.9] (f)(3)(A),(B),(C),(D),(F) 916.9 [936.9, 956.9] (f)(4)(A),(B),(C) 916.9 [936.9, 956.9] (g)(2(B)(1) 916.9 [936.9, 956.9] (g)(2)(B)(2)(iii)	Monitoring effectiveness of WLPZ canopy closure in Demonstration State Forests harvest plans.	BOF-MC (2014)	FGC § 1602(a) & 1603(a)
	1.5	WLPZ	Riparian function	916.4 [936.3, 956.4] (a),(b)	The effectiveness of implementing Section 916.4(a) and Section 916.4(b) in protecting, maintaining and/or restoring the functions set forth in Section 916.4(b).	CDFW (2015)	FGC § 1602(a) & 1603(a)
	1.6	WLPZ	Riparian function	916.9 [936.9, 956.9] (c)(4) 916.9 [936.9, 956.9] (g)	Effectiveness of Class II-L rules to protect, maintain and restore riparian function	BOF-FPC (2014)	FGC § 1602(a) & 1603(a)
	1.7	WLPZ	Riparian Function	916.9 [936.9, 956.9] (c)(4)	Evaluate how effectively the ASP Class II-L definition breaks out watercourses with summertime flow ~~(to put it another way~~, i.e. how Class II S watercourses have water during summer months so that compliance with the Basin Plan temperature objective may be an issue.	MSG (2009) Water Boards (2015)	

Commented [SLF29]: mid summer stream flow is not a criteria for determining a Class II-L watercourse anymore

	1.8	WLPZ	Riparian Function	916.9 [936.9, 956.9] (c)(1)(2)(3)	WLPZ tree blowdown and potential impacts or benefits to water quality.	MSG (2009) EMC (2015)	FGC § 1602(a) & 1603(a)
	1.9	WLPZ	Riparian Function	916.9 [936.9, 956.9] (g)(2)(B)	Effectiveness of FPRs in retaining predominant conifers in all WLPZs as recommended in Section 916.9(g)(2)(B), such as focusing practices on thinning from below and maintaining large woody debris input to streams.	CDFW (2015)	FGC § 1602(a) & 1603(a)
	1.10	WLPZ	Riparian Function	916.5 [936.5, 956.5] (e) G, I 916.9 [936.9, 956.9] (a)(7) 916.9 [936.9, 956.9] (f)(2)(A),(B),(C) 916.9 [936.9, 956.9] (f)(3)(A),(B),(C),(D),(F) 916.9 [936.9, 956.9] (f)(4)(A),(B),(C) 916.9 [936.9, 956.9] (g)(2(B)(1) 916.9 [936.9, 956.9] (g)(2)(B)(2)(iii)	Effectiveness of FPRs in maintaining both conifer and deciduous species in WLPZs to maintain riparian shade and primary productivity.	EMC (2015)	FGC § 1602(a) & 1603(a)
	1.11	WLPZ	Riparian function	916.9 [936.9, 956.9] (c)(1)(2) 916.9 [936.9, 956.9] (f)(2)(A),(B) 916.9 [936.9, 956.9] (f)(3)(A),(B),(C) 916.9 [936.9, 956.9] (f)(4)(A),(B) 916.9 [936.9, 956.9] (g)(2(A),(B)	Effectiveness of FPRs in maintaining input of organic matter into watercourses to maintain primary productivity measured by distribution and abundance of macroinvertebrate assemblages.	EMC (2015)	
	1.12	WLPZ	Slash Treatment	916.5 [936.5, 956.5] 916.9 [936.9, 956.9] (v)(6)	Effectiveness of WLPZ management to reduce potential fire behavior and spread under a variety of fuel matrix(s).	Water Boards and EMC (2015)	
	1.13	WLPZ	Stand Structure	916.9 [936.9, 956.9] (s,)(t),(u) 1038, 1052.4	Effectiveness of flag and avoid rules on fire severity in the WLPZ	Water Boards (2015)	

Commented [WU30]: Canopy requirements; little mention of WLPZ input of organic matter, except for 916.9(c)(2).

2	*2.1*	Watercourse Channel	Sediment	914 [934, 954] 915 [935, 955] 923 [943, 963] TRA#2 Appendix A(2)(a),(3)	Is excess sediment decreasing, on a regional basis, watershed or subwatershed basis?	Water Boards (2015)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a)
	2.2	Watercourse Channel	Sediment	914 [934, 954], 915 [935, 955] 923 [943, 963] TRA#2 Appendix A(2)(a),(3)	Is there a trend of recovery from excess sediment impairment occurring in managed watersheds?	Water Boards (2015)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a)
	2.3	Watercourse Channel	Sediment	913 [933, 953] 914 [934, 954], 915 [935, 955] 923 [943, 963] TRA#2 Appendix A(2)(a),(3)	Effect of hillslope prescriptions on fluvial geomorphology, such as scour, down-cutting, and channel complexity.	CGS (2015)	
3	*3.1*	Roads	Sediment	916.1 [936.1, 956.1] 916.11 [936.11, 956.11] 916.9 [936.9, 956.9] (v)(3)(A)(7), (v)(5)(I)	Effectiveness of additional plan mitigation measures and in-lieu practices within WLPZs	MSG (2009)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a)
	3.2	Roads	Sediment	923.1 [943.1, 963.1] (e) 923.7 [943.7, 963.7] (k) 923.9 [943.9, 963.9] (u)	Erosion Control Plan effectiveness	MSG (2009)	
	3.3	Roads	Sediment	FPA § 4551.9(b)	Comparison of the economic costs of implementing the Road Rules 2013 versus ecological benefit.	BOF-FPC (2014)	
	3.4	Roads and WLPZ	Sediment	913 [933, 953] 914 [934, 954] 915 [935, 955] 923 [943, 963]	What extent are management practices under FPRs generating excess sediment (i.e., canopy removal, log skidding, and road construction and use) and delivering to watercourse channels.	Water Boards (2015) MSG (2009)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a)
	3.5	Roads and WLPZ	Sediment	913 [933, 953] 914 [934, 954], 915 [935, 955] 923 [943, 963]	To what extent can excess sediment generated from management practices be further minimized by improving those practices and to what extent is sediment production unavoidable (for example, does canopy removal always result in *some* increase in sediment production due to	Water Boards (2015)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a)

