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**DRAFT**  
**EFFECTIVENESS MONITORING COMMITTEE (EMC)**  
**Strategic Plan**



**Submitted to the California Board of Forestry and Fire Protection**

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## 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
CGS	California Geological Survey
CNRA	California Natural Resources Agency
DSF	Demonstration State Forests
EMC	Effectiveness Monitoring Committee
<u>ESA</u>	<u>Endangered Species Act</u>
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
<u>NRV</u>	<u>Natural Range of Variability</u>
<u>Plans</u>	<u>THP and all other harvest documents as defined under 14 CCR 895.1</u>
<u>RPF</u>	<u>Registered Professional Forester</u>
RSC	Research and Science Committee
<del>RWQCB</del>	<del>California Regional Water Quality Control Board</del>
SWAMP	Surface Water Ambient Monitoring Program
<del>SWRCB</del>	<del>State Water Resources Control Board</del>
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
<u>Water Boards</u>	<u>State and Regional Water Quality Control Boards</u>
WHR	Wildlife Habitat Relationship
WLPZ	Watercourse and Lake Protection Zone
<u>Working Groups</u>	<u>Ecological Performance Measures Working Group, Data and Monitoring Working Group, Administrative Performance Measures Working Group,</u>

**Comment [SLF2]:** Edit by Pete C.

**Comment [SLF3]:** May 21 EMC discussion

**Comment [SLF4]:** May 21 EMC discussion and Water Board comments

**Comment [SLF5]:** May 21 EMC discussion

\_\_\_\_\_ and the Interagency Information Systems Working Group under the  
\_\_\_\_\_ AB1492 program.

## 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). 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~~ <sup>These</sup> 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 ~~hillslope and instream~~ 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.

### 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 (~~FPRs~~) and other natural resource protection laws, codes and regulations, herein after referred to as the FPRs and regulations, in maintaining or enhancing water quality, aquatic habitat, and wildlife habitats (Figure 1).

#### 1.1.1 EMC Current Membership

In 2014, the Board of Forestry and Fire Protection (Board) appointed ~~two~~ <sup>two</sup> Co-Chairs, ~~fifteen~~ <sup>15</sup> committee members and identified ~~five~~ <sup>four</sup> 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 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~~ ~~It is anticipated~~ ~~by the EMC~~ that dedicated staff and funding may be necessary to achieve some EMC goals and objectives, and support projects reviewed and ~~supported~~ ~~approved~~ by the EMC. Public agencies and ~~d~~Departments including CAL FIRE, CDFW, State and Regional Water ~~B~~boards, CGS, U.S. Forest Service, NMFS and the Natural Resources Agency 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 ~~e EMC is~~ Strategic Plan ~~the EMC has identified~~ 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~~ ~~support~~ 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 Ecological Performances Data Group. Also —see Section 2.23 for more information related to the TRFR program.
- Funding 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, aerial photo acquisition)

**Comment [SLF6]:** May 21 EMC discussion

**Comment [SLF7]:** May 21 EMC David B.

## 2.0 EMC STRATEGIC PLAN OR "ROAD MAP"

The EMC Strategic Plan is the ~~committee~~ "road map" that will guide how the ~~C~~committee intends to achieve the EMC goals and objectives. It is the intent ~~to use of~~ the EMC ~~to use the~~ 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 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 ~~was~~ seeking and accepting priorities and monitoring questions from a wide variety of stakeholders including ~~a~~Agency(s), ~~d~~Department(s), Board(s), EMC members and identifying key areas of concern of the interested public. The EMC ~~will~~ review ~~ed~~ the various proposed priorities and monitoring questions and develop ~~ed~~ 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 ~~of the~~ Strategic Plan ~~will be submitted to the Board for review~~. 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 and~~ Strategic Plan. Appendix D summarizes priorities and monitoring questions received, to date, from various stakeholders. ~~The third step is o~~nce ~~priorities and~~ critical monitoring questions are ~~finalized~~ identified, specific monitoring projects described in Appendix E will be ~~evaluated~~ initiated (detailed information on project evaluation process is provided in Appendix G). The final step is

to initiate EMC sponsored projects. The following summaries are intended to be a brief summary of the priorities and monitoring questions listed in Appendix D.

### 2.1.1 Board of Forestry and Fire Protection - Committee ~~P~~riorities

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.

**Comment [SLF8]:** Added by Pete C. from EMC 5/21/15 discussion.

### 2.1.2 Board of Forestry and Fire Protection - Cumulative ~~E~~ffects-~~I~~mpacts

The Board identified ~~C~~umulative ~~e~~ffects during committee discussions and ~~s~~as priority in their Annual Report (Board 2014). Cumulative impacts 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.

**Comment [SLF9]:** Co-chair edits based on EMC 5/21/15 discussion

The Board ~~understands~~recognizes that natural processes are complex and highly variable ~~e~~ility over time and space. In addition, our understanding of these processes and linkages are imperfect. However, it is ~~known~~recognized that on-site control of potential impacts offers the most direct and rapid mitigation of potential impacts and ~~provides~~offers 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) ~~f~~Focus on effectiveness monitoring activities to provide adaptive management approaches (MacDonald 2000), (2) ~~r~~Research new computer modeling to improve analysis (Benda et al. 2007), and (3) ~~i~~mprove collection of information from on-going analysis to create watershed databases for agencies and public use.

The EMC also recognizes that cumulative ~~e~~ffects~~i~~mpacts 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 ~~e~~ffects~~i~~mpacts. One, to monitor at relatively smaller spatial and temporal scales the causal linkages between FPRs and 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~~or 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 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~~~~link~~ ~~establish~~~~causal~~ linkages between ~~the~~ FPRs and regulations and the ecological performance of ~~resources and~~ 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~~~~impacts~~ 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~~~~impacts~~ 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 (~~FPRs-14 CCR §~~ 919.1). In general, information regarding the ~~FPRs~~ effectiveness ~~of FPRs~~ 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~~~~impacts~~ 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 ~~Ecological Performances~~ 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 ~~of FPRs~~ 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~~~~collectively~~

should be demonstrated as meeting the objectives stated under ~~Section 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 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 regulations, as necessary. While modern forestry practices have been substantially improved since the passage of the Z'Berg-Nevedly 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's priorities for impaired water bodies are to evaluate ~~the effectiveness of the~~ FPRs and regulations ~~designed 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 wild fire-affected areas.

Monitoring studies should be designed to evaluate both the specific FPRs and regulations effectiveness ~~effectiveness of specific FPRs or regulations~~ and ~~evaluate~~ long-term watershed trends to help inform adaptive management of the ~~and guide the overall~~ FPRs and regulations, as they apply to all FPRs ~~subject to the FPRs~~. 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 utilize 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 of the FPRs~~ 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 ~~impacts~~ to

**Comment [SLF10]:** Edits for this paragraph provided by State and Regional board staff at March 26 EMC

**Comment [SLF11]:** Edits based on EMC 5/21/15 discussion.

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~~the effectiveness ~~of any particular FPR~~. 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~~~~envelop~~ 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, 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 (~~s~~See Section 4.3.2) Also, 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. Most importantly, some specific FPRs may need to be evaluated for effectiveness following both forest management operations and rare and large events (~~s~~See Section 4.3.2.1).

### 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 ~~of the FPRs~~ in protecting wildlife habitat for Board-listed sensitive ~~species~~ 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 ~~of FPRs~~ 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 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 4.2.1). The current FPRs effectiveness ~~of current FPRs~~ for meeting Basin Plan water quality objectives ~~also~~ 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, the Department encourages the EMC to develop monitoring efforts to determine the effectiveness of measures used to ensure take avoidance 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.

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~~ ~~impacts~~ 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 ~~Federal~~ **Public** Agency(s) and Public Stakeholders

The U.S. Forest Service (USFS), our state university system(s) 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 FPR's. 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>) 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:

(1) ~~i~~ \_\_\_ The status of select watershed conditions.

(2.ii) The status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems.

(3.iii) The status of focal species to assess the ecological conditions required under § 219.9.

(4.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.

(5.v) The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.

(6.vi) Measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area.

(7.vii) Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities.

(8.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]

**Comment [SLF12]:** Section 2.1.8 Anadromous Fisheries was moved to new Section 4 based on EMC 5/21/15 discussion

## 2.2 Ecological Performance - Timber Regulation and Forest Restoration Program

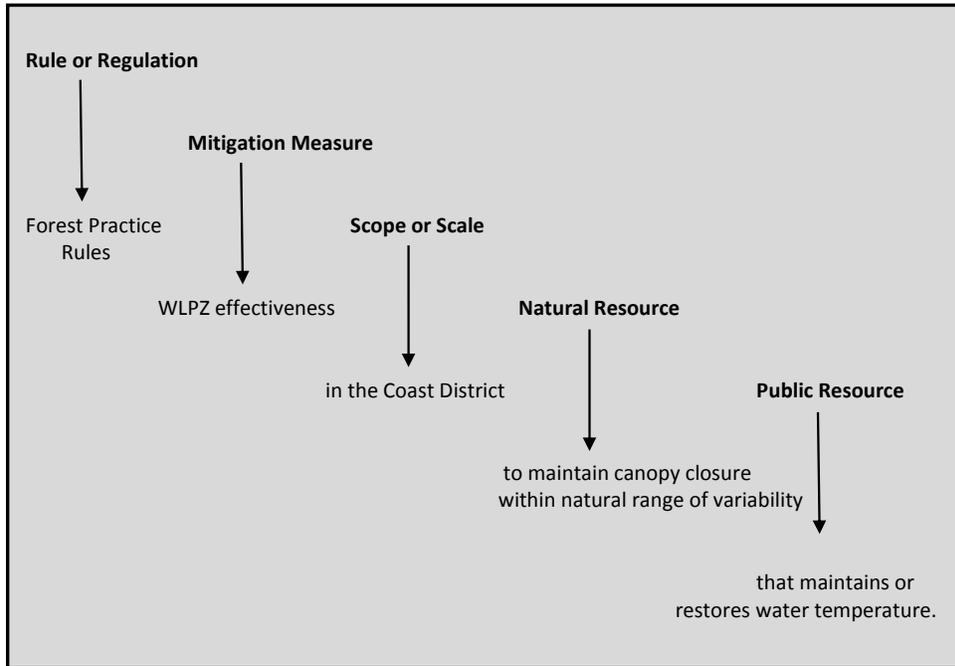
The Timber Regulation and Forest Restoration (TRFR) Program is directed by AB 1492 to develop ecological performance measures for ~~the management of~~ state and private forestland ~~managements~~. The program is at only the very initial stages of this work, having released draft charters in late 2014 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~~ ~~Per the timelines in~~ the draft ~~W~~working ~~G~~group charters, it will be some time in the future—mid-2016 at the earliest—that the working set of ecological performance measures will ~~behave been~~ 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 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. 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 3 Example: EMC critical monitoring question structure**



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

**Comment [SLF13]:** New paragraph added by Co-chair to reflect discussion and ranking of resource categories.

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.

**Category 12: WLPZ Riparian Function**

Riparian areas/WLPZs 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.

The FPRs, WLPZs, and Water Board Objectives effectiveness on private forestlands and Demonstration State Forests in all Districts to .....

- (a) maintain and restore canopy closure within the natural range of variability *(Implementation and Compliance)*
- (b) maintain and restore stream water temperature within the natural range of ~~fr~~ variability ~~——~~ *(Effectiveness)*
- (c) ~~retain~~ predominant conifers in WLPZs *(Implementation and Compliance)* and monitor large woody debris input to watercourse channels *(Effectiveness)*
- (d) retention of conifer and deciduous species to maintain or restore riparian shade, ~~e~~ ~~——~~ to maintain or restore water temperature within the natural range of variability and maintain or restore primary productivity.
- (e) maintain or restore 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) maintain and restore riparian function of Class II-L watercourses in the Coast District.
- (g) maintain and restore 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

**Category 24: Watercourse Channel Sediment**

The FPRs 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 and through~~ watercourse channels by...