Commented [WU31]: Went very general here and the ones below.

Commented [WU32]: General rules related to sediment generation potential.

Commented [WU33]: General rules related to sediment generation potential.

				changes in peak flows)?		
3.6	Roads and WLPZ	Sediment	916.4 [936.4, 956.4] (b)(6)	Monitoring effectiveness of WLPZ surface erosion filtration on private forestlands and Demonstration State Forests harvest plans.	BOF-MC (2014)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a)
3.7	Roads and WLPZ	Sediment	923 [943, 963] TRA#5	How effective are the Road Rules 2013 in preventing or minimizing sediment discharge?	Water Boards (2015)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a)
3.8	Roads and WLPZ	Sediment	923.9 [943.9, 963.9] (c), (g),(n)	Effect of crossing structure design on fluvial geomorphology such as sediment routing and fish passage of all life stages..	CGS (2015)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a) FGC § 5901
3.9	Roads and WLPZ	Sediment	923.2 [943.2, 963.2] (5), 923.4 [943.4, 963.4] (a), 923.5 [943.5, 963.5] (a), 923.7 [943.7, 963.7] (a), 923.9 [943.9, 963.9] (m)(2) TRA#5	Effectiveness of Road Rules 2014 to reduce hydrologic disconnection and sediment transport to a watercourse channel	BOF-FPC (2014) EMC (2015)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a)
3.10	Roads and WLPZ	Sediment	923 [943, 963]	Effect of large storms on landslides (debris flows) and as related to roads, landings and crossings.	CGS (2015)	FGC § 5650(a)(6) FGC § 1602(a) & 1603(a)
3.11	Roads and WPZ	Sediment	923.9 [943.9, 963.9] (c) 923 [943, 963]	FORPRIEM - watercourse crossings and fish passage of all life stages.	CALFIRE (2014)	FGC § 1602(a) & 1603(a) FGC § 5901
3.12	Roads and WLPZ	Sediment	923.9 [943.9, 963.9] (f) 923.9 [943.9, 963.9] (o) TRA#5	Effectiveness of crossing construction practices with regard to long-term sustainability and resilience to episodic events.	CGS (2015)	FGC § 1602(a) & 1603(a)
3.13	Roads and WLPZ	Sediment	923.1 [943.1, 963.1] 923.2 [943.2, 963.2] 923.4 [943.4, 963.4]	Effectiveness of road and landing construction practices with regard to long-term sustainability and resilience to episodic	CGS (2015)	FGC § 1602(a) & 1603(a)

Commented [WU34]: General rules related to road, landing, crossing sediment generation potential.

				923.7 [943.7, 963.7]	events.		
4	*4.1*	Mass Wasting	Sediment	923.1 [943.1, 963.1] (a)(5),(d) 923.2 [943.2, 963.2] (a)(2) 923.4 [943.4, 963.4] (d) 923.5 [943.5, 963.5] (d) 923.9 [943.9, 963.9] (m)(3) 1038 (b)(4) 1038 (f)(6) 1051 (a)(7) 1090.5 (s),(y) TRA#5	Effectiveness of plan mitigation measures to minimize sediment delivery from existing chronic unstable geologic features	MSG (2009) EMC (2015)	
	4.2	Mass Wasting	Sediment	923.1 [943.1, 963.1] (a)(5), (d) 923.2 [943.2, 963.2] (a)(2) 923.4 [943.4, 963.4] (d) 923.5 [943.5, 963.5] (d) 923.9 [943.9, 963.9] (m)(3) 1038 (b)(4) 1038 (f)(6) 1051 (a)(7) 1090.5 (s), (y) TRA#5	Effectiveness of plan mitigation measures to minimize sediment delivery from potential episodic geologic events	EMC (2015)	
	4.3	Mass Wasting	Sediment	923.1 [943.1, 963.1] (a)(5),(d) 923.2 [943.2, 963.2] (a)(2) 923.4 [943.4, 963.4] (d) 923.5 [943.5, 963.5] (d) 923.9 [943.9, 963.9] (m)(3) 1038 (b)(4) 1038 (f)(6) 1051 (a)(7) 1090.5 (s),(y) TRA#5	Review of landslide dimension and causal relationships.	MSG (2009)	
	4.4	Mass Wasting	Sediment	923.1 [943.1, 963.1] (a)(5),(d) 923.2 [943.2, 963.2] (a)(2) 923.4 [943.4, 963.4] (d) 923.5 [943.5, 963.5] (d)	Effect of large storms on landslides as related to hillslope management prescriptions.	CGS (2015)	

Commented [WU35]: No specific road rules to address this issue.