- (a) monitoring at watershed and sub-watershed level in managed watersheds.
  - (b) monitoring individual Plans-THPs 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)).*

**Category 5: Ecological benefit versus economic cost**

~~The FPRs Road Rules 2014 effectiveness on private forestlands and Demonstration State Forests in providing an ecological benefit versus economic cost of implementing the rules.~~

**Comment [SLF14]:** Edits for Cat 2 based on EMC 5/21/15 discussion

**Comment [SLF15]:** Moved to Section 3.1.1 based on EMC 5/21/15 discussion

**Category 36: Road and WLPZ Sediment**

The FPRs, ~~and~~ Water Board Objectives, and Fish and Game Code regulations effectiveness on private forestlands and Demonstration State Forests in all Districts ... (~~s~~See Section 43.2 for discussion of appropriate scale(s)).

- (a) to reduce or minimize ~~forest~~ management-related generation of sediment and delivery to watercourse channels.
- (b) for WLPZs to filter sediment.
- (c) of Road Rules 2013 to reduce generation and sediment delivery to watercourse channels.
- (d) to reduce the effects of large storms on landslides as related to watercourse crossings ~~and landings, roads, landings and road crossings~~
- (e) to maintain or improve fish passage ~~at or~~ through watercourse ~~road~~ crossing structures.

**Comment [SLF16]:** Edits based on EMC 5/21/15 discussion

**Category 47: Mass Wasting Sediment**

The FPRs effectiveness 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 43.2.1)
- (c) mass wasting from high risk vulnerable geologic features ~~identified with high risk~~ vulnerability.

**Comment [SLF17]:** Edits to Cat 4 based on EMC 5/21/15 discussion

**Category 58: Fish Habitateries**

The FPRs effectiveness 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 thea 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).~~

**Comment [SLF18]:** Edits to Cat 5 based on EMC 5/21/15 discussions

**Category 69: Wildfire Hazard**

The FPRs effectiveness in wildfire hazard reduction on private forestlands and Demonstration State Forests in all Districts foref...

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

#### **Category 710: Wildlife Habitat Species and Nest Sites**

The FPRs effectiveness to protect nest sites on private forestlands and Demonstration State Forests in all Districts that provide...

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

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 Northern spotted owls following 14 CCR § 919.9 and 14 CCR § 919.10.
- (b) ensure take avoidance of Northern spotted owls 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).

#### **Category 811: Wildlife Habitat Seral Stages**

The FPRs effectiveness in maintaining functional wildlife habitat on private forestlands and Demonstration State Forests in all Districts by...

- (a) retaining and recruiting late and diverse seral stage habitat components in WLPZs for wildlife.
- (b) maintingenance or increasinge 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).

#### **Category 912: Wildlife Habitat Cumulative Impacts**

The FPRs including Technical Rule Addendum No. 2 effectiveness on private forestlands and Demonstration State Forests in all Districts in...

- (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).

### Category ~~1013~~: Wildlife Habitat Structures

The FPRs Variable Retention ([14 CCR § 913.4\(d\)](#)) effectiveness at the Plan scale on private forestlands and Demonstration State Forests in all Districts to retain structural elements or biological legacies to meet...

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

The FPRs snag retention effectiveness ([14 CCR § 919.1](#)) on private forestlands and Demonstration State Forests in all Districts to retain a mix of stages of snag development that maintain properly functioning levels of wildlife habitat.

The FPRs effectiveness on private forestlands and Demonstration State Forests in all Districts to retain native oaks ([14 CCR § 959.15](#)) where required to maintain wildlife habitat.

### **2.42.4 Catalog 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 BOF'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. General background/trend monitoring projects without specific objectives/hypotheses are omitted, as are Waiver/GWDR-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

**Comment [SLF19]:** Added by Pete C. based on EMC 5/21/15 discussion with a few edits from the Co-chair.

investigated, principle investigator(s), and brief sources of additional information (e.g., website links, references).

## **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.

*(To Be Developed)*

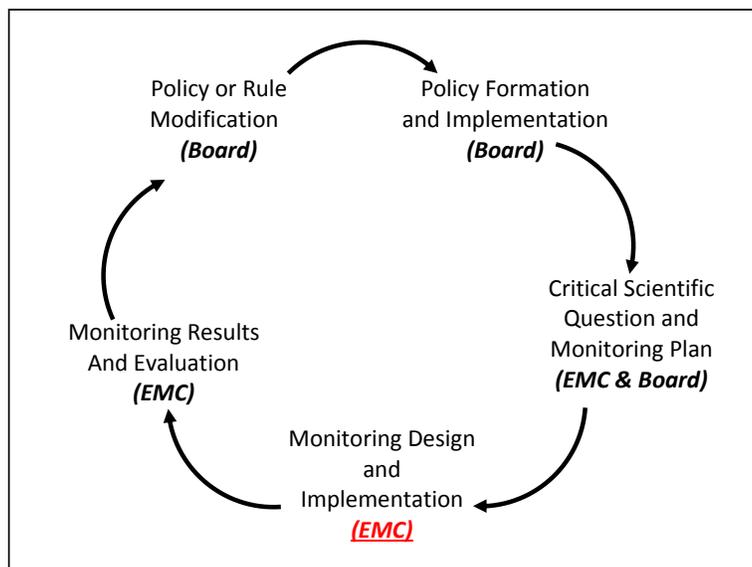
### 3.04.0 BOARD - ADAPTIVE MANAGEMENT FRAMEWORK

**Comment [SLF20]:** This was moved from Section 4.0 to 3.0 based on EMC 5/21/15 discussions. Did not use track change for the cut-n-paste to hopefully reduce confusion

The Board has previously discussed the benefits of implementing an Adaptive Management Framework. The Adaptive Management Framework is 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 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:

- (1) To provide compliance with the state and federal Endangered Species Act(s) for species found on state and private forestlands.
- (2) To maintain and restore forest-dependent species on state and private forestlands, for species that depend on the — 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 ~~also~~ 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 either~~ the scientific report ~~and/or~~ 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, ~~W~~water ~~Q~~quality ~~O~~bjectives, 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 ~~more~~ detailed description of this checklist. One portion of the checklist refers to ~~more~~ scientific questions appropriate for the EMC while the Board portions of the checklist refers to more policy based questions.

## 34.0 APPROPRIATE SCIENTIFIC METHODS AND REPORTS

### 34.1 Study Design within Adaptive Management Framework

The goal of any effectiveness monitoring study design is to determine if the FPRs and regulations related to natural resources ~~mitigating activities described through legislation and rules~~ are maintaining and/or restoring desired ecological 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/tilized 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 pPlans to meet the objectives;
- ( 3 ) Implementing plans;
- ( 4 ) Collecting information about the impacts of the pPlans;
- ( 5 ) Evaluating the collected information in light of stated objectives; and
- ( 6 ) Adjusting pPlans 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), regulations (e.g. FPRs and 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 (based on existing literature) 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

**Comment [SLF21]:** Additional editing to Section 3.1 provided by Erin K.

**Comment [SLF22]:** Edits by Co-Chair for consistency with EMC Charter based on EMC 5/21/15 discussion.

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**

[So Board members can better evaluate cost of implementing the existing FPRs and 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 every EMC sponsored project should also include an evaluation.](#)

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

### **34.2 Appropriate Temporal and Geographic Scale**

This section provides guidance for selecting appropriate spatial and temporal (~~time~~) 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~~4~~ to four~~5~~ 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).

**Comment [SLF23]:** Sub-committee of Erin K. and Co-chair to move Category 5 to Section 3.1.1 based on EMC 5/21/15 discussions

**Comment [SLF24]:** Need to discuss during EMC meeting our role of conducting a resource benefit and economic analysis versus the Board's economic analysis when rule packages are considered, Co-chair.

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 Monitoring Dynamic Ecosystems

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

- (1) ~~\_\_\_\_\_~~ Ecosystem processes functioning at drastically different rates and at spatial scales varying 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;~~;-and,~~
- (3) ~~\_\_\_\_\_~~ Ecosystems displaying 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).

Natural range of variability (NRV) is a concept put forth by applied scientists and managers to acknowledge these characteristics, with the goal of providing guidance and context for managing ecological systems (Landres et al., 1999). NRV is defined as “the ecological condition, and the spatial and temporal variation in these conditions, that are relatively unaffected by people, within a period of time and geographical area appropriate to an expressed goal” (Landres et al., 1999). In general, FPRs and regulations have been crafted to address concerns that cut across these broad spatial and temporal variations. For example:

- (1) Productivity of the land is reflected in stocking rules; less productive lands have lower stocking standards.
- (2) FPRs and regulations protecting watercourse zones vary based only on flow and presence of aquatic life.
- (3) Sediment movement in watersheds occurs naturally whether there is management activities or not; rules moderate or minimize management-based sediment movement.
- (4) Very different climate and soils between coastal, Cascade, Sierra, and Great Basin geographic regions are described in the FPRs and regulations by distinct forest districts.

**Comment [SLF25]:** EMC NRV sub-committee 6/22/15 Versions from Rene, Drew, Bill and Tom. Section 4.2.1 is a new section. However track change only shows changes made to Rene's original draft by sub-committee members so we could follow the most recent changes.

**Comment [SLF26]:** Additional comments were provided by sub-committee members Drew and Bill and edits by Co-chair

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 (Landres et al., 1999). 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).

### **Natural Range of Variability and Effectiveness Monitoring**

A primary goal of the EMC is to determine the FPRs and regulations effectiveness of forest practices in achieving regulatory standards. 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. This standard regulatory model runs counter to the notion of natural variability, which emphasizes the dynamic character of ecosystems (Hollis and Meffe, 1996; Reeves et al., in press). Consequently, 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 NRV are two fundamentally different questions that may be incompatible within a monitoring study. For example, NRV is best defined at spatial scales ranging 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 the concept of NRV into a monitoring study may provide additional insight into the effectiveness of management practices in achieving desired resource goals and objectives.

However, 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 often limited data which exist to define NRV for ecosystem processes at a variety of scales (Keane et al., 2009). Except as discussed above, Given due to the anticipated 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/question, then a larger effort will likely be required with a specific study design at the NRV 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.

**Comment [SLF27]:** Comment by Tom E. Also see existing text in Section 4.4

### **34.2.21 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~~~~which~~ 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 ) ~~Very-L~~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.

**Comment [SLF28]:** Added back in based on EMC 5/21/15 meeting

An effectiveness monitoring program that relies on annual measurements may not capture the information necessary to determine ~~to~~ the effectiveness of these practices relative to ~~the~~ 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 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 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 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.

#### **4.2.32-2.8 Anadromous Fish Monitoring**

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 that adults rear in the ocean and return to freshwater to spawn, adults and juveniles 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, abundant data to data that ~~are~~ 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 typically have a ~~three 3~~-year life cycle so a minimum of ~~nine 9~~ years of population data would be required to capture a minimum ~~three 3~~-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 from timber harvesting impacts or restoration projects to fisheries populations, particularly at a reach or watershed scale.

Similarly, fisheries managers use stream habitat, spawning substrate, stream temperature, and riparian vegetation data to make determinations of project impacts on fish populations. As with fish population 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~~~~increases~~ in stream temperature can rapidly document

negative impacts from projects and similarly ~~changes~~increases in pool-riffle ratios and macroinvertebrate assemblages can provide quick results to determine project success. This type of monitoring allows managers to make inferences on impacts to fish populations. For these reasons, the EMC will focus primarily on fisheries habitat monitoring and, when available, will use fish population data as another line of evidence to document any changes.

**Comment [SLF29]:** Comments from March 26 EMC meeting

(Insert discussion of turbidity monitoring)

**Comment [SLF30]:** Comments from March 26 EMC meeting

### 34.3 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 are in achieving goals and objectives of the~~ FPRs and regulations, ~~W~~water ~~Q~~quality ~~O~~bjectives and Fish and Game codes and regulations are in achieving their goals.

### 34.4 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.~~internet.~~

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 3.04.0) 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.