Commented [SB36]: I think that the rules listed address the question.

Commented [SB37]: I think the rules below address the question.

				923.9 [943.9, 963.9] (m)(3) 1038 (b)(4) 1038 (f)(6) 1051 (a)(7) 1090.5 (s),(y) TRA#5			
5	*5.1*	Fish Habitat	Habitat	916.4 [936.4, 956.4] (a)(2)	The FPRs effectiveness in describing and mapping distribution of foraging, rearing and spawning habitat for anadromous salmonids.	MSG (2009) EMC (2015)	
	5.2	Fish Habitat	Habitat	916.4 [936.4, 956.4] (a)(2)	The FPRs effectiveness in maintaining a distribution of foraging, rearing and spawning habitat for anadromous salmonids.	EMC (2015)	FGC § 2081(b) FGC § 1602(a) & 1603(a)
	5.3	Fish Habitat	Habitat	916.4 [936.4, 956.4] (a)(2)	The FPRs effectiveness in maintaining a distribution of foraging, rearing and spawning habitat non-anadromous salmonids	EMC (2015)	
6	*6.1*	Silviculture	Slash Treatment	917 [937], 957 1038(c) 1038(i),(j) 1051.3,4 1052.4	Effectiveness of fuel treatment to reduce fire hazard reduction.	BOF-FPC (2014)	
	6.2	Silviculture	Slash Treatment	917.5 [937.5, 957.5]	Effectiveness of residual slash pile treatment in comparison to fire hazard reduction or fire behavior	BOF-FPC (2014)	
	6.3	Silviculture	Slash Treatment	915.2 [935.2, 955.2] (a) 919.1 [939.1, 959.1] 1052.4(e)	Effectiveness of treating post-harvest slash and retaining wildlife habitats structures including snags and large woody debris.	EMC (2015)	
	6.4	Silviculture	Slash Treatment	917.5 [937.5, 957.5]	Effectiveness of treating post-harvest slash piles to reduce fire behavior to better understand ignition and spread using a variety of pile sizes.	EMC (2015)	
	6.5	Silviculture	Slash Treatment	913.4 [933.4, 953.4] (c)	Effectiveness of vegetation management and construction and maintenance of fuel breaks for fire hazard reduction.	EMC (2015)	

	6.6	Silviculture	Slash Treatment	917.5 [937.5, 957.5]	Effectiveness of treating post-harvest slash piles to reduce fire behavior under a variety of slash pile locations within a stand and impacts to adjacent untreated stands.	EMC (2015)	
	6.7	Silviculture	Slash Treatment	915.2 [935.2, 955.2] (b) 916.9 [936.9, 956.9] (g) 917.3, 937.3, 957.3	Effectiveness of treating post-harvest slash using control burning treatment versus chipping on soil dynamics and vegetation response.	EMC (2015)	
	6.8	Silviculture	Invasive Plants	No applicable FPRs	The effectiveness of FPRs in reducing and/or treating invasive plants for both fire threat reduction and sensitive plant habitat protection and restoration.	CDFW (2015)	
	6.9	Silviculture	Stand Structure	912.7 [932.7, 952.7] 921.4, 961.4, 927.10 1071	The effectiveness of stocking requirements with respect to long-term forest management for fire suppression.	Water Boards (2015), CDFW (2015)	
	6.10	Silviculture	Sediment and Water Temperature	915.3 [935.3, 955.3] 915.4 [935.4, 955.4]	The effectiveness of the FPRs in protecting water quality with respect to silvicultural herbicide application post-treatment ground cover.	Water Boards (2015)	
7	*7.1*	Wildlife Habitat	Nest Sites	919.2 [939.2, 959.2]	The effectiveness of Section 919.2, General Protection of Nest Sites, "…for the protection of Sensitive species…"	CDFW (2015)	FGC § 2081(b) FGC § 3511 FGC § 3513 FGC § 3503 FGC § 3503.5
	7.2	Wildlife Habitat	Nest Sites	919.3 [939.3, 959.3]	The effectiveness of Section 919.3, Specific requirements for Protection of Nest Sites.	CDFW (2015)	FGC § 2081(b) FGC § 3511 FGC § 3513 FGC § 3503 FGC § 3503.5
	7.3	Wildlife Habitat	Species	919.9 [939.9] (g)	The effectiveness of Section 919.9(g) in avoiding take of Northern Spotted Owls	CDFW (2015)	FGC § 2081(b)
	7.4	Wildlife Habitat	Species	919.9 [939.9] 919.10 [939.10]	Effectiveness of Northern spotted owl rules and regulations in protecting and conserving the species	BOF-FPC (2014)	FGC § 2081(b)
	7.5	Wildlife	Species	919.16 [939.16, 959.16]	Effectiveness of FPRs and guidance to ensure	CALFIRE (2015)	FGC § 2081(b)