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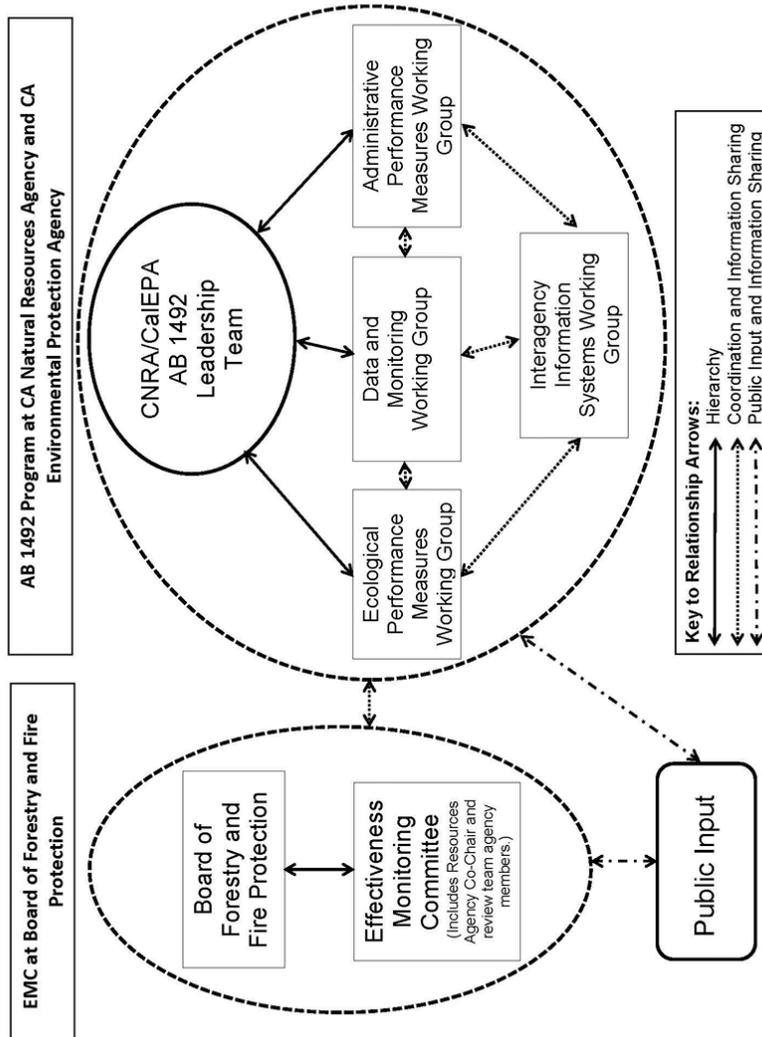
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**APPENDIX A: EMC APPOINTED MEMBERS AND STAFF**

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

**Comment [SLF38]:** Edits provided by Executive Officer

**APPENDIX B: ORGANIZATIONAL FRAMEWORK OF AB1492**



**APPENDIX C: ADAPTIVE MANAGEMENT FRAMEWORK CHECKLIST**

Framework Responsibility	Adaptive Management Checklist
EMC	<p><b>Overall Scientific or Policy Relevance</b></p> <ol style="list-style-type: none"> <li>1. Does the study better inform understanding of effectiveness of FPR’s?</li> <li>2. Does the study better information understanding of <u>W</u>ater <u>Q</u>uality <u>O</u>bjectives and <u>F</u>ish and <u>W</u>ildlife <u>C</u>ode or regulations?</li> <li>3. Does the study contribute to understanding achievement of numeric or performance targets set <u>by a</u>gencies or <u>d</u>epartments?</li> </ol>
EMC	<p><b>Overall quality of the study design and results</b></p> <ol style="list-style-type: none"> <li>1. Was the study design and analysis of results consistent with EMC recommendations?</li> <li>2. Are study results scientifically relevant and significant?</li> </ol>
EMC	<p><b>Confidence in results explaining effectiveness of FPR’s</b></p> <ol style="list-style-type: none"> <li>1. What is our previous scientific understanding and how have the results better informed our current scientific understanding?</li> <li>2. What scientific uncertainty remains in our current understanding?</li> <li>3. What is the relationship between this study and other that may be planned, underway or recently completed?</li> <li>4. Feasibility of obtaining additional information to better inform policy and what will the additional information provide?</li> <li>5. What will additional information or studies cost and timelines for completion?</li> </ol>
BOARD	<p><b>Review scientific results and additional EMC information</b></p> <ol style="list-style-type: none"> <li>1. Develop appropriate management policy <u>from</u>te information provided by EMC.</li> <li>2. If management policy action is necessary, identify options and determine how feasible each option is from an operational and regulatory perspective.</li> <li>3. If Board action is necessary, identify whether appropriate for Committee development or full Board review.</li> </ol>

**APPENDIX D: PRIORITY RECEIVED FROM BOARDS, DEPARTMENTS & AGENCIES**

(Priorities received have been grouped by ~~natural~~ resource category/subject).

Category	Sub-Category	Management Resource	Natural Resource	Priority or Monitoring Question	Submitted by and Year
1	1.1	WLPZ	Canopy closure	WLPZ effectiveness in maintaining canopy closure and water temperature?	MSG (2009)
	1.2	WLPZ	Canopy closure	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)
	1.3	WLPZ	Canopy closure	FORPRIEM - Implementation and compliance of WLPZ shade	CALFIRE (2014)
	1.4	WLPZ	Canopy closure	Monitoring effectiveness of WLPZ canopy closure in Demonstration State Forests harvest plans.	BOF-MC (2014)
2	<del>1.5</del> <del>2-1</del>	WLPZ	Riparian function	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)
	<del>1.6</del> <del>2-2</del>	WLPZ	Riparian function	Effectiveness of Class II-L rules to protect, maintain and restore riparian function	BOF-FPC (2014)
	<del>1.7</del> <del>2-3</del>	WLPZ	Riparian Function	Evaluate how effectively the ASP Class II-L definition breaks out watercourses with summertime flow (to put it another way, 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)
	<del>1.8</del> <del>2-4</del>	WLPZ	Riparian Function	WLPZ tree blowdown and potential impacts or benefits to water quality.	MSG (2009) EMC (2015)
	<del>1.9</del> <del>2-5</del>	WLPZ	Riparian Function	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)
	<del>1.10</del> <del>2-6</del>	WLPZ	Riparian function	Effectiveness of FPRs in maintaining both conifer and deciduous species in WLPZs to	EMC (2015)

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				maintain riparian shade and primary productivity.	
	<u>1.11</u> <del>2-7</del>	WLPZ	Riparian function	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)
	<u>1.12</u> <del>9-6</del>	WLPZ	Slash Treatment	Effectiveness of WLPZ management to reduce potential fire behavior and spread under a variety of fuel matrix(s).	Water Boards and EMC (2015)
	<u>1.13</u> <del>9-7</del>	WLPZ	Stand Structure	Effectiveness of flag and avoid rules on fire severity in the WLPZ	Water Boards (2015)
<u>2</u> <del>4</del>	<u>2.1</u> <del>4-1</del>	Watercourse Channel	Sediment	Is excess sediment decreasing, on a regional basis, watershed or subwatershed basis?	Water Boards (2015)
	<u>2.2</u> <del>4-2</del>	Watercourse Channel	Sediment	Is there a trend of recovery from excess sediment impairment occurring in managed watersheds?	Water Boards (2015)
	<u>2.3</u> <del>4-3</del>	Watercourse Channel	Sediment	Effect of hillslope prescriptions on fluvial geomorphology, such as scour, down-cutting, and channel complexity.	CGS (2015)
<u>3</u> <del>5</del>	3.1	Roads	Sediment	Effectiveness of additional plan mitigation measures and in-lieu practices within WLPZs	MSG (2009)
	3.2	Roads	Sediment	Erosion Control Plan effectiveness	MSG (2009)
	3.3	Roads	Sediment	Comparison of the economic costs of implementing the Road Rules <del>2013</del> 2014 versus ecological benefit.	BOF-FPC (2014)
<u>6</u>	<u>3.4</u> <del>6-1</del>	Roads and WLPZ	Sediment	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)
	<u>3.5</u> <del>6-2</del>	Roads and WLPZ	Sediment	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 <i>some</i> increase in sediment production due to changes in peak flows)?	Water Boards (2015)
	<u>3.6</u> <del>6-3</del>	Roads and WLPZ	Sediment	Monitoring effectiveness of WLPZ surface erosion filtration on private forestlands and Demonstration State Forests harvest plans.	BOF-MC (2014)
	<u>3.7</u> <del>6-4</del>	Roads and WLPZ	Sediment	How effective are the Road Rules 201 <del>3</del> 4 in preventing or minimizing sediment discharge?	Water Boards (2015)
	<u>3.8</u> <del>6-5</del>	Roads and WLPZ	Sediment	Effect of crossing structure design on fluvial geomorphology such as sediment routing and	CGS (2015)

				fish passage of all life stages..	
	<u>3.9</u> <u>6.6</u>	Roads and WLPZ	Sediment	Effectiveness of Road Rules 2014 to reduce hydrologic disconnection and sediment transport to a watercourse channel	BOF-FPC (2014) EMC (2015)
	<u>3.10</u> <u>6.7</u>	Roads and WLPZ	Sediment	Effect of large storms on landslides (debris flows) and as related to roads, landings and crossings.	CGS (2015)
	<u>3.11</u> <u>6.8</u>	Roads and WPZ	Sediment	FORPRIEM - watercourse crossings and fish passage of all life stages.	CALFIRE (2014)
	<u>3.12</u> <u>6.9</u>	Roads and WLPZ	Sediment	Effectiveness of crossing construction practices with regard to long-term sustainability and resilience to episodic events.	CGS (2015)
	<u>3.13</u> <u>6.10</u>	Roads and WLPZ	Sediment	Effectiveness of road and landing construction practices with regard to long-term sustainability and resilience to episodic events.	CGS (2015)
<u>4</u> <u>7</u>	<u>4.1</u> <u>7.1</u>	Mass Wasting	Sediment	Effectiveness of plan mitigation measures to minimize sediment delivery from existing chronic <u>unstable</u> geologic features	MSG (2009) EMC (2015)
	<u>4.2</u> <u>7.2</u>	Mass Wasting	Sediment	Effectiveness of plan mitigation measures to minimize sediment delivery from potential episodic geologic events	EMC (2015)
	<u>4.3</u> <u>7.3</u>	Mass Wasting	Sediment	Review of landslide dimension and causal relationships.	MSG (2009)
	<u>4.4</u> <u>7.4</u>	Mass Wasting	Sediment	Effect of large storms on landslides as related to hillslope management prescriptions.	CGS (2015)
<u>5</u> <u>8</u>	<u>5.1</u> <u>8.1</u>	Fish <u>Habitat</u> <u>eries</u>	Habitat	The FPRs effectiveness in describing and mapping distribution of foraging, rearing and spawning habitat for anadromous salmonids.	MSG (2009) EMC (2015)
	<u>5.2</u> <u>8.2</u>	Fish <u>Habitat</u> <u>eries</u>	Habitat	The FPRs effectiveness in maintaining a distribution of foraging, rearing and spawning habitat for anadromous salmonids.	EMC (2015)
<u>6</u> <u>9</u>	<u>6.1</u> <u>9.1</u>	Silviculture	Slash Treatment	Effectiveness of fuel treatment to reduce fire hazard reduction.	BOF-FPC (2014)
	<u>6.2</u> <u>9.2</u>	Silviculture	Slash Treatment	Effectiveness of residual slash pile treatment in comparison to fire hazard reduction or fire behavior	BOF-FPC (2014)
	<u>6.3</u> <u>9.3</u>	Silviculture	Slash Treatment	Effectiveness of treating post-harvest slash and retaining wildlife habitats structures including snags and large woody debris.	EMC (2015)
	<u>6.4</u> <u>9.4</u>	Silviculture	Slash Treatment	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)
	<u>6.5</u> <u>9.5</u>	Silviculture	Slash Treatment	Effectiveness of vegetation management and construction and maintenance of fuel breaks for fire hazard reduction.	EMC (2015)