		Habitat			take avoidance of Townsend's big-eared bat.		
	7.6	Wildlife Habitat	Species	898.2(d)	Effectiveness of FPRs and guidance to ensure take avoidance of Sierra Nevada yellow-legged frog.	CALFIRE (2015)	FGC § 2081(b)
8	*8.1*	Wildlife Habitat	Seral habitats	897(b)(1)(C)	The effectiveness of the Rules per Section 897, in retaining and recruiting late and diverse seral stage habitat components for wildlife in WLPZs and as appropriate to provide for functional connectivity; including individuals and patches of trees.	CDFW (2015)	FGC § 2820 et seq.
	8.2	Wildlife Habitat	Seral habitats	919.16 [939.16, 959.16]	The effectiveness of Section 919.16, Late Succession Forest Stands, with respect to maintenance of the amount and distribution of late succession forest stands or their functional habitat values on forestland ownerships.	CDFW (2015)	FGC § 2820 et seq.
9	*9.1*	Wildlife Habitat	Cumulative Effects	912,9 [932.9, 952.9] TRA#2 TRA#2 Appendix C	The effectiveness of Section 912.9 and Technical Rule Addendum No. 2 in characterizing and avoiding significant adverse impacts to terrestrial wildlife species, their habitats and ecological processes.	CDFW (2015)	
	9.2	Wildlife Habitat	Cumulative Effects	913.1 [933.1, 953.1] (a) (3) 912,9 [932.9, 952.9] TRA#2 TRA#2 Appendix C(4)(g)	The effectiveness of Section 913.1(a)(3) in avoiding forest habitat fragmentation.	CDFW (2015)	
10	*10.1*	Wildlife Habitat	Structures	913.4 [933.4, 953.4] (d)	The effectiveness of Section 913.4(d), Variable Retention, in the retention of structural elements or biological legacies" …to achieve various ecological, social and geomorphic objectives."and other co-benefits.	CDFW (2015)	
	10.2	Wildlife Habitat	Structures	919.1 [939.1, 959.1]	The effectiveness of Section 919.1, Snag Retention, "…to provide wildlife habitat…." and to retain a mix of (decay) stages of snag development and restoring snag densities	CDFW (2015)	

				towards "properly functioning" levels.		
10.3	Wildlife Habitat	Structures	919 [939, 959] 912,9 [932.9, 952.9] TRA#2 TRA#2 Appendix C(4)(f)	The effectiveness of various Rules in retaining and recruiting late and diverse seral stage habitat components with characteristics such as basal hollows, broken tops, multiple tops, furrowed bark, large diameter, reiterative limbs, large platform limbs and others.	CDFW (2015)	
10.4	Wildlife Habitat	Structures	1052 1052.4(e) 1052.5(b)(4)(A) 1052.5(b)(4)(C)(i),(ii)	The effectiveness of Section 1052 Emergency Notice, with respect to retention of habitat structural elements and biological legacies.	CDFW (2015)	
10.5	Wildlife Habitat	Oak	959.15	The effectiveness of Section 959.15, Protection of Wildlife Habitat, in retaining and protecting 400 sq. ft. basal area of oak per 40 acres, "…on areas designated by DFG as deer migration corridors, holding areas, or key ranges when consistent with good forestry practices."	CDFW (2015)	
10.6	Wildlife Habitat	Aspen	913.4 [933.4, 953.4] (e)	The effectiveness of Section 913.4(e), Aspen, meadow and wet area restoration,"….to restore, retain, or enhance…for ecological or range values."	CDFW (2015)	

** BOF-FPC = Forest Practices Committee, BOF-RPC = Resource Protection Committee,*
BOF-MC = Management Committee, MSG = Monitoring Study Group

APPENDIX E: SUMMARY OF EMC REVIEWED PROJECTS

The following summary table is a catalog of proposed monitoring projects received or developed by the Effectiveness Monitoring Committee. Following the summary table are individual Project Summary(s) that provide more detailed project information.

Project Number	Project Title	Current Status	Principal Investigator(s)
EMC-2014-001	Class II-L Monitoring		D. Coe
EMC-2014-002	FORPRIEM (revised)- Watercourse Crossing Monitoring		P. Cafferata, D. Coe~~C. Brandow~~
EMC-2014-003	FORPRIEM (revised)- WLPZ Total Canopy Monitoring		P. Cafferata, D. Coe ~~C. Brandow~~
EMC-2014-004			
EMC-2014-005	Road Rules - effectiveness of reducing mass wasting		D. Coe
EMC-2014-006	Road Rules - effectiveness of reducing hydrologic disconnection and surface erosion.		D. Coe
EMC-2014-007	Effectiveness of Class II headwater WLPZ for water temperature, near stream humidity and stream flow		NCRWQCB
EMC-2014-008	Post-harvest effectiveness of WLPZ measures to maintain or enhance coho (*Oncorhynchus kisutch)* in forested watersheds		Public Comment
EMC-2014-009	Redding THP Review Pilot Project		CALFIRE
EMC-2014-010	Monitoring relative abundance of anadromous species in forested watersheds		MSG (2009)
EMC-2014-011	Stream water and habitat quality monitoring - Pilot Project		C. James, J. Harrington
~~EMC-2014-012~~	~~Railroad Gulch In-Stream Effectiveness of THP Implementation~~		~~A. Stubblefield~~
EMC-2014-0123	Landscape-level long-term water temperature monitoring of forested watersheds		B. McFadin, R. Fadness
EMC-2014-0134	Long-term trend monitoring of SWAMP sites		J. Burke NCRWQCB State Board