	<del>6.6</del> 9.6	Silviculture	Slash Treatment	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)
	<del>6.7</del> 9.7	Silviculture	Slash Treatment	Effectiveness of treating post-harvest slash using control burning treatment versus chipping on soil dynamics and vegetation response.	EMC (2015)
	<del>6.8</del> 9.8	Silviculture	Invasive Plants	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)
	<del>6.9</del> 9.9	Silviculture	Stand Structure	The effectiveness of stocking requirements with respect to long-term forest management for fire suppression.	Water Boards (2015), CDFW (2015)
	<del>6.10</del> 9.10	Silviculture	Sediment and Water Temperature	The effectiveness of the FPRs in protecting water quality with respect to silvicultural herbicide application post-treatment ground cover.	Water Boards (2015)
7 1 0	<del>7.1</del> 10.1	Wildlife Habitat	Nest Sites	The effectiveness of Section 919.2, General Protection of Nest Sites, "...for the protection of Sensitive species..."	CDFW (2015)
	<del>7.2</del> 10.2	Wildlife Habitat	Nest Sites	The effectiveness of Section 919.3, Specific requirements for Protection of Nest Sites.	CDFW (2015)
	<del>7.3</del> 10.3	Wildlife Habitat	Species	The effectiveness of Section 919.9(g) in avoiding take of Northern Spotted Owls	CDFW (2015)
	<del>7.4</del> 10.4	Wildlife Habitat	Species	Effectiveness of Northern spotted owl rules and regulations in protecting and conserving the species	BOF-FPC (2014)
	<del>7.5</del> 10.5	Wildlife Habitat	Species	Effectiveness of FPRs and guidance to ensure take avoidance of Townsend's big-eared bat.	CALFIRE (2015)
	<del>7.6</del> 10.6	Wildlife Habitat	Species	Effectiveness of FPRs and guidance to ensure take avoidance of Sierra Nevada yellow-legged frog.	CALFIRE (2015)
8 1 1	<del>8.1</del> 11.1	Wildlife Habitat	Seral habitats	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)
	<del>8.2</del> 11.2	Wildlife Habitat	Seral habitats	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)
9 1 2	<del>9.1</del> 12.1	Wildlife Habitat	Cumulative Effects	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)

	<del>9.2</del> <del>12.2</del>	Wildlife Habitat	Cumulative Effects	The effectiveness of Section 913.1(a)(3) in avoiding forest habitat fragmentation.	CDFW (2015)
<b>1013</b>	<del>10.1</del> <del>13.1</del>	Wildlife Habitat	Structures	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)
	<del>10.2</del> <del>13.2</del>	Wildlife Habitat	Structures	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 towards “properly functioning” levels.	CDFW (2015)
	<del>10.3</del> <del>13.3</del>	Wildlife Habitat	Structures	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)
	<del>10.4</del> <del>13.4</del>	Wildlife Habitat	Structures	The effectiveness of Section 1052 Emergency Notice, with respect to retention of habitat structural elements and biological legacies.	CDFW (2015)
	<del>10.5</del> <del>13.5</del>	Wildlife Habitat	Oak	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)
	<del>10.6</del> <del>13.6</del>	Wildlife Habitat	Aspen	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.

<b>Project Number</b>	<b>Project Title</b>	<b>Current Status</b>	<b>Principal Investigator(s)</b>
EMC-2014-001	Class II-L Monitoring		D. Coe
EMC-2014-002	FORPRIEM - Watercourse Crossing Monitoring		P. Cafferata, C. Brandow
EMC-2014-003	FORPRIEM - WLPZ Total Canopy Monitoring		P. Cafferata, 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 ( <i>Oncorhynchus kisutch</i> ) 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-2014-013	Landscape-level long-term water temperature monitoring of forested watersheds		B. McFadin, R. Fadness
EMC-2014-014	Long-term trend monitoring of SWAMP sites		J. Burke NCRWQCB State Board

## APPENDIX F: INDIVIDUAL EMC REVIEWED PROJECT(S)

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

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### 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.*

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Project Number: EMC-2014-002  
Project Name: FORPRIEM watercourse crossing monitoring

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**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:** 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.*

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Project Number: EMC-2014-003  
Project Name: FORPRIEM - WLPZ Total Canopy Monitoring

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**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:** 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:

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**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.*

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

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**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.*

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

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**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 XXXXXXXXXX 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

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**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.*

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

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**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

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**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.*

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

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**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-2014-013  
Project Name: Landscape-level long-term water temperature monitoring of forested watersheds.

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**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, 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*

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Project Number: EMC-2014-014  
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, NCWQCB, CDFW-SWAMP

**Existing or Needed Funding:**

**Timeline and Fiscal year (s):** The current SWAMP workplan 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*

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**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						

**Comment [SLF39]:** Edit to Ranking based on EMC 5/21/15 discussion

**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: PAST AND ONGOING COOPERATIVE AND INDIVIDUAL MONITORING

**Comment [SLF40]:** Did not use track change when moving previously Section 2.4 to Appendix H to hopefully reduce confusion.

**Comment [SLF41]:** Pete C. reordered study(s) into Cooperative and Individual as discussed during EMC 5/21/15 discussion.

No.	Monitoring Entity	Study Title	General Monitoring Objectives/Hypothesis Being Investigated; Principle Investigator(s)	Online Websites and Other Available Information
<b>Cooperative Projects</b>				
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.	The FORPRIEM report with data from 2008-2013 with revision recommendations is available at: <a href="http://bofdata.fire.ca.gov/board_committ/ees/monitoring_study_group/msg_monitoring_reports/forpriem_report_final_022715.pdf">http://bofdata.fire.ca.gov/board_committ/ees/monitoring_study_group/msg_monitoring_reports/forpriem_report_final_022715.pdf</a>
2	CAL FIRE and USFS PSW	Caspar Creek Experimental Watersheds—New 3 <sup>rd</sup> Experiment (South Fork); 2 <sup>nd</sup> 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 3 <sup>rd</sup> cycle logging using unevenaged management. North Fork (Second Experiment) recovery monitoring continues. Matt Busse, Leslie Reid, Liz Keppeler are PIs.	Caspar Creek published papers are at: <a href="http://www.fs.fed.us/psw/topics/water/caspar/">http://www.fs.fed.us/psw/topics/water/caspar/</a> . The third experiment is discussed in the 50 year Caspar summary paper: <a href="http://calfire.ca.gov/resource_mgt/downloads/reports/California_Forestry_Report_5.pdf">http://calfire.ca.gov/resource_mgt/downloads/reports/California_Forestry_Report_5.pdf</a>
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 in progress.	The Little Creek watershed study is described at: <a href="http://spranch.calpoly.edu/research_watershed.ldml">http://spranch.calpoly.edu/research_watershed.ldml</a> Several Little Creek MS theses available.
4	Cal Poly SLO and CAL FIRE (anticipated)	Predicting Instream Community Structure to Inform Spatially-Explicit Riparian Management Strategies	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 Chris Surfleet are PIs.	Not available at this time.
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.	Data from the first year sampled at SF Wages Creek (2004-2005) are available at: <a href="http://bofdata.fire.ca.gov/board_committ">http://bofdata.fire.ca.gov/board_committ</a>