APPENDIX F: INDIVIDUAL EMC REVIEWED PROJECT(S)

Project Number: EMC-2014-001
Project Name: Class II-L Monitoring

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation: 14 CCR 916.9 (936.9, 956.9)(c)(4)

EMC Critical Question or Priority:

Collaborators:

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact: Drew Coe, CALFIRE

Submitted by XXXXXX XXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-002
Project Name: FORPRIEM (revised) watercourse crossing and road monitoring

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: CALFIRE, NCRWQCB, CVRWQCB, CGS, DFW

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact: Pete Cafferata, CALFIRE

Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-003
Project Name: FORPRIEM (revised)- WLPZ ~~Total~~ Canopy Monitoring

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: CALFIRE, NCRWQCB, CVRWQCB, CGS, DFW

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact: Pete Cafferata, CALFIRE

Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-004
Project Name:

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators:

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact:

Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-005
Project Name: Road Rules - Effectiveness of reducing mass wasting

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: CALFIRE, NCWQCB, CGS

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact: D. Coe, CALFIRE

Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number:	EMC-2014-006
Project Name:	Road Rules - Effectiveness of reducing hydrologic disconnection and surface erosion.

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: CALFIRE, NCWQCB, CGS

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact: D. Coe, CALFIRE

Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-007
Project Name: Effectiveness of Class II headwater WLPZ for water temperature, near stream humidity and stream flow

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: CALFIRE, NCWQCB, Private forestland owners

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact:

Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-008
Project Name: Post-harvest effectiveness of WLPZ measures to maintain or enhance coho (Oncorhynchus kisutch) in forested watersheds.

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators:

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact:

Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-009
Project Name: Redding THP Review Pilot Project

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: CALFIRE, NCWQCB, CGS, CDFW

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact:

Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-010
Project Name: Monitoring relative abundance of anadromous species in forested watersheds.

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: Monitoring Study Group (MSG)

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact:

Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-011
Project Name: Stream water and habitat quality monitoring - Pilot project

Background and Justification: The intent of this project is to establish a monitoring framework to support collaborative monitoring for applying California's SWAMP ecological performance measures to evaluate water and habitat quality in streams on private forest lands. Direct collaborators include SWRCB, DFW, CALFIRE, CFA, and private forest owners. This project will also collaborate with US Forest Service scientists currently developing a similar probability based monitoring program with SWAMP on California public forest lands.

Objective(s) and Scope: This project will use the SWAMP Protocol which is a well-tested, standardized method for direct site assessment of channel hydrologic and geomorphic conditions, stream and riparian habitat type, water chemistry, and benthic macro invertebrate and algal community composition. Sites will be assessed using the full SWAMP protocol and additional measures relevant to forestry such as riparian canopy cover, vegetation and species stand type will be included. All sample locations will be permanently marked by monument to help field crews locate the exact stream site for future monitoring events performed. Sampling will be conducted by experienced SWAMP field crews, biological and chemical samples will be processed by certified laboratories. SWAMP bioassessment data provide direct measures of ecological condition and can be used to compare stream reaches across space and time.

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: SWRCB, DFW, CALFIRE, California Forestry Association, private landowners

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact: Cajun James, Sierra Pacific Industries
Jim Harrington, DFW

Submitted by XXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulations.

Project Number: EMC-2014-012
Project Name: Railroad Gulch In-Stream Effectiveness of THP implementation

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: Humboldt State University, Humboldt Redwood

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact: A. Stubblefield
Submitted by XXXXXXXXX 10/29/14
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation.

Project Number: EMC-2014-0123
Project Name: Landscape-level long-term water temperature monitoring of forested watersheds.

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority

Objective(s) and Scope:

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: CALFIRE, NCRWQCB, CDFW-SWAMP

Existing or Needed Funding:

Timeline and Fiscal year (s):

Principal Investigator or Contact: Bryan McFaddin, Rich Fadness

Submitted by XXXXXXXXX
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation

Project Number: EMC-2014-0134
Project Name: Long-term trend monitoring of SWAMP sites

Background and Justification:
Suggested sub-topics:
Initial Stakeholder concern,
Conservation or Recovery Plan objectives
Board, Agency or Department Priority
This project involves the addition of continuous temperature monitoring in the warmer months (May to September) at a subset of sites routinely monitored as part of the SWAMP Status and Trend Monitoring Program. The Regional SWAMP Program rotates through watersheds on a planned basis as resources allow. The Regional Board believes this approach allows for the best use of resources given available resources.

Objective(s) and Scope:
The approach focuses on a few watersheds at a time, cycling back through them every four years as funding allows. The Regional SWAMP Program began the Status and Trend Monitoring Program in Fiscal Year (FY) 2000-01. The original monitoring design utilized a two-component approach to address regional monitoring: 1) long-term "permanent" monitoring sites for trend analysis, and 2) rotating "temporary" sites for basin surveys. The original rotation schedule was closely coordinated with the TMDL development schedule to provide additional current information on water quality parameters to the TMDL development process.

Rule or Regulation:

EMC Critical Question or Priority:

Collaborators: CALFIRE, NCRWQCB, CDFW-SWAMP

Existing or Needed Funding:

Timeline and Fiscal year (s): The current SWAMP work plan for Calendar ((CY) 2012 through CY 2015 identifies 28 of the original long-term sites and 38 of the rotating basin sites for monitoring, while also adding 12 new sites. The Regional Temperature Monitoring Program will monitor temperature at a subset of these sites to monitor temperature status and trends at key locations.

Principal Investigator or Contact: J. Burke, NCRWQCB, State Board

Submitted by XXXXXXXXX
Note: Rule or Regulation = Forest Practice Rule, Water Quality Objective or Fish and Wildlife Code or Regulation

APPENDIX G: RANKING OF PROPOSED EFFECTIVENESS MONITORING PROJECTS

Project Number	Project Title	Critical Question	Scientific Uncertainty	Geographic Application	Collaboration & Feasibility	Overall Ranking
Example: EMC-15-001						

Ranking Method for EMC Proposed Monitoring Projects

Critical Question Ranking: Proposed monitoring project addresses one or more EMC critical monitoring questions with appropriate study design and experimental methods.

Scientific Uncertainty: Current scientific understanding is not well-studied or validated. This ranking is weighed twice (2 times) the weight of other rankings.

Geographic Application: Critical question and proposed project has broad geographic scope.

Collaboration & Feasibility Ranking: Number of active contributing collaborators relative to the monitoring subject. Consider the magnitude and expertise of the collaborators. Feasibility of monitoring project to meet stated goals and objectives within expected budget and timelines needed by the EMC, Board or stakeholders.

On a categorical scale of 1 to 5, reviewers should refer to the following guidance when reviewing any category:

1 = Does not meet any portion of the Ranking

2 = Does not meet key portions of the Ranking

3 = May meet some portions of the Ranking, either key or ancillary.

4 = Meets key portions of the Ranking and does not address ancillary portions.

5 = Meets all portions of the Ranking

APPENDIX H: CATALOG OF ~~PAST AND~~ ONGOING COOPERATIVE AND INDIVIDUAL MONITORING PROJECTS

No.	Monitoring Entity	Study Title	General Monitoring Objectives/Hypothesis Being Investigated; Principle Investigator(s)	Geomorphic Region	Online Websites and Other Available Information
		Cooperative Projects			
1	CAL FIRE (with assistance from CGS, DFW, and RWQCBs, EMC)	Forest Practice Rules Implementation and Effectiveness Monitoring FORPRIEM (revised)	Data on FPR implementation and effectiveness related to water quality (program to be revised in 2015 for new road rules, stratified random sampling, and to reflect input from the EMC). Clay Brandow was PI; Pete Cafferata, Drew Coe, and Stacy Stanish to lead revision work in 2015.	Coast Ranges, Klamath Mountains, Cascade Range, Modoc Plateau, Sierra Nevada	The FORPRIEM report with data from 2008-2013 with revision recommendations is available at: http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/msg_monitoring_reports/forpriem_report_final_022715.pdf
2	CAL FIRE and USFS PSW	Caspar Creek Experimental Watersheds—New 3rd Experiment (South Fork); 2nd Experiment (North Fork) Recovery	Study plan for the Third Experiment in the South Fork is under development by Salli Dymond, USFS PSW. Hydrologic impacts of 3rd cycle logging using unevenaged management. North Fork (Second Experiment) recovery monitoring continues. Matt Busse, Leslie Reid, Liz Keppeler are PIs.	Coast Ranges	Caspar Creek published papers are at: http://www.fs.fed.us/psw/topics/water/caspar/ The third experiment is discussed in the 50 year Caspar summary paper: http://calfire.ca.gov/resource_mgt/downloads/reports/California_Forestry_Report_5.pdf
3	Cal Poly SLO and CAL FIRE, Oregon State University	Post-Harvest and Post-Fire Watershed Response in the Little Creek Watershed	Study documents NTMP harvest impacts (one winter period) and 2009 Lockheed Fire impacts (three winter periods) in the Little Creek watershed. Brian Dietterick is PI. Final report finished in July 2015.	Coast Ranges	The Little Creek watershed study is described at: http://spranch.calpoly.edu/research_watershed.ldml Several Little Creek MS theses available.
4	Cal Poly SLO and CAL FIRE (anticipated)	Predicting Instream Community Structure to Inform Spatially-Explicit Riparian Management	Study planned to be conducted in the Little Creek watershed, Swanton Pacific Ranch, documenting site-specific WLPZ management impacts using bioassessment methods; Brian Dietterick and	Coast Ranges	Not available at this time.