				<a href="https://www.dfg.ca.gov/monitoring_study_group/msg_supported_reports/2005_supported_reports/31_-_gma_2005_sf_wages_wy2004-2005.pdf">ees/monitoring_study_group/msg_supported_reports/2005_supported_reports/31_-_gma_2005_sf_wages_wy2004-2005.pdf</a>
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.	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 ( <i>Martes pennanti</i> ) 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.	See: <a href="https://r1.dfg.ca.gov/portal/FisherTranslocation/tabid/832/Default.aspx">https://r1.dfg.ca.gov/portal/FisherTranslocation/tabid/832/Default.aspx</a>
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.	<a href="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">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</a>
9	Green Diamond Resource Co., CSU, CAL FIRE	Quantifying Cumulative Watershed Effects Over Time in the Little River Watershed, Humboldt County	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 (CSU) are PIs.	Not available at this time.
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.	See Michelle Haskins HSU MS project description at: <a href="http://www2.humboldt.edu/fwr/grad_students/detail/michelle_haskins">http://www2.humboldt.edu/fwr/grad_students/detail/michelle_haskins</a>
11	NCRWQCB and	Garcia River Monitoring	EMAP/SWAMP physical habitat and biological	2012 Monitoring Plan is available at:

	The Nature Conservancy	Program	monitoring to evaluate conditions and trends per the Garcia River TMDL. Jonathan Warmerdam and Jennifer Carah are PIs.	<a href="http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/workplans/final_garcia_reg_one.pdf">http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/workplans/final_garcia_reg_one.pdf</a>
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.	See abstract at: <a href="http://abstractsearch.agu.org/meetings/2012/FM/EP52C-08.html">http://abstractsearch.agu.org/meetings/2012/FM/EP52C-08.html</a>
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.	<a href="https://watershed.ucdavis.edu/project/impacts-hydrograph-shape-sediment-transport">https://watershed.ucdavis.edu/project/impacts-hydrograph-shape-sediment-transport</a>
<b>Individual Projects</b>				
14	Campbell Global, LLC	SF Ten Mile Streamflow and Sediment Monitoring	Sediment data collection to validate TMDL estimates. Kevin Faucher is PI.	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.	<a href="http://www.academia.edu/8133134/A_Preliminary_Study_of_Streamside_Air_Temperatures_Within_the_Coast_Redwood_Zone_2001_to_20031">http://www.academia.edu/8133134/A_Preliminary_Study_of_Streamside_Air_Temperatures_Within_the_Coast_Redwood_Zone_2001_to_20031</a>
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.	<a href="https://r1.dfg.ca.gov/portal/EcosystemBiodiversityMonitoringProject/EBMProjectDescription/tabid/843/Default.aspx">https://r1.dfg.ca.gov/portal/EcosystemBiodiversityMonitoringProject/EBMProjectDescription/tabid/843/Default.aspx</a>
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 searches for feathers and pellets, nighttime calling surveys. Joe Croteau and Andy Yarusso are PIs.	See abstract at: <a href="http://www.wildlifeprofessional.org/western/tws_abstract_session_list.php?sessionID=48">http://www.wildlifeprofessional.org/western/tws_abstract_session_list.php?sessionID=48</a>
18	Fruit Growers Supply Company	Wildlife Camera Station Monitoring Project	Extensive camera station monitoring across FGS ownership (more details to be provided).	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	<a href="https://greendiamond.com/responsible-forestry/california/reports/4thBiennialRep">https://greendiamond.com/responsible-forestry/california/reports/4thBiennialRep</a>

			HCP standards. Matt House is PI.	<a href="#">ort (Final With Appendices).pdf</a>
20	Green Diamond Resource Co.	Class III Sediment Monitoring Study	Sediment fences installed on headwater channels to monitor sediment delivery. Matt House is PI.	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.	HRC aquatic condition monitoring reports are available at: <a href="http://www.hrcllc.com/monitoring/aquatic-conditions/">http://www.hrcllc.com/monitoring/aquatic-conditions/</a>
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.	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.	See: <a href="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">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</a>
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	MRC fisheries monitoring reports are available at: <a href="http://www.hrcllc.com/monitoring/aquatic-conditions/">http://www.hrcllc.com/monitoring/aquatic-conditions/</a>
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.	The MRC road surface erosion study is described in the following PPT: <a href="http://ucanr.org/sites/forestry/files/145281.pdf">http://ucanr.org/sites/forestry/files/145281.pdf</a>
26	Mendocino Redwood Company	Stream Temperature Monitoring Study	Monitor stream temperatures to assess effectiveness of HCP/NCCP measures. Kirk Vodopals is PI.	Not available at this time.
27	Roseburg Resource	Fisher Monitoring	Roseburg, in coordination with USFWS, is conducting camera station and track plate monitoring of fisher	Not available at this time.

	Company		use in the Fountain Fire area near Burney.	
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.	<a href="http://www.naturalresourceservices.org/projects/elk-river-and-freshwater-creek-sediment-monitoring-project">http://www.naturalresourceservices.org/projects/elk-river-and-freshwater-creek-sediment-monitoring-project</a>
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.	SPI's 2012 Battle Creek monitoring report is available at: <a href="http://www.spi-ind.com/research/JamesandMacDonaldGr eaterBattleCreekWatershedUpdateAdditions_SPI.pdf">http://www.spi-ind.com/research/JamesandMacDonaldGr eaterBattleCreekWatershedUpdateAdditions_SPI.pdf</a>
30	Sierra Pacific Industries	Upper San Antonio Creek Monitoring Study	Determine the impact of evenaged silviculture on water quality parameters. Cajun James is PI.	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.	See: <a href="http://ceshasta.ucanr.edu/files/137630.pdf">http://ceshasta.ucanr.edu/files/137630.pdf</a>
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.	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.	See video at: <a href="https://www.youtube.com/watch?v=hCg6uYXd3tM">https://www.youtube.com/watch?v=hCg6uYXd3tM</a>
34	Sierra Pacific Industries	Camera Station Monitoring	Extensive wildlife camera station monitoring across SPI's ownership.	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)	Not available at this time.