		Strategies	Chris Surfleet are PIs.		
5	Campbell Global, LLC and CAL FIRE	South Fork Wages Creek Cooperative Instream Monitoring Project	THP-scale water quality effectiveness monitoring project began in 2004—expected completion in 2020. Kevin Faucher is PI.	Coast Ranges	Data from the first year sampled at SF Wages Creek (2004-2005) are available at: http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/msg_supported_reports/2005_supported_reports/31_-_gma_2005_sf_wages_wy2004-2005.pdf
6	Campbell Global, LLC and DFW	Pudding Creek Large Wood BACI Experiment	Treat 80% of Pudding Creek with large wood and determine if there is an increase in life stage specific abundance of juvenile salmonids. Sean Gallagher and Dave Wright are PIs.	Coast Ranges	See: Gallagher, S.P., S. Thompson, and D.W. Wright. 2011. Identifying factors limiting coho salmon to inform stream restoration in coastal Northern California. California Fish and Game 98(4):185-201.
7	DFW, USFWS	Fisher Translocation Project	The fisher (*Martes pennanti*) translocation project has relocated individuals from their northern California extent above Shasta Lake to a northern Sierra, Stirling City location. DFW and USFWS have radio-collared most individuals and are tracking their habitat use and breeding success. They also have set camera stations in known denning areas. Rich Callas is PI.	Cascade Range, Sierra Nevada	See: https://r1.dfg.ca.gov/portal/FisherTranslocation/tabid/832/Default.aspx
8	Green Diamond Resource Co., Oregon State University, USFS PSW and PNW	Riparian Canopy Experiment	Reach and watershed-scale experiment to test if thinning riparian areas to enhance light and nutrient input will improve salmonid production; pilot project implemented. Matt House and Lowell Diller are PIs.	Coast Ranges	http://bof.fire.ca.gov/board_committees/monitoring_study_group/msg_archived_documents/msg_archived_documents_/diller_bof_msg_canopy_density_experiment__12-10-13_.pdf
9	Green Diamond Resource Co., CSU, CAL FIRE	Quantifying Cumulative Watershed Effects Over Time in the Little River Watershed, Humboldt	Water quality and fisheries data collected by GDRCo in the Little River watershed from 2004-2014 will be analyzed; project to be conducted from 2015-2017. Lee MacDonald and Phil Turk	Coast Ranges	Not available at this time.

		County	(CSU) are PIs.		
10	Humboldt Redwood Company, HSU, CAL FIRE, and CGS	Railroad Gulch BMP Evaluation Project	Paired watershed study associated with the McCloud Shaw THP in the Elk River watershed; expected completion 2020. Andy Stubblefield, HSU, is PI.	Coast Ranges	See Michelle Haskins HSU MS project description at: http://www2.humboldt.edu/fwr/grad_students/detail/michelle_haskins
11	NCRWQCB and The Nature Conservancy	Garcia River Monitoring Program	EMAP/SWAMP physical habitat and biological monitoring to evaluate conditions and trends per the Garcia River TMDL. Jonathan Warmerdam and Jennifer Carah are PIs.	Coast Ranges	2012 Monitoring Plan is available at: http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/workplans/final_garcia_reg_one.pdf
12	Sierra Pacific Industries and CAL FIRE	Judd Creek Cooperative Instream Monitoring Project	THP-scale effectiveness monitoring study to determine the impacts from the Engebretsen THP. Cajun James is PI; final report in progress.	Sierra Nevada	See abstract at: http://abstractsearch.agu.org/meetings/2012/FM/EP52C-08.html
13	UC Davis and CAL FIRE	Bedload Transport Regimes in Coarse Cobble-Bedded Streams	Field-based and flume experiments to study interactions between hydrograph shape and bedload transport. NF Caspar Creek field study site. Sarah Yarnell, UC Davis, and Lucas Siegfried (PhD student) are PIs.	Coast Ranges	https://watershed.ucdavis.edu/project/impacts-hydrograph-shape-sediment-transport
Individual Projects					
14	Campbell Global, LLC	SF Ten Mile Streamflow and Sediment Monitoring	Sediment data collection to validate TMDL estimates. Kevin Faucher is PI.	Coast Ranges	Not available at this time.
15	DFW	Stream Temperature and Microclimate Study	Document changes in microclimate, air, and stream temperatures on JDSF and Russian Gulch SP; study established in 2001. Brad Valentine was PI for DFW.	Coast Ranges	http://www.academia.edu/8133134/A_Preliminary_Study_of_Streamside_Air_Temperatures_Within_the_Coast_Redwood_Zone_2001_to_20031
16	DFW	Ecosystem Biodiversity Monitoring	Long-term monitoring (vegetation plots and camera stations) of terrestrial biodiversity at the ecoregion scale from the Cascades to the Central Sierra (DFW Regions 1 and 2). Karen Kovacs is Program Manager.	Klamath Mountains, Cascade Range, Modoc Plateau	https://r1.dfg.ca.gov/portal/EcosystemBiodiversityMonitoringProject/EBMProjectDescription/tabid/843/Default.aspx
17	DFW	Great Gray Owl Nest/Meadow Monitoring	Targeted monitoring of exceptional great gray owl habitat (large meadows >20 acres and associated surrounding forest structure), including meadow	Sierra Nevada, Cascade	See abstract at: http://www.wildlifeprofessional.org/western/tws_abstract_session_list.ph

			searches for feathers and pellets, nighttime calling surveys. Joe Croteau and Andy Yarusso are PIs.	Range, Modoc Plateau	p?sessionID=48
18	Fruit Growers Supply Company	Wildlife Camera Station Monitoring Project	Extensive camera station monitoring across FGS ownership (more details to be provided).	Klamath Mountains	Not available at this time.
19	Green Diamond Resource Co.	Aquatic HCP Monitoring Studies	Fisheries, sediment, water temperature, turbidity, amphibians, road erosion monitoring to validate HCP standards. Matt House is PI.	Coast Ranges	https://greendiamond.com/responsible-forestry/california/reports/4thBiennialReport_(Final_With_Appendices).pdf
20	Green Diamond Resource Co.	Class III Sediment Monitoring Study	Sediment fences installed on headwater channels to monitor sediment delivery. Matt House is PI.	Coast Ranges	Not available at this time.
21	Humboldt Redwood Company	Aquatic HCP Monitoring Studies	Fisheries, sediment, water temperature, turbidity, road erosion monitoring to validate HCP standards. Mike Miles is Program Manager.	Coast Ranges	HRC aquatic condition monitoring reports are available at: http://www.hrcllc.com/monitoring/aquatic-conditions/
22	Mattole Restoration Council	Mattole River Watershed Turbidity Monitoring	Monitor turbidity response to sediment reduction work in the Mattole River watershed. Sungnome Madrone is PI.	Coast Ranges	Not available at this time.
23	Mendocino Redwood Company	Turbidity and Suspended Sediment Monitoring in the SF Albion River Watershed	Study to determine if turbidity and suspended sediment improves with road upgrading work. Kirk Vodopals is PI.	Coast Ranges	See: http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/msg_archived_documents/msg_archived_documents_/vodopals_2013_s._fork_albion_river_suspended_sediment_loads.pdf
24	Mendocino Redwood Company	Coastal Tailed Frog/Southern Torrent Salamander/Salmonid Abundance and Distribution Studies	Monitor population levels to assess effectiveness of HCP/NCCP measures	Coast Ranges	MRC fisheries monitoring reports are available at: http://www.hrcllc.com/monitoring/aquatic-conditions/

25	Mendocino Redwood Company	Road Surface Erosion Monitoring Project	Establish a watershed-scale suspended sediment load in SF Albion River watersheds from roads and compare with results of SEDMODL. Kirk Vodopals is PI.	Coast Ranges	The MRC road surface erosion study is described in the following PPT: http://ucanr.org/sites/forestry/files/145281.pdf
26	Mendocino Redwood Company	Stream Temperature Monitoring Study	Monitor stream temperatures to assess effectiveness of HCP/NCCP measures. Kirk Vodopals is PI.	Coast Ranges	Not available at this time.
27	Roseburg Resource Company	Fisher Monitoring	Roseburg, in coordination with USFWS, is conducting camera station and track plate monitoring of fisher use in the Fountain Fire area near Burney.	Cascade Range	Not available at this time.
28	Salmon Forever	Freshwater and Elk River Water Quality Monitoring	Monitor to determine the adequacy of HRC AHCP standards and trends in water quality. Clark Fenton is PI; Jack Lewis is statistical consultant.	Coast Ranges	http://www.naturalresourcesservices.org/projects/elk-river-and-freshwater-creek-sediment-monitoring-project
29	Sierra Pacific Industries	Battle Creek Turbidity Monitoring Studies	Study to determine the impact of the logging, fire, and salvage logging on water quality parameters. Cajun James is PI.	Cascade Range	SPI's 2012 Battle Creek monitoring report is available at: http://www.spi-ind.com/research/JamesandMacDonaldGreaterBattleCreekWatershedUpdateAdditions_SPI.pdf
30	Sierra Pacific Industries	Upper San Antonio Creek Monitoring Study	Determine the impact of evenaged silviculture on water quality parameters. Cajun James is PI.	Sierra Nevada	See: CH2M Hill. 2001. Water quality data review. Technical memorandum prepared by John Gaston for Sierra Pacific Industries dated July 10, 2001. 3 p.
31	Sierra Pacific Industries	Millseat and Baily Creek Temperature and Microclimate Study	Determine the effect of 75 ft riparian buffers on water quality parameters. Cajun James is PI.	Cascade Range	See: http://ceshasta.ucanr.edu/files/137630.pdf
32	Sierra Pacific Industries	2-14-102-TEH (The LiNe THP) Monitoring Studies	Monitor the water temperature, canopy, and sediment impacts from a 28 mile shaded fuel break in Tehama County (2015-2017) crossing 7 Class I ASP watercourses. Clayton Code is RPF.	Sierra Nevada	Not available at this time.

33	Sierra Pacific Industries	California Spotted Owl Monitoring	Extensive monitoring project with sites throughout the Sierra Nevada; Kevin Roberts is PI.	Sierra Nevada	See video at: https://www.youtube.com/watch?v=hCg6uYXd3tM
34	Sierra Pacific Industries	Camera Station Monitoring	Extensive wildlife camera station monitoring across SPI's ownership.	Sierra Nevada, Cascade Range, Klamath Mountains, Coast Ranges	Not available at this time.
35	Sierra Pacific Industries	Botanical Species Monitoring	Extensive botany monitoring across SPI ownership in coordination with Dean Taylor (more details to be provided)	Sierra Nevada, Cascade Range, Klamath Mountains, Coast Ranges	Not available at this time.

see CGS 2002 for geomorphic region boundaries.